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Peningkatan Mutu Produk Dengan Metode Statistical Process Control Di Industri Elektronik

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Peningkatan Mutu Produk Dengan Metode Statistical Process Control Di Industri Elektronik

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ABSTRACT

Statistical Process Control (SPC) is a technique to increase the quality and to ensure the needs or requirements of customers are achieved. SPC is a set of tools for managing processes and determining and monitoring the quality of the output of an organization, and it provides an objective means of controlling quality in any transformation process. Besides, SPC is also a strategy for reducing variation in products, deliveries, processes, materials properties and equipment which are the cause of most quality problems. This study is conducted in an electronic industry - Toshiba Electronics, which manufactures transistors and other electronics parts, where its objective is to observe the implementation of quality management and its performance in the industry. To achieve the objective, the Statistical Process Control technique was applied for the analysis. The SPC tools used in this study are only Pareto analysis, and Cause and Effect analysis. Besides that, the use of questioners is also used to collect the data. Based on the results, although the quality production processes in the company are in control, some problems related to the quality have been identified. At the end of the study, some action plans and suggestions were recommended to improve the quality, especially on the quality management aspect.

Keywords: electronic industry, production process, quality management, SPC

PENDAHULUAN

Pengendalian Proses Statistik atau *Statistical Process Control* (SPC) melibatkan penggunaan teknik statistik untuk mengukur dan menganalisis variasi dalam proses. Paling sering digunakan untuk proses manufaktur, tujuan SPC adalah memantau mutu produk dan menjaga proses mencapai target tetap [1]. Selain itu ada pula yang disebut dengan *Statistical Quality* yang mengacu pada penggunaan teknik statistik untuk mengukur dan meningkatkan mutu proses, dan ini mencakup SPC serta teknik-teknik lainnya seperti pengurangan variasi, analisis kemampuan proses, dan rencana peningkatan proses [2].

Saat ini, mutu menjadi alat yang ampuh melalui organisasi untuk daya saing dan kelangsungan hidup. Mutu berarti, produk atau layanan yang dibuat sesuai kebutuhan pelanggan atau kepuasan pelanggan. Mutu itu

sendiri pada dasarnya didefinisikan sebagai sesuatu yang relasional. Mutu adalah proses berkelanjutan dalam membangun dan mempertahankan hubungan dengan menilai, mengantisipasi, dan memenuhi kebutuhan yang dinyatakan dan tersirat [3]

Burgess [4] menyatakan, setiap sistem manajemen mutu yang baik harus memiliki landasan tinjauan komprehensif terhadap produk dan proses baru. Tinjauan desain harus dimulai sejak awal, ketika desain masih fleksibel, dan diperluas hingga spesifikasi produk awal yang dihasilkan dan proses cara pembuatannya.

Bhuiyan dan Alam [5] menjelaskan, pemahaman sistem mutu, persyaratan implementasi dan manfaatnya sangat penting untuk membuat sistem efektif di tingkat akar rumput. Sejak awal, banyak karyawan yang salah memahami persepsi upaya kualitas. Sejumlah tokoh kunci menganggap upaya tersebut sia-sia karena menganggap status quo sudah cukup baik karena kualitas produk mereka dianggap terbaik di pasar.

Lee dkk. [6] menyatakan, sebagai bagian utama dari tanggung jawab manajemen dalam sistem manajemen mutu, manajemen harus menetapkan dan memelihara sistem mutu yang terdokumentasi dengan baik sebagai sarana untuk memastikan kesesuaian produk dengan persyaratan yang ditentukan. Terkait dengan industri, peneliti lainnya menyatakan bahwa industri harus mengadopsi sistem manajemen mutu yang lebih baik yang mencakup semua bidang industri, menekankan kepuasan pelanggan, dan menggunakan metode dan alat perbaikan berkelanjutan [7]. Gunasekaran dkk. [8] merekomendasikan pentingnya isu manusia dalam manajemen mutu sesuai dengan revolusi industri dan keselarasan antara revolusi teknologi dari waktu ke waktu dan keterlibatan aspek manusia dalam manajemen mutu.

Pada penelitian ini, kajian akan difokuskan pada SPC yang merupakan bagian dari alat mutu, khususnya penerapannya dalam industri elektronik. Data statistik akan dikumpulkan dari industri yang diteliti. Diharapkan pada akhir penelitian ini dapat diberikan beberapa saran kepada industri untuk meningkatkan mutu produknya berdasarkan teknik SPC.

METODE PENELITIAN

Dapat dijelaskan bahwa dalam penelitian ini hanya satu jenis produk yang akan dipilih dan hanya satu teknik yang akan digunakan yaitu teknik SPC. Data statistik akan dikumpulkan dari industri yang diteliti untuk mencapai tujuan penelitian ini. Karena penelitian ini berfokus pada bagian produksi, sebagian besar *engineer* atau *engineer* yang terlibat dalam penelitian ini akan dipilih dari departemen produksi ataupun departemen mutu. Jenis industri dalam penelitian ini adalah manufaktur elektronik. Secara ringkas tahapan-tahapan pada penelitian ini adalah sebagai berikut di bawah ini.

Tahap 1: Studi kepustakaan. Pada level ini, semua informasi dan detail topik ini dicari dari berbagai sumber seperti artikel, jurnal, dan buku. Juga beberapa informasi dikumpulkan dari situs web serta hasil yang didokumentasikan dari peneliti sebelumnya.

Selama tahap ini, semua informasi yang relevan termasuk metode (SPC), penerapan teknik ini, manfaat peningkatan mutu telah dipelajari untuk mendapatkan pemahaman mendalam tentang topik ini.

Tahap 2: Pemilihan pabrik. Setiap penelitian dan kajian biasanya dimulai dengan rumusan masalah dan beberapa permasalahan yang ingin diselesaikan. Pabrik yang dipilih harus merupakan industri elektronik agar dapat mencapai tujuan yaitu meningkatkan produk pada industri elektronik. Namun, penting juga untuk memastikan proses di industri yang dipilih sesuai dan dapat dianalisis dengan menggunakan teknik SPC.

Tahap 3: Pengumpulan data. Pengamatan terhadap seluruh proses di pabrik perlu dilakukan agar dapat memahami prosedur serta alur proses, seluruh data akan diamati dan dicatat. Data yang digunakan meliputi latar belakang pabrik, produk yang dihasilkan, alur proses produksi, dan data yang berkaitan dengan teknik SPC. Selain itu wawancara dengan beberapa karyawan pabrik juga penting dan akan sedikit membantu dalam penelitian ini.

Tahap 4: Implementasi. Pada tahap ini akan dilakukan penerapan teknik SPC dimana seluruh data yang terkumpul akan dirangkum, mengidentifikasi permasalahan dan melakukan peningkatan mutu pada produknya.

Tahap 5: Rekomendasi dan saran pada industri. Berdasarkan hasil penelitian ini, saran dan rekomendasi akan diberikan kepada industri untuk meningkatkan mutu produknya.

HASIL DAN PEMBAHASAN

Industri elektronik yang dijadikan objek penelitian ini adalah Toshiba Electronics yang memproduksi berbagai macam produk semikonduktor yaitu perangkat penyimpanan memori (*memory storage devices*), sirkuit terpadu (*integrated circuit*), transistor, diode, perangkat semi-konduktor optik, sensor, perangkat frekuensi radio, dan mikro-komputer. Selanjutnya akan dibahas tentang

analisis studi, kemudian dilanjutkan dengan pembahasan atau analisis terhadap data yang didapat pada penelitian ini.

Analisis studi meliputi tahapan-tahapan pengamatan, kuesioner, dan analisis proses. Adapun pengamatan dilakukan dengan mengunjungi pabrik industri elektronik terkait dan dilakukan pengamatan terhadap proses manufaktur di pabrik ini dan mengamati pula bagaimana pengendalian mutu produk diterapkan. Selain itu diamati juga bagaimana pabrik ini menerapkan SPC selama proses produksinya. Selanjutnya untuk tahapan kuesioner, dilakukan dengan mendapatkan data dari kuesioner yang telah dibagikan kepada responden yaitu sebanyak 20 orang yang terdiri dari operator, *engineer* produksi, dan *engineer* mutu. Kemudian untuk tahapan analisis proses pada analisis studi ini, dilakukan dengan memilih transistor sebagai produk yang akan diteliti.

Selanjutnya terkait pembahasan atau analisis terhadap data yang didapat, pembahasan akan meliputi Analisis Pareto, Analisis sebab-akibat (*Cause and Effect Analysis*), serta Analisis Kuesioner. Adapun Analisis Kuesioner akan diperinci lagi berdasarkan beberapa kategori berdasarkan butir-butir pertanyaan di lembar kuesioner yaitu lamanya bekerja di Perusahaan, persepsi pentingnya SPC, pemahaman tujuan akhir SPC, prioritas analisis SPC, kapan SPC diaplikasikan, alat-alat pengendalian SPC, penyebab tidak diaplikasikannya SPC, dan kategori pengaplikasian SPC menurut *engineer*. Dapat dijelaskan pula bahwa pada penelitian ini pengumpulan data mengacu pada data pabrik untuk produksi yang tercatat pada tahun 2022. Data yang dikumpulkan secara bulanan meliputi data jumlah produk yang diproses, jumlah produk yang ditolak, dan persentase tingkat mutu.

1. ANALISIS PARETO

Dari pengamatan terhadap produksi dapat diketahui bahwa terjadi beberapa penyebab yang mempengaruhi proses produksi. Kerugian yang paling banyak terjadi selama proses

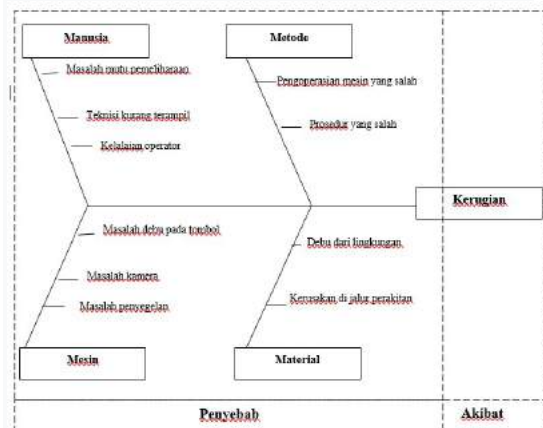
adalah disebabkan oleh adanya tiga faktor yaitu kelalaian operator, faktor yang disebabkan oleh debu, dan faktor mesin.

Tabel 1. Lembar data analisis Pareto

Penyebab	Total kerugian (unit)	Persen (%)	Kumulatif persentasi
Kelalaian Operator	12686	30.36	30.36
Debu	11556	27.65	58.01
Faktor mesin	10252	24.54	82.55
Masalah pengaturan	7294	17.45	100.00
	41788	100.00	

2. ANALISIS SEBAB-AKIBAT

Diagram sebab akibat (diagram tulang ikan) akan diterapkan dengan mencatat semua penyebab dan faktor-faktor pada setiap jenis penyebab cacat yang berdampak pada proses. Dari Gambar 1 penyebab utama terjadinya kerugian adalah dari manusia, mesin, metode, dan material.



Gambar 1. Diagram sebab-akibat

Untuk cacat yang disebabkan oleh manusia, hal ini disebabkan karena kurangnya mutu dalam cara pemeliharaan mesin, kelalaian operator, misalnya kelalaian dalam menangani peralatan. Selain itu juga karena kelalaian *engineer* dan kurang terampil.

Kecacatan yang disebabkan oleh mesin karena debu yang terletak pada tombol *on-off* dan ini menyebabkan penglihatan kamera mengalami masalah. Cacat ini juga disebabkan oleh masalah pada sistem penyevelan.

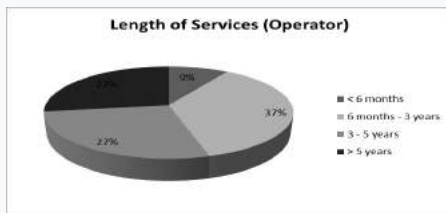
Faktor lainnya adalah metode pengoperasian mesin yang salah dan tidak mengikuti urutan proses yang benar. Terakhir, material juga mengalami cacat karena debu dari lingkungan dan kerusakan bagian yang dihasilkan dari jalur perakitan.

3. ANALISIS KUESIONER

Kuesioner ini melibatkan 20 responden yang meliputi *engineer* dan operator produksi. Responden dibagi menjadi dua kelompok agar mudah dikenali. Kedua kelompok bergerak dengan tujuan yang sama dalam menerapkan SPC. Selain itu juga untuk melihat tingkat pemahaman mereka terhadap aplikasi SPC ini. Kuesioner ini juga bertujuan untuk mengetahui apakah semua alat SPC telah diterapkan sepenuhnya di lini produksi.

3.1. Lamanya bekerja di Perusahaan

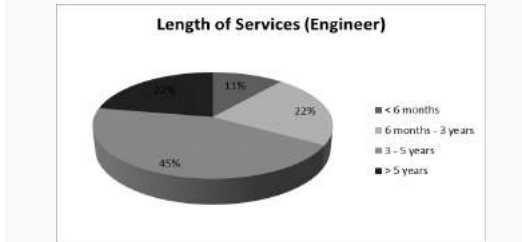
Gambar 2 menunjukkan bahwa 27% operator telah bekerja di pabrik selama lebih dari lima tahun dan 27% operator memiliki masa kerja tiga sampai lima tahun. Selain itu, terdapat 9% operator yang dapat dikategorikan sebagai pekerja baru dimana mereka hanya bertugas di bawah enam bulan dan sebagian besar operator bekerja di pabrik selama enam bulan hingga tiga tahun yaitu 37%.



Gambar 2. Lama bekerja (operator)

Untuk Gambar 3, sebagian besar *engineer* (45%) bekerja di pabrik selama tiga sampai lima tahun. Jumlah yang sama dibagi antara *engineer* yang bekerja sekitar enam bulan hingga tiga tahun dengan *engineer* yang sudah mengabdikan lebih dari lima tahun yang persentasenya 22%. Sedangkan *engineer* lainnya (11%) hanya bekerja di pabrik kurang dari enam bulan. Rasional dari pertanyaan ini

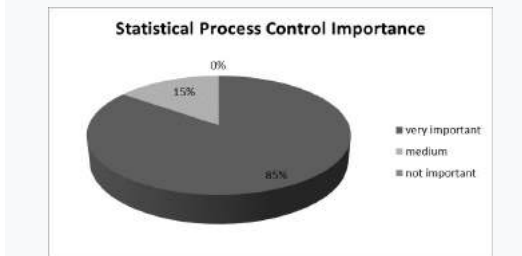
adalah untuk melihat apakah masa kerja di pabrik juga berperan dalam membimbing pekerja untuk lebih memahami penerapan SPC.



Gambar 3. Lama bekerja (*engineer*)

3.2. Persepsi pentingnya SPC

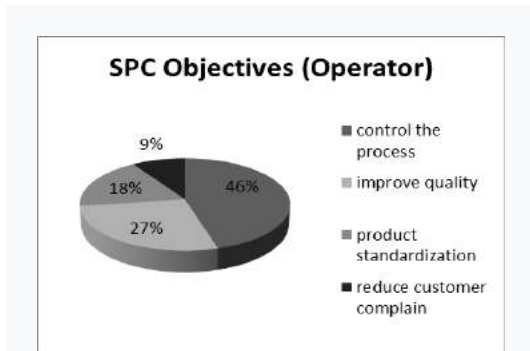
Gambar 4 menunjukkan bahwa sebagian besar responden yaitu 85% menganggap penerapan SPC sangat penting di pabriknya. Hal ini menunjukkan tingginya apresiasi responden terhadap penerapan SPC. Namun ada juga sebagian responden yang berpendapat berbeda mengenai hal ini. Terdapat 15% responden yang menyatakan pentingnya penerapan SPC pada tingkat sedang. Dengan hasil ini dapat disimpulkan bahwa penerapan SPC masih belum diterima secara menyeluruh oleh para pekerja pabrik.



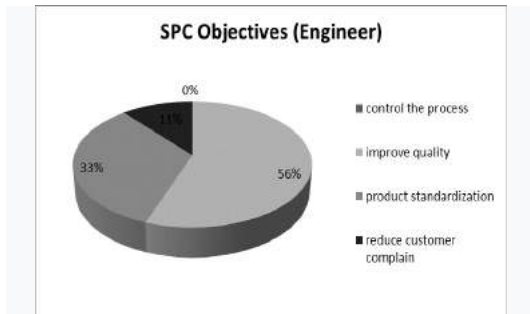
Gambar 4. Persepsi pentingnya SPC

3.3. Pemahaman tujuan akhir SPC

Gambar 5 menunjukkan bahwa 46% operator mengatakan bahwa tujuan SPC adalah untuk mengendalikan proses. Mayoritas operator memilih opsi ini namun sebaliknya seperti yang ditunjukkan pada Gambar 6, tidak ada *engineer* yang mengatakan demikian. Untuk pilihan lainnya, 56% *engineer* dan 27% operator berpendapat bahwa tujuan utama SPC adalah untuk meningkatkan mutu produk. Namun, hanya 11% *engineer* (yang merupakan persentase terendah) yang mengatakan bahwa tujuan SPC adalah untuk mengurangi keluhan pelanggan.



Gambar 5. Pemahaman tujuan akhir SPC (operator)

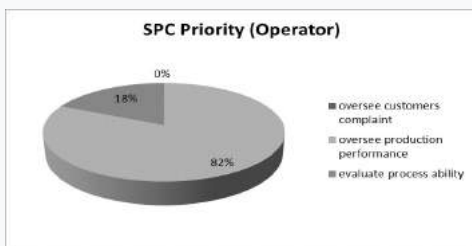


Gambar 6. Pemahaman tujuan akhir SPC (engineer)

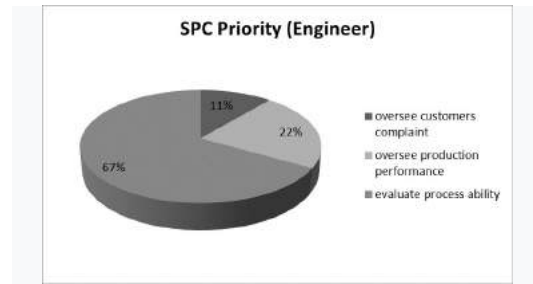
Berdasarkan hasil ini, maka tujuan SPC yang untuk memastikan bahwa keluhan pelanggan berkurang adalah tidak terbukti. Dan mengacu pada Gambar 6, 33% *engineer* dan 18% operator mengatakan bahwa tujuan utama SPC adalah memastikan produk mengikuti standarnya.

3.4. Prioritas analisis SPC

Gambar 7 menunjukkan bahwa 82% operator mengatakan bahwa prioritas SPC adalah mengamati dan mengawasi kinerja proses produksi. Hal ini sesuai dengan pekerjaan operator yang seharusnya lebih fokus pada proses produksi. Pada Gambar 8, terlihat bahwa sebagian besar *engineer* (67%) mengatakan bahwa prioritas SPC adalah untuk mengevaluasi kemampuan proses.



Gambar 7. Prioritas analisis SPC (operator)

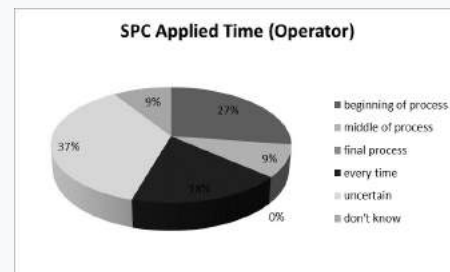


Gambar 8. Prioritas analisis SPC (engineer)

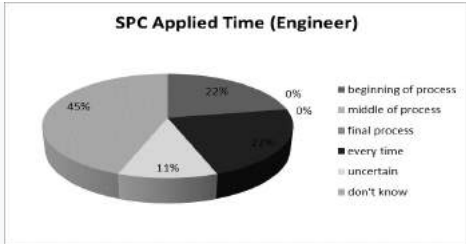
Sementara itu, hanya 11% *engineer* yang berpendapat bahwa prioritas SPC adalah mengawasi keluhan pelanggan. Namun jika mengacu pada kuesioner sebelumnya mengenai keluhan pelanggan, hanya 11% *engineer* yang menyatakan demikian. Temuan ini menunjukkan bahwa di pabrik ini, para *engineer* masih mengalami kesulitan dalam memahami penerapan SPC yang benar.

3.5. Kapan SPC diaplikasikan

Mengacu pada Gambar 9 dan Gambar 10, terlihat bahwa waktu penerapan SPC berbeda antara operator dan *engineer*. Bagi operator, waktu penggunaan SPC berbeda-beda karena jalur atau proses yang berbeda. Namun, hampir separuh *engineer* (45%) tidak mengetahui kapan SPC diterapkan. Hal ini menunjukkan bahwa kesadaran sebagian besar *engineer* di pabrik ini terkait penerapan SPC masih perlu ditingkatkan. Mengirimkan *engineer* untuk kursus yang berhubungan dengan SPC seharusnya menjadi cara terbaik untuk meningkatkan pengetahuan mereka.



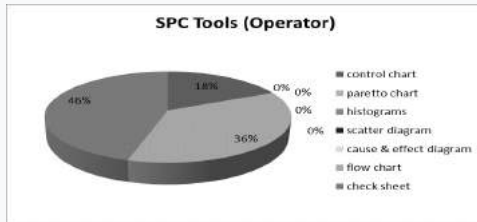
Gambar 9. Waktu pengaplikasian SPC (operator)



Gambar10. Waktu pengaplikasian SPC (*engineer*)

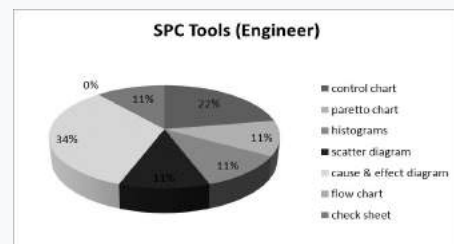
3.6. Alat-alat pengendalian SPC

Berdasarkan Gambar 11 terlihat bahwa operator hanya menggunakan tiga jenis alat SPC yaitu *flow chart*, *control chart*, dan *check sheet*. Hal ini sesuai dengan lingkup deskripsi pekerjaan operator dimana mereka lebih fokus pada proses produksi dibandingkan melakukan analisa.



Gambar 11. Alat-alat pengendalian SPC (*operator*)

Gambar 12 menunjukkan bahwa hampir semua jenis alat SPC digunakan oleh para *engineer* di pabrik ini. Hal ini juga sesuai dengan cakupan deskripsi pekerjaan *engineer* di mana seorang *engineer* harus membuat analisis yang lebih inklusif pada proses manufaktur.

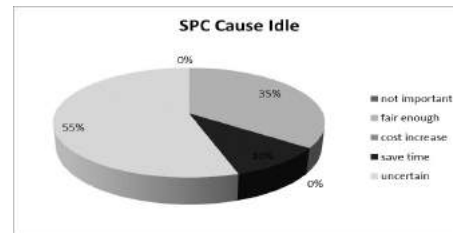


Gambar 12. Alat-alat pengendalian SPC (*engineer*)

Pada Gambar 12, yang terbanyak digunakan adalah *cause & effect diagram* (34%), disusul dengan *control chart* (22%). Namun penggunaan *flow chart* adalah 0%, dan alat-alat atau metode lainnya masing-masing 11%.

3.7. Penyebab tidak diaplikasikannya SPC

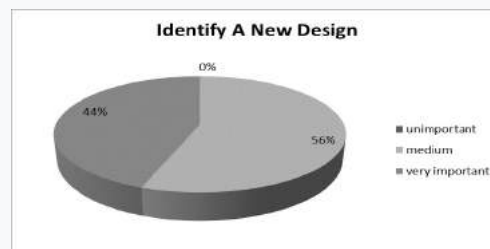
Gambar 13 menunjukkan bahwa 35% responden menyatakan bahwa alat SPC yang digunakan di pabrik ini sudah cukup baik sehingga tidak semua alat SPC perlu digunakan. Selain itu, sisa responden masing-masing sebesar 55% menyatakan tidak yakin dan 10% responden berpendapat dengan tidak menerapkan seluruh SPC akan lebih menghemat waktu. Namun tidak ada satu pun responden yang berpendapat bahwa penerapan seluruh alat SPC akan menambah biaya dan tidak ada satu pun responden yang berpendapat bahwa alat SPC tidak penting.



Gambar 13. Alat-alat pengendalian SPC (*engineer*)

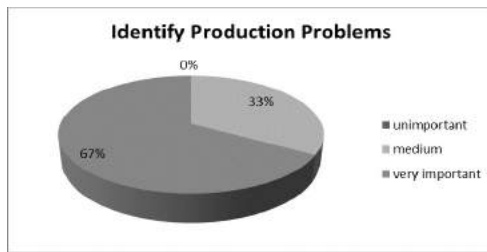
3.8. Kategori pengaplikasian SPC (*engineer*)

Gambar 14 menunjukkan bagaimana SPC membantu dalam merancang atau mengidentifikasi desain baru dan terkini. Mengacu pada angka tersebut, terdapat 44% responden yang menyatakan bahwa SPC sangat penting dalam proses perancangan. Hal ini menunjukkan bahwa SPC berperan penting dalam proses perancangan di pabrik ini.



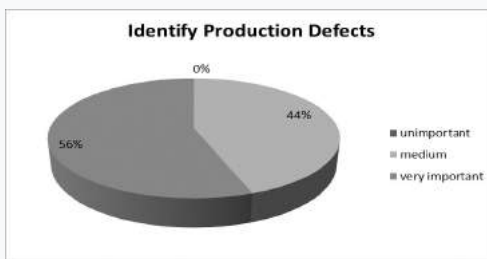
Gambar 14. Penggunaan SPC dalam perancangan

Gambar 15 menunjukkan bahwa 67% responden menyatakan SPC sangat penting untuk mengidentifikasi masalah produksi. Sebaliknya, terdapat 33% responden yang memilih metode lainnya untuk tujuan tersebut. Namun secara jelas terlihat bahwa SPC sangat penting untuk mengidentifikasi permasalahan produksi di pabrik ini.

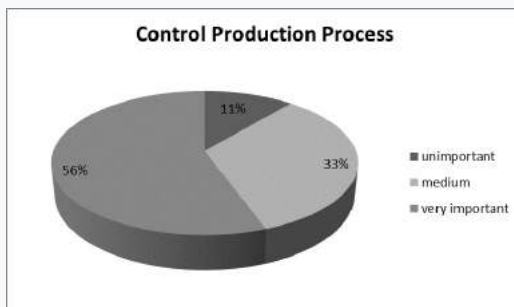


Gambar 15. SPC untuk identifikasi masalah produksi

Gambar 16 menunjukkan bahwa 56% responden berpendapat bahwa alat SPC sangat penting untuk mengidentifikasi cacat produk. Sebanyak 44% responden lainnya mengatakan bahwa tingkat pentingnya itu hanya pada level sedang atau medium. Gambar 16 ini menunjukkan bahwa SPC penting untuk mengidentifikasi cacat produk di pabrik ini.



Gambar 16. SPC untuk identifikasi masalah cacat



Gambar 17. SPC untuk mengendalikan proses produksi

Gambar 17 menunjukkan terdapat 56% responden yang menyatakan SPC sangat penting untuk mengendalikan proses produksi. Namun terdapat 11% responden di pabrik ini yang menganggap SPC tidak penting untuk pengendalian proses produksi

KESIMPULAN

Bagan Pareto (*Pareto Chart*) berguna untuk menentukan prioritas tindakan terhadap

masalah-masalah yang menghasilkan kerugian tertinggi. Diagram sebab-akibat merupakan bagian dari alat-alat statistik yang pada dasarnya membahas secara sistematis akibat-akibat potensial yang mungkin terjadi yang diakibatkan oleh sebab-sebab tertentu. Hasil pengolahan data kuesioner pada penelitian ini memberikan informasi kepada pihak manajemen perusahaan untuk mengambil langkah-langkah tindakan yang diperlukan agar pelaksanaan SPC benar-benar bermanfaat bagi kemajuan dan kebaikan perusahaan kedepannya. Perusahaan disarankan agar menindak-lanjuti hasil dari penelitian ini terutama agar memberikan pemahaman yang lebih intensif lagi tentang SPC kepada para pekerjanya.

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2023

BOOK PROGRAM

Prepared for:

- SNTTM XXI
- The 4th ISAIME 2023

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BKS-TM
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Kata Pengantar

Seminar Nasional Tahunan Teknin Mesin

(SNTTM XXI)

and

International Symposium On Advance And Innovation In Mechanical Engineering

(The 4th ISAIME 2023)

Assalamu'alaikum warahmatullahi wabarakatuh.

Alhamdulillahirrabbi'l'amin, Puji syukur kepada Allah SWT berkat rahmat dan hidayah-Nya, Program Book kegiatan **Seminar Nasional Tahunan Teknik Mesin ke-21** dan **The 4th International Symposium On Advance and Innovation in Mechanical Engineering** ini dapat diselesaikan. Seminar dengan tema **“Improving Mechanical Engineering Resources and Technology Capabilities for Facing The Challenge of Industry 4.0”** diselenggarakan di Hotel Aryaduta, Bandung, tanggal 5 Oktober 2023.

Pada seminar ini akan dipresentasikan hasil penelitian, review, dan hasil layanan industri sesuai dengan tren era ini, yang telah dilakukan oleh dosen/mahasiswa/peneliti/profesional yang berasal dari perguruan tinggi penyelenggara program studi teknik mesin di Indonesia. Hasil seminar tersebut akan dipublikasikan dalam prosiding. Program Book ini memuat jadwal konferensi sesi plenary, sesi paralel, dan pengaturan presentasi pada berbagai ruang beserta moderatornya untuk setiap artikel. Buku ini disusun dan diberikan kepada peserta sebagai panduan dalam mengikuti seminar. Daftar judul, abstrak, dan penulis juga ditampilkan pada Program Book ini.

Panitia mengucapkan terima kasih atas partisipasi para peserta konferensi ini dan mengucapkan terima kasih dan penghargaan yang tinggi kepada reviewer yang telah memberikan komentar dan saran sehingga artikel memenuhi standar untuk dipublikasikan. Ucapan terima kasih juga disampaikan kepada Pengurus Badan Kerja Sama Teknik Mesin se-Indonesia, anggota panitia dan sponsor yang telah memberikan arahan dan saran. Semoga penelitian dan pengembangan pengetahuan bidang teknik mesin semakin maju di masa yang akan datang.

Seminar akan dapat terlaksana dengan sukses atas bantuan dari banyak pihak. Oleh karena itu kami ucapkan terima kasih kepada banyak pihak yang membantu terselenggaranya seminar ini. Kami menyadari bahwa masih banyak kekurangan dalam penyusunan Program Book ini, sehingga berbagai saran dan kritik yang membangun sangat diperlukan. Semoga Program Book ini bermanfaat bagi para pembaca dan pihak yang memerlukan.

Wassalamu'alaikum warahmatullahi wabarakatuh.

Bandung, 26 September 2023

Panitia SNTTM XXI and
The 4th ISAIME 2023



Welcome Note

Seminar Nasional Tahunan Teknin Mesin (SNTTM XXI) and **International Symposium On Advance And Innovation In Mechanical Engineering** (The 4th ISAIME 2023)

Assalamu'alaikum warahmatullahi wabarakatuh.

Praise be to Allah SWT. Thanks to His mercy and wisdom, the 21st National Annual Seminar on Mechanical Engineering and the 4th International Symposium on Progress and Innovation in Mechanical Engineering can be completed. The seminar with the theme "Improving resources and technology capabilities in mechanical engineering to meet the challenge of Industry 4.0" will be held on October 5th, 2023 at the Aryaduta Hotel in Bandung.

This seminar will present the research results, reviews and results of industrial services within the trends of this time conducted by lecturers/students/researchers/professionals of universities organizing mechanical engineering degree programs in Indonesia. The seminar results will be published in the conference proceedings. This program book contains a conference schedule with plenary sessions, parallel sessions and presentation arrangements in different rooms, as well as moderators for each article. This book is compiled and given to participants as a guide for attending the seminars. The titles, abstracts, and authors list is also included in this Program Book.

The committee thanked the participants for this conference and expressed its gratitude and great appreciation to the reviewers who provided comments and recommendations to ensure that the articles meet the publication rules. Acknowledgments were also made to the management of the Mechanical Engineering Cooperation Agency across Indonesia, as well as to committee members and sponsors who provided instructions and advice. It is hoped that the research and development of knowledge in the field of mechanical engineering will be further promoted in the future.

With the aid of many people involved, the seminar will be carried out successfully. We would therefore like to thank many of those involved who helped organize this seminar. We are aware that there are still many limitations in the preparation of the book program, so any suggestions and constructive criticism are needed. Hopefully this book program will be valuable to readers and those in need.

Wassalamu'alaikum warahmatullahi wabarakatuh.

Bandung, September 26th, 2023

SNTTM XXI and The 4th ISAIME 2023



Committee

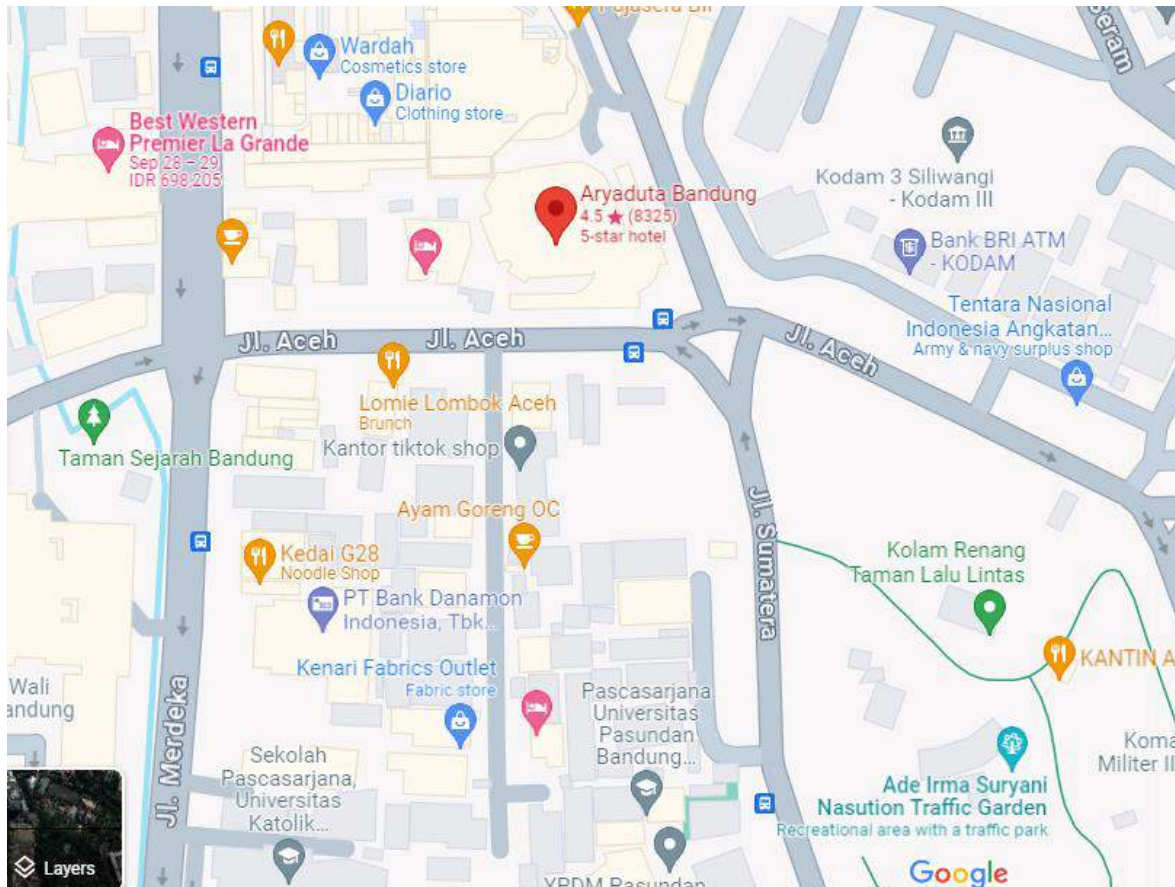
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Hotel Aryaduta Bandung



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Invited Speaker 2



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Keynote Speaker 1



Prof. T. M. Indra Mahlia, University of Technology Sydney

Keynote Speaker 2



Prof. Dominique Perreux, University of Franche-Comte

Plenary Session

Thursday, October 5th, 2023
The Aryaduta Hotel, Jalan Sumatera No. 51 Bandung

TIME	DESCRIPTION	ACTION
07:30-08:00	Registration	Committee
	Opening	MC
	Indonesia Raya's Song	MC
	Speech by Chair of ISAIME and SNTTM	MC
	Speech by Chair General Secretary of BKS-TM	MC
	Speech by Dean of Engineering Faculty Unpas	MC
08:00-09:30	Speech and Opening the event by Rector of Unpas	MC
	Do'a	MC
	Etnic Dance	MC
	Keynote Speech Prof. Indra Mahlia (University of Technology Sydney)	MC
	Keynote Speech Prof. Dominique Perreux (University of French Comte)	MC
09:30-10:00	<i>Coffee Break</i>	Committee
10:00-12:00	PARALLEL SESSION 1	Committee/Moderator
12:00-13:00	<i>Break + ISHOMA</i>	Committee
13:00-16:00	PARALLEL SESSION 2	Committee/Moderator
16:00-16:30	<i>Coffee Break</i>	Committee
16:30-18:00	PARALLEL SESSION 3	Committee/Moderator

SNTTM XXI Parallel Session

Thursday, October 5th, 2023
The Aryaduta Hotel, Jalan Sumatera No. 51 Bandung

TIME	SNTTM XXI 2023			
	ROOM			
	Galunggung	Malabar	Krakatau	Ciremai
10:00 - 10:10	4	101	3	9
10:10 - 10:20	7	106	5	11
10:20 - 10:30	12	107	6	31
10:30 - 10:40	13	108	19	37
10:40 - 10:50	14	109	20	40
10:50 - 11:00	15	111	23	48
11:00 - 11:10	16	113	25	49
11:10 - 11:20	17	118	38	53
11:20 - 11:30	21	124	54	61
11:30 - 11:40	22	126	55	66
11:40 - 11:50	24	129	57	79
11:50 - 12:00	26	130	59	86
12:00 - 13:00	ISHOMA			
13:00 - 13:10	27	133	60	89
13:10 - 13:20	28	135	64	91
13:20 - 13:30	30	136	70	95
13:30 - 13:40	32	147	74	115
13:40 - 13:50	34	148	78	116
13:50 - 14:00	35	81	76	128
14:00 - 14:10	39	82	100	139
15:10 - 15:20	45	83	103	140
15:20 - 15:30	46	87	105	142
15:30 - 15:40	50	88	110	144
15:40 - 15:50	51	90	117	145
15:50 - 16:00	52	93	123	149
16:00 - 16:30	ISHOMA			
16:30 - 16:40	65	98	125	114
16:40 - 16:50	68	102	127	119
16:50 - 17:00	75	104	131	121
17:00 - 17:10	77	112	132	2
17:10 - 17:20	80	134	141	10
17:20 - 17:30	84	137	44	18
17:30 - 17:40	85	143	47	29
17:40 - 17:50	92	96	62	33
17:50 - 18:00	94	97	99	

The 4th ISAIME Parallel Session

Thursday, October 5th, 2023

The Aryaduta Hotel, Jalan Sumatera No. 51 Bandung

TIME	The 4 th ISAIME 2023		
	Ballroom-3A	Ballroom-3B	Burangrang
10:00 - 10:10	5	11	2
10:10 - 10:20	7	23	4
10:20 - 10:30	9	30	6
10:30 - 10:40	12	31	10
10:40 - 10:50	13	33	15
10:50 - 11:00	14	46	16
11:00 - 11:10	18	55	21
11:10 - 11:20	19	60	27
11:20 - 11:30	22	67	29
11:30 - 11:40	24	72	34
11:40 - 11:50	25	76	47
11:50 - 12:00	26	53	48
12:00 - 13:00	ISHOMA		
13:00 - 13:10	28	2	1
13:10 - 13:20	36	4	3
13:20 - 13:30	38	6	8
13:30 - 13:40	39	10	17
13:40 - 13:50	43	15	20
13:50 - 14:00	44	16	35
14:00 - 14:10	45	21	50
15:10 - 15:20	49	27	61
15:20 - 15:30	51	29	68
15:30 - 15:40	52	34	69
15:40 - 15:50	54	47	71
15:50 - 16:00	56	48	78
16:00 - 16:30	ISHOMA		
16:30 - 16:40	57	61	67
16:40 - 16:50	58	68	69
16:50 - 17:00	62	69	71
17:00 - 17:10	63	71	72
17:10 - 17:20	64	78	73
17:20 - 17:30	65	75	36
17:30 - 17:40	66	77	41
17:40 - 17:50	70	79	42
17:50 - 18:00	80	78	43



SNTTM XXI Abstract List

Submission list

Paper id :

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[2] Zulhanif Zulhanif ([Universitas Lampung](#)), Adi Saputra ([Universitas Lampung](#)) and Harnowo Supriadi ([Universitas Lampung](#)). *PENGARUH WAKTU PELAPISAN PROSES ELEKTROPLATING PADA BAJA AISI 1020 YANG DILAPISI KROM DAN NIKEL* .

Abstract. Electroplating is a process of depositing a desired protective metal on top of another metal by means of electrolysis where electrolysis is carried out in a vessel called an electrolytic cell containing an electrolyte solution or a bath immersed in at least two electrodes where each electrode is connected to an electric current, divided into The positive and negative poles are known as the cathode and anode poles. This study examines how the effect of immersion time on the results of chrome and nickel plating on the surface roughness and hardness of the chrome and nickel coating in the electroplating process. The material used in this study was AISI 1020 Steel which was cut to a size of 50×50×10 mm. This study varied the length of immersion time of 5, 10, 15 and 20 minutes into the chrome electrolyte solution and nickel electrolyte solution. The result of this research is the length of time of coating affects the value of surface roughness and hardness value but at 20 minutes of coating time the coating fails. The surface roughness value for a coating time of 15 minutes is the most optimal coating time where nickel plating produces a surface roughness value of 0.237 μm (54% decrease) and chrome plating produces a surface roughness value of 0.155 μm (70% decrease). The hardness value for 15 minutes plating time is the most optimal coating time where nickel plating produces a hardness value of 225 HV (23% increase) and chrome plating produces a hardness value of 245,3 HV (34% increase).

Keywords: Electroplating, Roughness test, Hardness test

[3] Unggul Wasiwitono (Teknik Mesin), Bambang Pramujati (T. Mesin ITS), Latifah Nurahmi (Department of Mechanical Engineering, Institut Teknologi Sepuluh Nopember) and Suwarmin Suwarmin (ITS).

Analisa dan Reduksi Getaran yang Diterima Inertia Measurement Unit sebagai Sensor Orientasi pada Sistem Self-Balancing.

Abstract. Inertia Measurement Unit (IMU) merupakan sensor orientasi yang banyak digunakan di berbagai bidang seperti robotika dan sistem kendali. Estimasi orientasi yang akurat melalui sensor yang terjangkau merupakan masalah penting dalam sistem kendali untuk memastikan perilaku dan pengoperasian sesuai dengan yang telah ditentukan. Gangguan berupa getaran berlebih bisa mempengaruhi pembacaan dari IMU khususnya pada low-cost IMU. Secara umum, akurasi hasil pengukuran berkurang karena IMU menghasilkan kesalahan pengukuran pada konsisi dengan getaran berlebih. Tujuan dari penelitian ini adalah untuk menganalisa pengaruh peletakan sensor IMU yang digunakan untuk mendeteksi orientasi pada sistem penyeimbang (self-balancing) kendaraan roda dua dan mendesain sistem isolasi untuk mereduksi getaran yang dialami oleh IMU. Mekanisme sistem penyeimbang menggunakan control moment gyroscope untuk menghasilkan torsi presesi (precession torque). Besarnya torsi presesi tergantung dari besarnya putaran flywheel. Semakin besar kecepatan putar flywheel akan menghasilkan torsi presesi yang makin besar juga. Akan tetapi semakin besar putaran flywheel juga meningkatkan getaran yg diterima struktur. Pada penelitian ini pertama-tama dilakukan analisa modal pada struktur prototipe system penyeimbang kendaraan roda dua untuk melihat karakteristik getarannya. Dari hasil analisa ini dapat digunakan untuk menentukan penempatan sensor IMU dengan dengan pengaruh getaran yang lebih kecil. Hasil analisa kemudian diverifikasi dengan eksperimen. Selain itu sistem isolasi didesain untuk mereduksi lebih lanjut pengaruh getaran. Dua jenis peredam dianalisa performanya dalam mengisolasi getaran. Dari hasil modal analisis di peroleh hasil bahwasanya posisi dengan kemungkinan amplitudo getaran paling kecil berapa di tengah struktur. Untuk sistem isolasi getaran, dari hasil pengujian dengan dua jenis peredam, PVA spons mampu mereduksi getaran lebih baik dari pada silicon foam dengan reduksi getaran rata-rata mencapai 79.08 % dari rms tanpa peredam getaran.

Keywords: Inertia Measurement Unit, Drift, Pendulum Terbalik, Reduksi Getaran

[4] Mohamad Yamin (Universitas Gunadarma), Cokorda Prapti Mahandari (Universitas Gunadarma) and Riyan Firmansyah (Universitas Gunadarma). *Performance Enhancement of an H-Type Darrieus Vertical Axis Wind Turbine equipped with NACA Profile Flap.*

Abstract. This present study performs a numerical investigation to improve the performance of the H-Darrieus type Vertical Axis Wind Turbine (VAWT), which consists of 3 main blades with flaps on each blade. This research evaluates performance and geometry optimization, especially the gap distance between the main blade and the flap. The Computational Fluid Dynamics (CFD) numerical method is used to analyze the performance of the VAWT turbine and optimize the gap distance between the blade and flap. NACA profile 0018 is used on the main blade, while NACA profile 7715 on the flaps. The two-dimensional CFD model of the VAWT turbine was analyzed using the Unsteady Reynolds Averaged Navier-Stokes (URANS) approach with the k- ω Shear Stress Transport (SST k- ω) turbulence model. Simulations were carried out using ANSYS Fluent software with turbine models without and with flaps. The simulation results without a flap turbine are validated experimentally and numerically. Simulations with flaps are varied based on the parameter of the gap distance between the blade and the flap at various Tip Speed Ratio (TSR) values. The results show an optimum gap between the main blade and the flap where the power coefficient is maximum. Overall, adding flaps improves the aerodynamic performance of the VAWT turbine.

Keywords: H-Darrieus VAWT, aerodynamic performance, CFD, ANSYS

[5] Muhammad Alif Wahab Adhichahya (Hasanuddin University), Nasaruddin Salam (Hasanuddin University) and Rustan Tarakka (Hasanuddin University). *Pipe Stress Analysis of Peralite Fuel Discharge Pipeline PT. Pertamina Patra Niaga Integrated Terminal Makassar* .

Abstract. Pipeline that directly connected to rotating machines (e.x, pumps, turbines, compressors) must be considered in the analysis. PT. Pertamina Patra Niaga Integrated Terminal Makassar has a pipeline system called the New Gantry System (NGS) which distributes peralite, pertamax, and diesel fuel to the bay. Each type of fuel is supplied by different pipelines and connected to different pumps. The purpose of this research is to determine the value of stress that occurs in the discharge pipeline of P-MKS-001A Pump which is a distribution pump with the largest capacity for distributing peralite fuel. This research is conducted by comparing the value of the stress between computational method using CAESARII software and theoretical method using ASME B31.4 standard with the allowable stress limits from ASME B31.4. The result shows that the stress is caused by hydrotest load, operating load, sustain load, and expansion load. The highest stress due to hydrotest load and sustain load, respectively is 3,227.426 lb/in² and 2,669.6531 lb/in² at node 150 with allowable stress limit 26,250 lb/in². The highest stress due to operating load is 14,521.5896 lb/in² at node 210 with allowable stress limit 35,000 lb/in². The highest stress due to expansion load is 15,196.2 lb/in² at node 240 with allowable stress limit 18,000 lb/in². Without any stress value that exceed the allowable stress, the pipeline is safe according to computational and theoretical method.

Keywords: CAESARII, ASME B31.4, Hydrotest load, Operating load, Sustain load, Expansion load

[6] Jamiatul Akmal (Universitas Lampung). *Double Pontoon TLP for Relatively Stable Dynamic Response*.

Abstract. Lately, oil and gas exploration activities have been carried out in deep seas due to the decreasing availability of oil and gas resources on land. This exploration activity was carried out on a moored floating platform, known as a TLP (Tension Leg Platform). For safety and comfort in operations, of course, a TLP with a relatively more stable response to sea waves is needed. For this reason, many suggestions have been made by engineers, for example modifying the TLP geometry to be triangular, adding and adjusting the mass of dampers, and proposing a new model of mooring system configuration. This article proposes a TLP design with double pontoons consisting of a main pontoon as a place for exploration activities and an attached pontoon as a stabilizer. The design is carried out by optimizing the mass ratio, the distance between the two pontoons and the stiffness of the connecting structure which satisfies the 2-DOF vibration equation. The minimal dynamic response on the main pontoon is obtained if the distance between the two pontoons is half a wavelength ($x/\lambda = \frac{1}{2}$), while the mass ratio is 3:1

Keywords: TLP, Dynamic response, Stability, Double pontoon

[7] Muhammad Nurul Ahabab (PT. Pertamina Lubricants), Atsirur Romdhoni (PT. Indonesia Power Bali PGU), Bhima Ananta Ragil (PT. Pertamina Lubricants) and Yusuf Maulana Sait (PT. Indonesia Power Bali PGU). *Predictive – Proactive Maintenance Evaluation and Oil Performance Monitoring for Wartsila W18V50DF Gas Engine* .

Abstract. The Bali Power Generation Unit operates 12 Diesel and Gas Power Plants (PLTDG) located in Pesanggaran, Denpasar, Bali. The PLTDG uses the Wartsila W18V50DF with natural gas as the main fuel. The power plant demands the reliability of the equipment to ensure that the electricity supply is not constrained. Maintaining the synergy of operational conditions between the Gas Engine and Lubricants is one of the parameters that determines the operational reliability of generator engines. Evaluation is carried out starting from the first filling of lubricant (0 hours) up to 12000 hours of operation using multi-technology oil analysis and borescope inspection. As blood functions in the human body, the parameters evaluated are those that can describe the health conditions of the machine including: lubricating properties of new oil and used oil with parameters: kinematic viscosity (ASTM D 7279-16), foam characteristic (ASTM D892-13), total acid number (ASTM D664-11a), total base number (ASTM D2896-15), contaminant (ASTM D5185-13), wear metal (ASTM D5185-13), sulphated ash content (ASTM D874-13a), pentane insoluble, toluene insoluble, water content by Karl Fischer, flash point (ASTM D 92-16b), and FTIR (ASTM E2412). While the operational parameters evaluated include: cooler temperature, gas methane number, percentage of dual fuel mode, oil temperature, oil pressure, lubricant topping up data, and visual condition of the combustion chamber. Evaluation for 12,000 hours shows that the lubricant is still in usable condition and there are no significant operational problems.

Keywords: Multitechnology, Wartsila, W18V50DF, Reliability, Borescope, Gas Engine, Lubricants, Proactive, Predictive

[9] Pebri Aryanto (Universitas Global Jakarta), Mohamad Zaenudin (Universitas Global Jakarta), Yasya Khalif Perdana Saleh (Universitas Global Jakarta) and Nashrul Chanief Hidayat (Universitas Global Jakarta). *Analisis Kekuatan Material PET (Polyethylene Terephthalate) Terhadap Ekstrusi pada Mesin Filamen Maker 3D Printer*.

Abstract. Penelitian ini bertujuan untuk menganalisis pengaruh suhu terhadap ekstrusi filament maker pada material (PET) polyethylene terephthalate serta melakukan analisis kekuatan material filamen yang dihasilkan untuk aplikasi pada 3D printer. Filamen maker merupakan alat yang dirancang khusus untuk penelitian ini, yang bertujuan untuk menghasilkan filamen dengan kualitas yang optimal untuk digunakan dalam 3D printer. Metode penelitian ini melibatkan pengujian suhu pada proses ekstrusi filamen maker, di mana berbagai suhu dieksplorasi untuk melihat pengaruhnya terhadap kualitas filamen yang dihasilkan. Selain itu, analisis kekuatan material filamen juga dilakukan menggunakan uji tarik untuk mengevaluasi performa filamen yang dihasilkan. Dalam pembuatan filamen 3D printer, bahan botol bekas digunakan (PET-A 77,0°C, PET-L 77,0 °C dan PET-V 76.0 °C) dan selanjutnya dibuat menjadi spesimen uji tarik dengan menggunakan 3D printer, serta variasi density mulai dari 25%, 50%, 75% dan 100%. Hasil yang kontras didapatkan terhadap uji tarik pada botol PET-A 25% (14,81 MPa), 50% (16,36 MPa), 75% (23,23 MPa) 100% (33,51 MPa), dimana hasil pada botol PET-A menjadi yang paling baik. Penelitian ini memberikan kontribusi dalam pemahaman terhadap parameter suhu yang optimal dalam proses ekstrusi filamen pada filamen maker, serta memberikan wawasan tentang kekuatan material filamen PET yang dihasilkan. Hal ini penting dalam pengembangan teknologi 3D printing, dimana pemilihan dan pemrosesan material yang tepat merupakan faktor kunci dalam menghasilkan cetakan berkualitas tinggi.

Keywords: Filament maker, 3D Printer, PET (polyethylene terephthalate), analisis kekuatan material

[10] Ferdy Ardiyansyah (Universitas Malahayati Bandar Lampung), Tumpal Ojahan R (Universitas Malahayati) and Anang Anshori (Universitas Malahayati). *Keramik Mullite Berbahan Fly Ash, Al Dross, Basalt Terhadap Temperature Sintering Uji X-RF dan X-RD.*

Abstract. Mullite ceramics is a mixed oxide material consisting of Al_2O_3 and SiO_2 , with a combination of $3Al_2O_3+2SiO_2$ achieved through a synthetic mixing process. The purpose of the conducted research is to determine the elements and phases present in mullite ceramics. The basic materials used in this study are fly ash, aluminum dross, and basalt obtained from East Lampung Regency, Lampung Province. These components are mixed using ratio comparison parameters, followed by sintering heat treatment at varying temperatures of $600^\circ C$, $900^\circ C$, and $1200^\circ C$ for a duration of 4 hours. X-Ray Fluorescence (X-RF) testing is conducted to examine the elements of mullite ceramics, while X-Ray Diffraction (X-RD) testing is performed to observe the mullite phase. The addition of fly ash, aluminum dross, and basalt will affect the Al_2O_3 content of mullite ceramics. From the X-Ray Fluorescence (X-RF) testing results, the highest value of Al_2O_3 content is found in sample 1 with a percentage of 41.062%, consisting of 40% fly ash and 60% aluminum dross at a temperature of $600^\circ C$. The lowest value of Al_2O_3 content is recorded in sample 9 with a percentage of 28.381%, consisting of 60% fly ash, 30% aluminum dross, and 10% basalt at a temperature of $1200^\circ C$. The addition of basalt will cause a decrease in Al_2O_3 content, while the Fe_3C content increases. Mullite ceramics made from fly ash, aluminum dross, and basalt as the base materials, subjected to various sintering temperatures, exhibit a more dominant Mullite phase with a percentage of 90.4% at a temperature of $1200^\circ C$, composed of 50% fly ash, 45% aluminum dross, and 5% basalt. From the X-Ray Diffraction (X-RD) testing results, as the temperature increases, the mullite phase becomes more dominant compared to other phases.

Keywords: Keramik Mullite, Fly Ash, Alumunium Dross, X-Ray Diffraction, X-Ray Flourences

[12] Amrul Amrul (Universitas Lampung), Ali Mustofa (Universitas Lampung) and Muhammad Irsyad (Universitas Lampung). *Karakteristik Termogravimetri dan Spektrometri Massa (TG-DTG) pada Pembakaran Campuran (Co-Firing) Batubara dan TKKS Tertorefaksi.*

Abstract. The use of Oil Palm Empty Fruit Bunches (EFB) as fuel has a positive impact in efforts to reduce the use of coal for the continuation of environmental ecosystems because the use of biomass produces neutral carbon and low sulfur and nitrogen content so that it can reduce SOX and NOX emissions during combustion. However, the use of biomass as the sole fuel, in general, can cause slagging and fouling problems because it contains a lot of alkali and alkaline earth metals. Thermodynamic analysis through thermogravimetric tests is a fairly simple and effective method for observing fuel combustion profiles. Thermogravimetric analysis (TGA) on the co-firing of coal and biomass shows that adding biomass to coal combustion can reduce the ignition temperature and increase the mass loss rate. In this research, thermogravimetric analysis will be carried out to assess the complexity of the thermal decomposition of materials on the kinetics of combustion. The results of the thermogravimetric analysis showed that sub-bituminous coal B experienced a high mass loss gradient at a temperature of $400-520^\circ C$ worth $65 \mu g/minute$ and torrefied EFB experienced a high mass loss gradient at a temperature of $200-400^\circ C$ worth $473 \mu g/minute$.

Keywords: Coal, oil palm empty fruit bunches (EFB), torrefaction, co-firing, thermogravimetric analysis (TGA)

[13] Bagas Prabowo (Universitas Lampung), Asnawi Lubis (Universitas Lampung), Jamiatul Akmal (universitas Lampung), Harmen Harmen (Universitas Lampung) and Zuhendri Hasymi (Universitas Lampung). *Study of Limit Load and Stress Distribution in the Design of Two Phase Separator for Geothermal Power Plant.*

Abstract. Two phase separator is a very important component in a geothermal power plant system. The main function of the separator is to remove liquid from the geothermal fluid mixture and ensure that the steam entering the turbine to turn the turbine is dry and clean. This paper presents the results of finite element study to determine the limit load (internal pressure) and to assess the stress distribution of vertical cyclone separator tank designed with three design methods commonly used in geothermal power plant system: Bangma, Lazalde-Crabtree, and Spiral Inlet methods. These design methods mainly differ in the opening structure of the main shell for the two-phase inlet to obtain the effect of centrifugal force for the separation of water and steam in the separator. Opening in the shell causes a reduction in the ability of the shell to withstand internal pressure load. The separator was designed for capacity of 375.27 ton/h, it is a typical two-phase separator used in PGE unit 3 and 4 Ulu Belu, Lampung, Indonesia. Design pressure (pD) and temperature were 970 kPa and 200°C respectively. With these design conditions, the diameter of inlet pipe to main shell of the separator (Dt) is 881 mm. The limit load was obtained via finite element method using ANSYS nonlinear capability with the Newton-Raphson option turned on. It was found that limit load of the separator designed using the Bangma, Lazalde-Crabtree, and Spiral Inlet is 1.726 pD, 1.28 pD, 1.087 pD respectively. For Bangma method, the maximum stress along the axial direction measured from the inlet is located at and decay at . It was concluded that the Bangma method results in higher stress in the shell, but has higher limit load compared to the other two methods.

Keywords: Bangma, Lazalde-Crabtree, Spiral Inlet, Limit Load, Stress Distribution, Maximum Stress

[14] Muhamad Repaldi (Ibn khaldun bogor university), Dwi Yuliaji (Ibn khaldun bogor university) and Mulya Juarsa (Badan Riset dan inovasi Nasional (BRIN)). *OPTIMASI ISOLASI SISTEM PEMANAS WATER HEATING TANK PADA UNTAI REKTANGULAR FASILITAS SIMULASI SISTEM PASIF (FASSIP 04 VER.0).*

Abstract. ABSTRACT

Abstract. Research on Rectangular Loop Passive Cooling System Simulation Facility (FASSIP-04 Version 0) in the design of Water Heating Tank design is needed to obtain optimization results from the application of heating system insulation (Water Heating Tank). This study aims to obtain the temperature characteristics on the surface of the Water Heating Tank and obtain the value of thermal loss in conditions without insulators and with insulators. Thermal insulation is a method or process used to reduce the rate of heat transfer. The analysis is carried out by calculating the amount of heat loss without using insulating material and using insulation with a variable thickness of 10 mm, 20 mm and 30 mm. The analysis process is carried out at the maximum temperature of the Water Heating Tank. From the results of the analysis of Polyurethane heat absorbers on the Water Heating Tank, the temperature of the heating chamber reaches $\pm 80-100^{\circ}\text{C}$ as measured using a K-type thermocouple and Polyurethane insulator from the results of the analysis of heat loss wasted on the condition of WHT without an insulator of 100.42 W. While for WHT that already uses 10 mm insulator 25.68 W, 20 mm 10.67 W and 30 mm of 5.8 W. So with the level of data acceptance R2 (WHT without insulator) = 0.99956 (99.956%). The addition of 30 cm thick insulation has reduced heat loss by 94.6%.

Keywords: FASSIP 04 VER.0, Isolator, Water Heating Tank

[15] Muhamad Rafel (Universitas Ibn Khaldun Bogor) and Mulya Juarsa (Badan Riset dan Inovasi Nasional). *Karakteristik Perubahan Laju Aliran Massa di Bagian Pendingin Berdasarkan Variasi Daya Selama pada Kondisi Tunak Untai Rektangular FASSIP-04 Ver.2.*

Abstract. The nuclear reactor accident at Fukushima Dai-Ichi on March 11, 2011 in Japan became an important background for developing passive systems in nuclear safety. Passive cooling system technology utilizes the phenomenon of natural circulation due to the balance of buoyancy force and friction resistance force. The occurrence of flow is due to the difference in density of the working fluid based on changes in temperature and power. The purpose of the research was carried out to analyze the natural circulation flow that arises due to changes in power. The research method was conducted experimentally by varying the heater power from 1400 W, 2800 W, and 4200 W for 6 hours. With the object of research on the cooling section of the rectangular loop FASSIP-04 Ver.2. The experimental results show that the higher the power variation, the greater the mass flow rate which has a value difference of 0.01 kg/s.

Keywords: FASSIP-04 Ver.2, natural circulation, power, mass flow rate, temperature, cooling section.

Keywords: FASSIP-04 Ver.2, Natural Circulation, Power, Flow rate, Temperature, Cooling section

[16] Rio Sandi (Universitas Ibn Khaldun), Roy Waluyo (Universitas Ibn Khaldun), Dwi Yuliaji (Universitas Ibn Khaldun) and Mulya Juarsa (Badan Riset dan Inovasi Nasional, Tangerang selatan PUSPITEK Setu, Tangerang Selatan, Banten 15314, Indonesia). *Karakterisasi Laju Aliran Menggunakan Beberapa Jenis Flowmeter dan Pengukuran Beda Tekanan Berdasarkan Variasi Buka Katup pada Kalibrator Aliran.*

Abstract. ABSTARCT

Measurement is an activity carried out to obtain the value of a quantity. Therefore, the flowmeter measurement tool must have a low error rate. So, the research was conducted to obtain the characteristics of the flowmeter measurement tool by calibrating it. This study aims to obtain the characteristics of the flow rate value on the flowmeter calibrator based on changes in valve opening using several flowmeters, namely electromagnetic flowmeter, water flowmeter, and pressure transmitter. Two methods are used: a 2-liter measuring cup as a container in an open loop and close loop state with a valve opening angle of 30°, 60°, and 90°. There are two pressure transmitters, IN and OUT. Based on the results of the measurements made, the flow rate data using a 2-liter measuring cup on the electromagnetic flowmeter is 13.97LPM, on the water flowmeter 11.18LPM and the pressure transmitter 9.91LPM with a deviation of 0.15LPM electromagnetic flowmeter, water flowmeter 2.92LPM, pressure transmitter 4.21LPM. While in close loop conditions, the electromagnetic flowmeter produces 14.19LPM when the valve opening is 90°, 13.98LPM when the valve opens 60°, and at 30° valve opening 8.13LPM, the Water flowmeter produces 15.43LPM, 15.28LPM and 8.51LPM, and for pressure transmitters 15.59LPM, 15.07LPM, 10.17LPM. Thus, it can be concluded that when the valve is in the 90° open position, the value produced exceeds the flowmeter and the pressure transmitter

Keywords: flowmeter, calibrator, flow rate, pressure transmitter, valve

[17] Reihan Deandra Ratmaza Boni (Universitas Ibn Khaldun Bogor), Chaesario Ramdan Widiyanto (Universitas Ibn Khaldun Bogor), Rio Sandi (Universitas Ibn Khaldun Bogor), Dwi Yuliaji (Universitas Ibn Khaldun Bogor), Roy Waluyo (Universitas Ibn Khaldun Bogor), Ryan Oktaviandi (Dapartemen Teknik Mesin dan Industri Universitas Gajah Mada, Yogyakarta), Esa Putra (Dapartemen Teknik Mesin dan Industri Universitas Gajah Mada, Yogyakarta), Shendy Akbar Maryadi (Universitas Ibn Khaldun Bogor), Sunandi Kharisma (Universitas Udayana Bali) and Mulya Juarsa (Pusat Riset Teknologi Reaktor Nuklir-Organisasi Riset BATAN-BRIN). *Karakterisasi Laju Aliran Air Menggunakan Elektromagnetik Flowmeter dengan Perbedaan Variasi Temperatur.*

Abstract. ABSTRACT

Measuring instruments must be traceable by providing the same measurement results to national or foreign standards in order for all measuring instruments to produce identical and validated measurements results. Flowmeters need to be calibrated to validate and correct deviations in flowmeter accuracy measurement. So, a flowmeter calibrator device was designed as an experimental facility regarding characterization using an electromagnetic flowmeter. This study aimed to obtain flow discharge characteristics based on differences in water temperature variations using an electromagnetic flowmeter through a flowmeter calibrator. This research method was carried out experimentally with two tests, namely the manual measuring method, changes in valve opening in open loop conditions using a measuring cup with a capacity of 2 liters as a water reservoir. Then, the second test uses a closed circuit at temperatures of 35°C, 40°C, 45°C, and 50°C to obtain flow discharge nilate. The results show a close loop for temperature changes from 35oC to 50oC. The electromagnetic flowmeter measurement resulted in the flow rate being 13.55 LPM, 13.98 LPM, 14.97 LPM, and 14.82 LPM at 50°C, respectively. Then, for the pressure transmitter measurement, the flow rate is 15.82 LPM, 16.18 LPM, 20.13 LPM, and 20.64 LPM, respectively, from 35oC to 50oC.

Keywords: flowmeter, flow rate, calibrator, electromagnetic, temperature, pressure

[18] M Sabri (Universitas Sumatera Utara) and Geubrina Hs (Universitas Sumatera Utara). *Analisis Kegagalan Mesin Screw Press Menggunakan Metode Failure Mode and Effect Analysis (FMEA) Pada Pabrik Minyak Kelapa Sawit.*

Abstract. The palm oil mill located in Aceh Tamiang has 3 units of screw press machines with a production capacity of 15 tons / hour. The screw press machine is tasked with extracting oil from palm fruit fiber, but the pressing process does not run optimally because the screw press machine has a high failure rate. The high failure rate of screw press machines is caused by reduced machine component lifetime which is influenced by the method of using the machine so that it can result in disruption of the production process and not achieving production targets due to high oil losses. To prevent failure in the screw press machine, it is necessary to identify the cause of failure in priority engine components so that appropriate maintenance measures can be taken. So this study was conducted using analysis with a Failure Mode and Effect Analysis (FMEA) approach to identify the causes of failure and priority scale by evaluating failure data that occurred. Based on the results of the research conducted, it was found that the component that has the highest Risk Priority Number (RPN) value is the worm screw component with a value of 288 so that the component that has the highest level of critical risk on the screw press machine is the worm screw component. The components that have the second highest RPN value are bearing components with a value of 175, followed by cylinder press cage components with a value of 168, oil seal components with a value of 140, drive shaft components with a value of 90, coupling components with a value of 84, and gear components with the lowest value of 56.

Keywords: Screw Press, Failure Rate, Lifetime, Risk Priority Number, FMEA

[19] Galih Abdul Aziz (Universitas Ibn Khaldun Bogor), Dwi Yuliaji (Universitas Ibn Khaldun Bogor), Roy Waluyo (Universitas Ibn Khaldun Bogor), Yeni Anggraini (Universitas Ibn Khaldun Bogor), Raden Ruswendi (Universitas Ibn Khaldun Bogor), Agung Haz (Universitas Ibn Khaldun Bogor), Ryan Oktaviandi (Universitas Gadjah Mada) and Mulya Juarsa (Pusat Riset Teknologi Reaktor Nuklir, Organisasi Riset Tenaga Nuklir (BATAN), Badan Riset dan Inovasi Nasional). *Rancang Bangun Struktur Rangka FASSIP-04 Ver.2.*

Abstract. A structural framework consists of interconnected elements that form a strong and stable framework or frame. This framework aims to withstand and distribute the loads of the components that act on the structure. FASSIP-04 ver.02 rectangular-TP loop frame's structure uses the AISI 1015 profile steel shielded metal arc welding (SMAW) method. This research aims to obtain a design design, obtain the strength value of the FASSIP-04 ver.02 frame structure, and obtain the strength value of the welding connection of the FASSIP-04 ver.02 frame structure. Testing in this study uses a simulation method in 3D software by looking for stress, strain, and displacement. Tests were carried out by entering the results of the calculation of component loads and also the volume of water in components totaling 91.0797 kg in the FASSIP-04 ver.02 frame structure using 3D software. The results of the simulation show that the strength value of the FASSIP-04 ver.2 frame structure can support a component load of 91.0797 kg by producing a maximum stress value of $1.791e+07$ N/m². In contrast, the welding strength stress value obtained from the calculation gives a maximum stress value of $3.137e+06$ N/m².

Keywords: Frame structure, simulation, FASSIP-04 ver.2, welded joint strength, natural circulation.

[20] Raden Muhamad Farhan Ruswendi (Department of Mechanical Engineering, Ibn Khaldun Bogor University), Putut Hery Setiawan Setiawan (Badan Riset Inovasi Nasional (BRIN)), Dwi Yuliaji (Universitas Ibn Khaldun Bogor (UIKA)), Ryan Oktaviandi Oktaviandi (Universitas Gadjah Mada (UGM)), Esa Putra Ariesta Raharjo Raharjo (Universitas Gadjah Mada (UGM)), Galih Abdul Aziz Aziz (Universitas Ibn Khaldun Bogor (UIKA)) and Mulya Juarsa (Badan Riset Inovasi Nasional (BRIN)). *Rancang Bangun Struktur Penyokong pada Untai Rektanguler FASSIP-04 Ver.1 Menggunakan Material Baja Profil AISI 1015.*

Abstract. Untai Rektanguler FASSIP-04 Ver.1 merupakan fasilitas eksperimen yang terdiri dari perpipaian berbentuk persegi panjang dengan dimensi panjang 304 cm dan lebar 102 cm. Pemanas dan pendingin diinstal pada unti dengan perbedaan ketinggian tertentu. Fluida kerja menggunakan nanofluida akan bersirkulasi secara alami di dalam unti. Struktur pendukung merupakan salah satu bagian penting pada Untai Rektanguler FASSIP-04 Ver.1 terkait dengan kemampuannya untuk mengalami pembebanan. Tujuan dari penelitian ini adalah untuk memperoleh hasil simulasi dan perancangan struktur pendukung pada Untai Rektanguler FASSIP-04 Ver.1 menggunakan software 3D. Metode penelitian dilakukan dengan simulasi untuk mengetahui tegangan, regangan, dan perubahan bentuk benda (perpindahan). Sedangkan massa Untai Rektanguler FASSIP-04 Ver.1 diperoleh dari perhitungan massa masing-masing komponen seperti poros, rangka rectangular, pipa SS 201, air, tangki pemanas air, dan tangki pendingin air. Hasil perhitungan massa total unti rektanguler dengan diameter 1 inci, 2 inci, dan 3 inci adalah 138,7382 kg, nilai massa total untuk simulasi titik pembebanan. Selanjutnya berdasarkan hasil persamaan perhitungan dapat diperoleh nilai Faktor Keamanan sebesar 3,9. Kemudian nilai Faktor Keamanannya harus lebih besar dari angka satu, agar Struktur Pendukung ini sangat aman menahan beban keseluruhan sebesar 138,7382 kg.

Keywords: AISI 1015, unti rektanguler, Safety Factor, simulasi, struktur penyokong, FASSIP-04 Ver.1

[21] Yeni Anggraini (Universitas Ibn Khaldun Bogor), Prys Moniaga (Department of Mechanical Engineering, Faculty of Engineering, Universitas Indonesia, Depok), Dwi Yuliaji (Universitas Ibn Khaldun Bogor), Ryan Oktaviandi (Departemen Teknik Mesin dan Industri Universitas Gajah Mada, Yogyakarta), Esa Putra (Departemen Teknik Mesin dan Industri Universitas Gajah Mada, Yogyakarta), Roy Waluyo (Universitas Ibn Khaldun Bogor), Shendy Akbar Maryadi (universitas ibn Khaldun Bogor), Galih Abdul Aziz (Universitas Ibn Khaldun Bogor) and Mulya Juarsa (Grup Riset Pengembangan Sistem Termo-Fluida Reaktor, (PRTRKN) (BATAN) (BRIN)). *IVESTIGASI LAJU ALIRAN MASSA PIPA PENUKAR KALOR PADA TANGKI PENDINGIN FASSIP-02 VER.1.*

Abstract. The phenomenon of natural circulation occurs due to the Buoyancy force and frictional force caused by the meeting between the fluid and the surface wall through which the fluid passes without the influence of external forces. The purpose of this study is to obtain the characteristics of mass flow rate values and reynolds values in the cooling tank heat exchanger pipe. This study was conducted experimentally with changes in the initial conditions of setting water temperature in the heating section varying from 50oC, 60oC and 70oC. All measurements were taken for 22 hours using a national instrumentation data acquisition system with a sampling rate of 1 data per second and data capture focused on cooling tanks. The value of mass flow rate is influenced by temperature differences, so the higher the temperature at WHT, the higher the mass flow rate at steady conditions. However, steady conditions affect the mass flow rate in the pipe due to bubbles in the natural circulation water flow making the speed of the mass flow rate inhibited, so that the graph of each mass flow rate when in a steady state will drop. The mass flow rate of each mass flow rate calculation results has the same profile as the natural circulation flow rate, this is because the mass flow rate is a function of the volumetric flow rate of natural circulation.

Keywords: Sirkulasi alami, Untai Uji FASSIP-02 Ver.1, WCT, Laju Aliran Massa, WHT

[22] Chaesario Ramdan Widiyanto (Universitas Ibn Khaldun Bogor), Rio Sandi (Universitas Ibn Khaldun Bogor), Reihan Deandra Ratmaza Boni (Universitas Ibn Khaldun Bogor), Dwi Yuliaji (Universitas Ibn Khaldun Bogor), Roy Waluyo (Universitas Ibn Khaldun Bogor) and Mulya Juarsa (Pusat Riset Teknologi Reaktor Nuklir - Organisasi Riset BATAN – BRIN, Tangerang Selatan). *KARAKTERISTIK PENGUKURAN LAJU ALIRAN BERDASARKAN PENGGUNAAN BEBERAPA JENIS FLOWMETER PADA KALIBRATOR ALIRAN.*

Abstract. Research on cooling system simulation facilities is part of the development of passive safety systems because it is motivated by nuclear accidents that have previously occurred, in addition to understanding natural circulation phenomena that require the reliability of flow rate measuring systems. To obtain the reliability of the flow rate measuring system, it is necessary to calibrate the measuring instrument carried out on the calibrator. This study aims to determine the characteristics of water flow rate as well as flow rate deviation and comparison value of Reynold's number in each flow rate measurement using 3 types of flowmeters, namely digital turbine flowmeter, electromagnetic flowmeter and water flowmeter on flow calibrator. This research method was carried out experimentally with two tests, namely with a 2L measuring cup with a valve position open 90° to obtain the standard value of the reference deviation of the flowmeter used. The second test was carried out on a closed tank with 3 valve position variations (30°, 60°, and 90°) to determine the deviation of flow readings from the turbine digital flowmeter, electromagnetic flowmeter and water flowmeter. The results showed that the deviation of flow readings on the flowmeter was greater when the valve position was fully open 90°, due to the difference in response of flowmeter readings due to the resulting flow speed. It can be obtained that the accuracy of flowmeter electromagnetic readings is better than other types of flowmeters based on the deviation results of lower flow readings.

Keywords: Calibrator, Flowmeter, Flowrate, Reynold Number, Deviation

[23] Agung Akbar Haz (Universitas Ibn Khaldun Bogor), Roy Waluyo (Universitas Ibn Khaldun Bogor), Dwi Yuliaji (Universitas Ibn Khaldun Bogor) and Mulya Juarsa (Universitas Ibn Khaldun Bogor, Grup Riset Pengembangan Sistem Termo-Fluida Reaktor (BRIN)). *Pengujian Tekanan Struktur Perpipaan Berbahan Baja SS 201 pada Untai Rektangular FASSIP-04 Ver.01.*

Abstract. The rectangular loop is the main component of FASSIP 04 ver 01, which functions to flow fluid. The rectangular loop consists of piping components, a water heating tank, a water cooling tank, and an expansion tank. The FASSIP 04 ver 01 rectangular loop uses Stainless Steel 201 steel piping connected by shielded metal arc welding (SMAW). This research aimed to obtain the Strength of the piping system and the pressure characteristics of loop piping based on pressure changes. Research methodology has been done experimentally obtained from 3 pneumatic tests with pressure variation from 0.4 bar to 2.4 bars gradually for each 0.4 bar using pneumatic and hydrostatic testing. The result shows no leakage from loop piping, even for maximum pressure until 2.4 bars.

Keywords: piping, structure, pressure, hydrostatic, pneumatic, testing, FASSIP-04 Ver.1

[24] Wawan Trisnadi Putra (Universitas Muhammadiyah Ponorogo), Sudarno Sudarno (Universitas Muhammadiyah Ponorogo) and Munaji Munaji (Universitas Muhammadiyah Ponorogo). *Analisa Performa Dan Emisi Gas Buang Antara Minyak Plastik Dengan Peralite.*

Abstract. Octane-rich fuel will generally result in strong performance, but this isn't always the case. The motor's compression ratio and fuel selection must be taken into consideration. In theory, the prime mover is an apparatus that transforms thermal energy into mechanical energy. Currently, the primary option for a prime mover is a combustion engine. As a result, mankind are still working to develop a combustion engine that provides high capacities. The PMP 30 mixture in the torque test generates the maximum average torque, 10.11 N.m., at 2650 rpm using PMP 30 gasoline. While the PMP 20 gasoline produces the lowest average torque of 9.73 N.m at 2650 rpm, The gasoline with the highest average output, PMP 30, generates 7.9 HP on average. While the average horsepower produced by the PMP 10 and PMP 20 fuels is 7.7. Tables and graphs show that the average power output rises from 2000 to 7000 rpm. Additionally, the average power output declines from 7000 to 9000 rpm. The results of the exhaust gas emission test with a government-mandated CO standard of 1.5% to 3.5%, fuel entering the standard at PMP 10 and PMP 20 at 9000 rpm, and a government-mandated HC standard of 200 ppm to 400 ppm, with fuel entering the standard at PMP fuel 10, PMP fuel 20, and fuel PMP 20, PMP 30 at 5500 rpm, respectively.

Keywords: Plastic oil, Peralite, Torque, Power, Exhaust emissions

[25] Anis Siti Nurrohkeyati (Universitas Muhammadiyah Kalimantan Timur), Noer Aden Bahry (Universitas Muhammadiyah Kalimantan Timur) and Sigiet Haryo Pranoto (Universitas Muhammadiyah Kalimantan Timur). *A Prototype of Chopping Machines as an Organic Waste Processor*.

Abstract. Waste utilization is used in various sectors such as industry, food, manufacturing, etc. Food or vegetable waste is one type of organic waste. Organic waste can be used as organic fertilizer and animal feed. This study aims to make a prototype of an organic waste chopping machine. Furthermore, the chopped results can be used as raw material for compost or animal feed. The main driving components in the prototype organic waste chopper are electric motors with a power of 1/2 HP and 2880 rpm, reducers with a rotation ratio of 1/20, a pulley ratio of 3/4, and a belt type A-66. Analysis of the prototype design of the organic waste chopper machine, namely the calculation of the planning of the v-belt, pulley, and the calculation of the rate and torque on the blade shaft. The capacity of the chopping results is distinguished based on 2 types of tests, namely testing using a reducer and without a reducer. The types of waste that were chopped were vegetable waste, organic skin waste, and cassava. Testing with a reducer produces shredded waste with a capacity of 16.5 kg/hour. Also, 8.7 kg/hour for organic skin waste, and 26.13 kg/hour for cassava. Meanwhile, the test results without using a reducer resulted in chopped vegetable waste as much as 111.84 kg/hour, and 93.72 kg/hour for organic skin waste.

Keywords: Organic Waste, Prototype of Shredding Machine, Design and Construction, Shredding Capacity

[26] Mega Nur Sasongko (Universitas Brawijaya) and Joshua Jeremiah Panggabean (Universitas Brawijaya). *Pengaruh Penambahan Aditif Butylated Hydroxytoluene terhadap Pembentukan Deposit Biodiesel Kelapa Sawit*.

Abstract. Biodiesel made from palm oil is one of the renewable energy in Indonesia. Biodiesel as an alternative fuel for diesel engines has several weaknesses, such as low thermal stability, high viscosity, and high density. The physical properties of biodiesel can result in the formation of deposits. Deposits that appear in the fuel line and engine combustion chamber could reduce the performance of the engine. One of the efforts made to overcome the weakness of biodiesel is by mixing it with additives in the form of antioxidants, namely Butylated Hydroxytoluene (BHT). The method used to observe the effect of BHT additives in the formation of biodiesel deposits is Hot Surface Depositon Test (HSDT) method. Additives added to biodiesel are varied in 500 ppm, 1000 ppm, 1500 ppm, 2000 ppm and 2500 ppm. Furthermore, the mixture of biodiesel and BHT is dripped on a hot plate with a heating temperature ranging from 250 to 300 °C. A deposit will form on the plate and its diameter is measured to see the trend of the additive effect on the formation of biodiesel deposits. The results showed that the values of density and viscosity decreased with increasing the percentage of BHT additives. In addition, the biodiesel deposit formed in the plate decreased with the increase in the percentage of additives and the heating plate temperature. This is because the addition of BHT additives can significantly inhibit the degradation process of biodiesel.

Keywords: Biodiesel, deposit area, butylated hydroxytoluene additive, physical properties

[27] Widya Wijayanti (Brawijaya University). *Pengaruh Variasi Rasio Biomassa Dan Air Terhadap Kualitas Hasil Char Hidrotermal (Water Content's Effect on the Hydrothermal Pyrolysis's Produced Char)* .

Abstract. The purpose of this research is to better understand the provision of water content in thermochemical conversion. In the conventional pyrolysis process, biomass is heated without any water content, with the moisture content of the biomass attempting to be as minimized as possible. In the case of hydrothermal pyrolysis, adding water content is intended to boost the pyrolysis process, where liquid and gas products can decompose quickly at high pressure, yielding the greatest amount of fixed carbon. This investigation used mahogany wood biomass derived from craft waste and was conducted at a pressure of 5 bar.

Each experiment was carried out with different biomass-to-water ratios of 1:3, 1:4, 1:5, and 1:6 where the biomass mass was 200 grams. Both hydrothermal and pyrolysis processes are typically carried out at a temperature of 200°C and a holding time of 60 minutes. The resulting char is then calculated for volume and mass before being analysed using proximate analysis. Furthermore, char is tested for calorific value to determine its energy potential.

In this study, the fixed carbon content increased, with the highest fixed carbon content occurring in a 1:6 water biomass ratio, amounting to 22.4% with a calorific value of 5560.9 (cal/gram). It should be recognized that the calorific value of untreated mahogany sawdust is 2598.1 (cal/gram). The result indicated that adding a high water content to the hydrothermal process resulted in a high calorific value and energy yield, which was the precise opposite of the conventional pyrolysis process. Furthermore, with a high water content, the fixed carbon produced is higher. This means that the hydrothermal process has a high potential for use as an energy conversion process to produce the appropriate alternative fuel in an effective and efficient manner.

Keywords: water content, hydrothermal, pyrolysis, char

[28] Moch. Syamsul Ma'Arif (Universitas Brawijaya), Yordan Harhar Barus (Universitas Brawijaya), Ing Wardana (Universitas Brawijaya), Djarot B Darmadi (Universitas Brawijaya), Oyong Novareza (Universitas Brawijaya) and Sugiarto (Universitas Brawijaya). *Pengaruh Komposisi Campuran Minyak Jarak dan Minyak Kelapa terhadap Interaksi antar Molekul Pelumas Nabati dengan Simulasi Hyperchem 8.0.*

Abstract. The need for lubricants is currently increasing along with the development of the manufacturing industry. In manufacturing, lubricant is very important in the machining process. Machining processes which are carried out without the use of coolant will cause very large friction between the tool and the workpiece. Mineral-based lubricants are generally not environmentally friendly because the disposal of waste lubricants can cause contamination of the environment and the health of workers. Therefore, in this study the researchers analyzed the effect of the composition of Jatropha oil and Coconut oil as lubricants on the intermolecular interactions that affect wetting on the surface of the material using the Hyperchem simulation program. The percentage of ratio between Jatropha oil to coconut oil to the vegetable lubricant that be mixed are with a percentage of 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% of the total volume of the vegetable lubricant mixture to be simulated, which is 1000 ml. It was found that the more the concentration of Jatropha oil in the vegetable lubricant mixture, the lower the value of the dipole moment, polarizability, and bond energy. This is because as the composition of the castor oil and coconut oil mixture is added, the electronegativity and diversity of the constituent elements of the vegetable lubricant decreases which results in a decrease in the bond energy of the vegetable lubricant and the more Jatropha oil concentration in the vegetable lubricant mixture causes an increase in wetting on the copper surface as seen from the smaller the contact angle formed and causes a smaller wear rate. This is due to the decrease in the bond energy between the molecules and the bond energy to the copper crystal.

Keywords: Lubricant, Jatropha oil, Coconut oil, Intermolecular interaction, Hyperchem

[29] Djarot Darmadi (Universitas Brawijaya) and Andika Satrio (Universitas Brawijaya). *Analisa Stress Corrosion Cracking Pada Sambungan Kawat Las ER70S Pada Plat Baja SS400.*

Abstract. The susceptibility of weld joints to the Stress Corrosion Cracking (SCC) load alarmed the researchers since pipeline blow-out which were initiated in the area closed to the weld joints. This article is evaluating the SCC resiliences of the ER70S wire filler metal to the SS400 plate. The Capacitive Discharge Welding (CDW) with varied angle of the filler metal as an independent variable, whilst the other parameters were kept constant. The joint, then exposed to the SCC load, i.e., dipped in the 1M HCL solution with varied external tensile load to obtain the dependent variable: time to failure (time to brake). The results show that, generally, a sharper wire tip provides higher SCC resilience accept what was shown by the 30° specimen. With the sharper wire tip, the higher volume of weld nugget is provided which guarantee the enough number of weld metal. However, the impact phenomenon in the CDW process splashed this too much nugget beyond the formed joint which is proven by the many spatter in the weld joint. This thrown out nugget substance in turn decrease the intended nugget volume to form the joint. The results show the 60° wire tip angle provide the joint with the highest SCC resiliences, indicated by the longest time to brake when loaded with an equal external load.

Keywords: Stress Corrosion Cracking, Capacitive Discharge Welding, SCC Resiliences, Time to Fail

[30] Dwicky Wicaksana (Mechanical Engineering Department, Faculty of Engineering, Hasanuddin University), Azwar Hayat (Mechanical Engineering Department, Faculty of Engineering, Hasanuddin University), Novriany Amaliyah (Mechanical Engineering Department, Faculty of Engineering, Hasanuddin University) and Andi Dian Sry Rezki Natsir (ATI Makassar Polytechnic). *Rancang Bangun Sistem Pembangkit Daya Berbasis Energi Surya Untuk Repeater Jaringan.*

Abstract. Di tengah perkembangan teknologi yang begitu cepat, akses informasi mengalami peningkatan dengan diciptakannya repeater untuk memperluas cakupan jaringan. Selain itu, teknologi energi terbarukan mengalami pengembangan dan peningkatan efisiensi termasuk peningkatan efisiensi Pembangkit Listrik Tenaga Surya (PLTS). Pembangkit Listrik Tenaga Surya (PLTS) mengubah energi matahari menjadi energi listrik yang kemudian disalurkan ke ruang penyimpanan energi. Melalui penelitian ini, kedua teknologi jaringan dan teknologi pembangkit daya tersebut dipadukan untuk menghasilkan suatu inovasi yang memperhatikan aspek energi baru dan terbarukan. Tahap awal penelitian adalah merancang alat menggunakan aplikasi Autodesk Fusion 360. Alat yang dirancang berbentuk kotak dan portable agar mudah di bawa kemana saja. Setelah itu, dilakukan pembuatan alat dengan rancangan yang dibuat sebelumnya. Setelah selesai dibuat, dilakukan proses pengambilan data berupa data tegangan dan arus yang dihasilkan oleh panel surya, yang masuk melalui Solar Charge Controller, dan yang keluar melalui inverter. Setelah pengambilan data dilakukan analisis data yang mana dari hasil analisis tersebut didapatkan rancang bangun sistem pembangkit tenaga surya ini aman untuk repeater dengan mengaktifkan repeater selama 24 jam. Daya yang dihasilkan panel surya lebih besar dibanding daya yang masuk ke dalam baterai melalui Solar Charge Controller. Hal ini disebabkan karena Solar Charge Controller mereduksi daya yang masuk agar sesuai dengan tegangan dan arus yang dibutuhkan oleh baterai. Daya yang dihasilkan pada sistem untuk kebutuhan baterai sebesar 208 watt dalam sehari sedangkan untuk penggunaan rata-rata baterai sebesar 103 watt dalam sehari. Sisa daya rata-rata sebesar 105 watt akan digunakan untuk keperluan daya malam hari.

Keywords: Repeater, Sel Surya, Internet

[31] Teguh Dwi Widodo (Departemen Teknik Mesin, Universitas Brawijaya), Arif Wahyudiono (Departemen Teknik Mesin, Universitas Negeri Malang), Rudianto Raharjo (Departemen Teknik Mesin, Universitas Brawijaya), Mega Nur Sasongko (Departemen Teknik Mesin, Universitas Brawijaya), Redi Bintarto (Departemen Teknik Mesin, Universitas Brawijaya) and Djarot Bangun Darmadi (Departemen Teknik Mesin, Universitas Brawijaya). *Pengaruh Depth of Cut Pada Proses Face Milling Terhadap Kekasaran Permukaan Baja Karbon.*

Abstract. In the machining process, stainless steel can be produced by a surface process that ultimately produces surface roughness. Since the surface roughness value is directly proportional to the corrosion rate, the parameters used in surface grinding greatly affect the resulting corrosion rate value. One way to minimize the increase in surface roughness is to use the minimum amount lubrication method as a lubricant. This method usually involves a vegetable oil-based lubricant with a cutting fluid that uses a relatively low flow rate of 50-500ml/hour and uses compressed air to create small particles that make the surface smoother and lubricated.

In this study, corn oil was used as the cutting fluid and the minimum quantity lubrication method was used as the lubrication method, and the parameters of depth of cut 0.2mm, 0.3mm, 0.4mm, 0.5mm and 0.6mm were used as independent variables. Machined with a fixed shaft of 2000 rpm and a speed of 80 mm/min. The machining process used HAAS VF-2 CNC machine to produce surface roughness values, which were tested with SJ-210 surface roughness tester, and macro images before and after corrosion test as supporting information.

The results show that the depth of cut value is directly proportional to the surface roughness value, with the higher the depth of cut value, the higher the surface roughness value

Keywords: Machining, MQL, Roughness

[32] Purnami Purnami (Brawijaya University), Willy Satrio Nugroho (Brawijaya University) and Mega Nur Sasongko (Brawijaya University). *Penambahan Surfaktan Sebagai Media Menurunkan Tegangan Permukaan pada Elektrolisis Air .*

Abstract. Water electrolysis is one method to produce Hydrogen as an alternative energy to replace fossil fuels. The main problem in the water electrolysis process is its low efficiency. It's because in the process of electrolysis of air, hydrogen bonds and covalent bonds are broken at the same time. Part of the effort to increase the efficiency of electrolysis is the addition of surfactants. Surfactants have the ability to reduce surface tension, which contributes to the capture of Hydrogen bonds. In this study, electrolyzed water was added with 5, 10, 15 ml of natural surfactant from Klerek. Hydrogen production, pH, and electric current data were taken for 10 minutes. The results showed that the addition of surfactant from Klerek was proven to increase Hydrogen production. It due to surfactants are able to effectively reduce surface tension and their aromatic ring content is able to decreases hydrogen bonding. The highest hydrogen production was obtained by adding 15 ml of surfactant at 22.500 ppm.

Keywords: Surfaktan, Klerek, Elektrolisis

[33] Redi Bintarto (UB), Moch. Syamsul Ma'Arif (UB), Rudianto Raharjo (UB), Teguh Dwi Widodo (UB) and Ahmed Wisam Abed (UB). *Effect of Pouring Time on the Defect Level of Aluminum Products.*

Abstract. The flow rate of liquid metal is a significant factor in casting, where the optimum flow rate will produce smooth castings with minimal defects. This study aims to obtain a relationship between the flow rate of liquid metal in the sand molding system and the level of metal defects in casting with aluminum recasting material. The research was conducted by pouring molten metal with the pouring time on the top gating system for 1 second, 1.3 seconds, and 1.6 seconds. As a comparison, a simulation was also carried out with different filling times in the casting system. The results show that the greater the filling time, the slower the flow rate so that the turbulence flow of the metal casting will decrease which causes the porosity to decrease. The results of the simulations and experimental experiments show a similarity in that the pouring time that is too fast will cause the workpiece defects to become larger.

Keywords: flow rate, liquid metal, defect, casting, sand molding, filling time

[34] Lilis Yulianti (Brawijaya University), Nurkholis Hamidi (Brawijaya University), Ibrahim Ahmad Ibadurrohman (Brawijaya University) and Ilham Ridwan Pujohastarto (Brawijaya University). *Karakteristik Pembakaran Droplet Campuran Metil Oleat – Etanol dengan Penambahan Multi-Walled Carbon Nanotubes / Combustion Characteristics of Droplet of Methyl Oleic - Ethanol Blend with Multi-Walled Carbon Nanotubes Addition .*

Abstract. This research intended to investigated the combustion characteristics of methyl oleic – ethanol blend with OH functionalized multi walled carbon nanotubes (MWCNT-OH) addition. Methyl oleic is an unsaturated fatty acid methyl ester which is a constituent of various biodiesels. The observed fuel was a mixture of methyl oleic with 20% vol of ethanol. MWCNT-OH content was varied by 100 ppm, 200 ppm, 300 ppm, 400 ppm and 500 ppm (wt based). The presence of ethanol in the droplets is intended to promotes the microexplosion phenomenon, which generates some smaller droplets and a shorter burning time. The experimental results show that the MWCNT-OH addition on the droplet of methyl oleic – ethanol blend decreasing the ignition delay and droplet burning time, while the constant burning rate and droplet temperature (as well as flame temperature) were increasing. The reduction of ignition delay time due to higher thermal conductivity of nanofluids droplet, results more effective heat absorption from the environment and better heat transport inside the droplet. Hence, droplet vaporization, flammable mixture formation and ignition occur in a shorter time. Furthermore, this condition encourage a higher burning rate and a lower droplet burning time. The higher droplet and flame temperatures are related to higher heating value of the methyl oleic – ethanol – MWCNT-OH mixture as well as higher droplet burning rate which results more heat release rate.

Keywords: Droplet combustion characteristics, Methyl oleic – ethanol blend, MWCNT-OH

[35] Nurkholis Hamidi (Universitas Brawijaya), Lilis Yuliati (Universitas Brawijaya) and Dyo Harpiwanda (Universitas Brawijaya). *EFEK PENAMBAHAN ADITIF MULTI-WALLED CARBON NANOTUBES TERHADAP KARAKTERISTIK PEMBAKARAN SINGLE DROPLET METIL LAURAT*.

Abstract. Konsumsi bahan bakar di Indonesia yang meningkat dan produksi energi yang menurun membuat persediaan energi kian menipis. Dibutuhkanlah energi alternatif pengganti bahan bakar fosil yaitu Biodiesel. Biodiesel merupakan bahan bakar yang tersusun dari beberapa fatty acid methyl ester (FAME) dari minyak nabati melalui proses esterifikasi/transesterifikasi. Salah satu senyawa penyusun biodiesel adalah metil laurat. Metil laurat merupakan asam lemak jenuh yang banyak terdapat dalam minyak kelapa dengan memiliki rumus kimia $\text{CH}_3(\text{CH}_2)_{10}\text{COOH}$. Metil laurat merupakan salah satu senyawa penyusun FAME dengan rantai karbon 12 hasil dari transesterifikasi. Namun metil laurat memiliki nilai heating value dan konduktivitas termal yang rendah. Oleh karena itu, droplet metil laurat akan ditambahkan zat aditif berupa Multi Wall Carbon Nano Tube (MWCNT). MWCNT dapat meningkatkan nilai heating value-nya dan memiliki konduktivitas termal yang baik agar meningkatkan pembakaran pada droplet. Penelitian ini dilakukan untuk mengetahui karakteristik pembakaran berupa ignition delay time, burning duration, burning rate, evolusi diameter, temperature pembakaran, serta untuk mengetahui visualisasi tinggi dan lebar nyala api droplet. Pengambilan data secara eksperimental menggunakan data logger dan kamera untuk merekam proses pembakaran. Hasil dari penelitian ini didapat semakin singkatnya ignition delay time dan burning duration, temperatur droplet yang lebih tinggi, serta nyala api semakin tinggi dan lebar nyala api semakin besar.

Keywords: Multi Wall Carbon Nano Tube (MWCNT), Metil Laurat, Karakteristik Pembakaran, Biodiesel, Pembakaran droplet

[36] Yoyok Winardi (Program Studi Teknik Mesin, Universitas Muhammadiyah Ponorogo), Nanang Sufiadi Ahmad (Program Studi Teknik Mesin, Universitas Muhammadiyah Ponorogo), Munaji Munaji (Program Studi Teknik Mesin, Universitas Muhammadiyah Ponorogo), Andhika M.R Magnadine (Program Studi Teknik Mesin, Universitas Muhammadiyah Ponorogo), Kuntang Winangun (Program Studi Teknik Mesin, Universitas Muhammadiyah Ponorogo) and Fadelan Fadelan (Program Studi Teknik Mesin, Universitas Muhammadiyah Ponorogo). *Analisis Sifat Fisik dan Mekanik Hasil Daur Ulang Alumunium Limbah Otomotif*.

Abstract. Alumunium merupakan logam yang ringan, tahan korosi, memiliki daya hantar panas dan listrik yang baik. Alumunium banyak digunakan dalam pembuatan komponen kendaraan. Namun dengan berjalannya waktu pemakaian, komponen tersebut harus diganti, yang kemudian menimbulkan limbah. Remelting merupakan salah satu cara yang tepat untuk dapat mendaur ulang limbah alumunium. Penelitian ini menyelidiki sifat fisik dan mekanik hasil daur ulang limbah otomotif. Cetakan pasir digunakan untuk membuat spesimen uji. Bahan yang digunakan dalam penelitian ini adalah limbah velg. Spesimen hasil pengecoran kemudian diuji komposisi, diamati struktur mikro, uji kekerasan dan uji Tarik. Dari uji komposisi diperoleh hasil bahwa terjadi penurunan unsur Si, Cu, Mg, Ti, Ni, Pb, dan Sn setelah dilakukan pengecoran ulang. Hasil pengamatan struktur mikro menunjukkan terjadi perubahan ukuran dan kerapatan susunan butir setelah pengecoran ulang. Pada uji kekerasan terjadi penurunan tingkat kekerasan. Rata-rata hasil sebelum dicor ulang senilai 6,49 BHN sedangkan yang sudah dicor ulang 4,44 BHN. Pada uji tarik memperoleh hasil rata-rata 0,0338 kN/mm². Dengan demikian, pengecoran ulang alumunium limbah otomotif dengan cetakan pasir dapat menurunkan sifat mekanik yang disebabkan oleh berkurangnya komposisi paduan, dan perubahan struktur mikro.

Keywords: sifat fisik, daur ulang, alumunium, limbah otomotif

[37] Gusri Akhyar Ibrahim (Universitas Lampung), Yanuar Burhanuddin (Universitas Lampung), Arinal Hamni (Universitas Lampung), Novri Tanti (Universitas Lampung), Muhammad Pandu Wibowo (Universitas Lampung) and Tito Valiandra (Universitas Lampung). *Optimization of Hammer-Disc Mill Parameters During Producing Glucomannan Flour Using Taguchi Method.*

Abstract. Porang tubers contain glucomannan which has health benefits for the human body. However, glucomannan also contains calcium oxalate which is toxic. To separate glucomannan and calcium oxalate, a Hammer-Disc mill (HDM) machine is used, in which the process was categorized as mechanical process. This study aims to optimize the parameters of Hammer-Disc Mill machine for producing a glucomannan flour by using the Taguchi Method. The selected parameters are mass of porang chip, motor rotation speed, and the distance of hammer blades. The Taguchi Method was used to design an experiment using the Orthogonal Array L9 (3 factors, 3 levels). In this study, statistical analysis was carried out using Analysis of Variance (ANOVA) to determine the effect of each parameter on glucomannan produced. The glucomannan granules were taken by using screener with of 60-80 mesh. The results show that the input mass parameter of porang chips has a significant effect on the glucomannan produced, which, F calculating (10 91) was more than f_{Table} (5.41). the contribution of mass input of porang chips in percentage is 85.36%. Based on the results of the best response, the optimal condition for the production of glucomannan flour is to use a mass of 1 kg of porang chip input (level 3), motor rotation speed of 3000 rpm (level 3), and hammer spacing of 1 cm (level 3). By optimizing this parameter, it is expected to increase the yield of glucomannan produced by the Hammer-Disc Mill machine.

Keywords: Optimization, Hammer-Disc Mill, Glucomannan, Taguchi

[38] Zahrul Fuadi (Universitas Syiah Kuala) and Rudi Kurniawan (Universitas Syiah Kuala). *Desain dan aplikasi alat uji tribometer bolak-balik sederhana sebagai alat bantu pendidikan dan riset dasar kajian ilmu Tribologi .*

Abstract. Friction and wear are two common phenomena occurring in daily life, for example the scuffing between the sole of the shoe and the floor that causes wear of the sole. In mechanical engineering, friction and wear are very important phenomena because they affect the efficiency of the engine, from combustion engines, powertrain system, as well as mechanical components in electric vehicle system. It is estimated that the energy losses caused by friction and wear reach 3% of GDP per year. Tribometer is a test equipment used to measure the friction and wear of two interacting surfaces relative to each other, playing a vital role in design of material, surface engineering, coatings and lubricants to produce effective and efficient tribo-systems. One of the drawbacks of commercial tribometer equipment is its relatively expensive prices. This paper describes a design of a simple tribometer test device that can be used to measure the friction coefficient of a tribo-pair. The tribometer is pin on disk type, designed with compliance to ASTM G133-22: Standard Test Method for Linearly Reciprocating Ball-on-Flat Sliding Wear. This tribometer has reciprocating motion and is designed using simple components that can be purchased on the market or self-produced at relatively low prices. The tribometer can be used for educational purpose as a test equipment for fundamental mechanical phenomenon or for basic researches on wear and lubrication performance of a tribo-pair. Despite its simplicity, test results obtained by the equipment have been used in several publication at internationally reputable journals.

Keywords: pin on disk tribometer, reciprocating, friction coefficient, dry and lubricated friction, wear

[39] Farhan Bima Adhitama (Politeknik Astra) and Setia Abikusna (Politeknik Astra). *Optimalisasi Kuantitas Fluida Automatic Fire Suppression System sesuai dengan SOP Qtec Fire Services dengan Membuat Water Level Indicator di PT. XYZ.*

Abstract. Penelitian ini dilakukan di perusahaan PT. XYZ yang bergerak di bidang Agriculture, Industrial, Construction, Mining, dan Energy. Penelitian ini bertujuan untuk memperbaiki masalah pada sistem Automatic Fire Suppression System (AFS) yang tidak menggunakan pengukuran level air pada saat pengisian tangki. Metode DMAIC digunakan dalam penelitian ini. Solusi yang diusulkan adalah pengembangan alat Water Level Indicator yang dapat membantu mekanik dalam mengukur ketinggian air sesuai dengan spesifikasi tangki. Alat ini menggunakan beberapa perangkat elektrikal yang disatukan seperti lampu indikator dan buzzer untuk menunjukkan kuantitas air yang tepat. Setelah implementasi, dilakukan survei kembali kepada mekanik serta melakukan pengujian sampel tangki AFS. Penelitian ini berhasil mengatasi masalah dalam instalasi Automatic Fire Suppression System dengan menciptakan alat Water Level Indicator yang efektif. Penggunaan alat ini dapat meningkatkan efisiensi dan akurasi pengisian tangki Automatic Fire Suppression System, sehingga diharapkan Automatic Fire Suppression System dapat bekerja secara maksimal dalam memadamkan api tanpa potensi kegagalan atau terjadi kesalahan sistem.

Keywords: Automatic Fire Suppression System, Kebakaran, Water Level Indicator, Metode DMAIC

[40] Rudianto Raharjo (Universitas Brawijaya), Djarot Bangun Darmadi (Universitas Brawijaya), Teguh Dwi Widodo (Universitas Brawijaya) and Redi Bintarto (Universitas Brawijaya). *Friction welding heating time adjustment using teak wood clamps.*

Abstract. Due to their benefits like lightweight, superior corrosion resistance, strength, and design flexibility, aluminum alloys and High-Density Polyethylene (HDPE) are employed in various applications, particularly in the industrial sector. This study aims to ascertain the Al-HDPE structure's shear strength. Friction spot welding, a different welding-based way of joining, is the method of connection used. The heating times used in this study were 10, 20, 30, and 60 seconds. The clamping frame material used was AISI 304 and teak wood. The aluminum surface is treated by grinding to create surface roughness, which increases shear strength. The ASTM D3163-01 standard was followed when conducting the shear strength test. According to the findings, the shear strength of the Al-HDPE structure peaked between 10 and 20 seconds into the heating process, and then it tended to decline until 60 seconds into the heating process. According to a study of macro pictures, HDPE absorbs little heat at a heating duration of 10 seconds, resulting in minor thermal degradation and low shear strength. The strength diminishes at a heating time of over 20 seconds due to too much heat being absorbed.

Keywords: heating time, friction welding, teak wood

[41] Farid Irfanuddin (Department of Mechanical and Industrial Engineering Faculty of Engineering Universitas Gadjah Mada) and Priyo Tri Iswanto (Department of Mechanical and Industrial Engineering Faculty of Engineering Universitas Gadjah Mada). *Peningkatan sifat fisis dan mekanis SS316L dengan perlakuan cold-rolling dan shot-peening bertekanan 9 Bar.*

Abstract. Indonesia is located on a series of active volcanoes. Therefore, Indonesia experiences many natural disasters such as earthquakes, volcanic eruptions, and tsunamis. Natural disasters and work accidents as well as transportation accidents cause many victims of broken bones. Under these conditions, a large number of medical implant plates had to be provided, but the fact is that most of the medical plates in Indonesia are still imported products. Titanium alloy, cobalt alloy and SS316L stainless steel are commonly used biomaterials for bone implants, dental implants, skull plate implants, spinal support implants and heart rings. 316L stainless steel is often applied in bone implants because it has good biocompatibility and corrosion resistance, moderate mechanical strength, affordable price, abundant availability and easy machining. Bone implant failure is usually caused by fatigue loads and corrosion attacks or a combination of both. Fatigue loads are usually from activities of daily living, such as walking, running or jumping and corrosion attacks due to the interaction of metal implants with human body fluids. Compared to cobalt chrome based alloys and titanium alloys, SS316L has a much lower specific strength but is much cheaper, so it is necessary to improve the physical mechanical and chemical properties of SS316L by surface treatment. Surface treatments that can be applied to SS316L are cold-rolling and shot-peening.

The specimens will receive cold-rolling surface treatment followed by shot-peening, with a rolling variation of 0 and 10% thickness reduction. The shot peening process was carried out at a pressure of 9 bar with variations in firing duration of 0, 5, 10, 15 and 20 minutes. The steel ball used in the shot peening process has a diameter of 0.6 mm with a hardness value of 45 HRC and a shooting range of 6 cm. Microstructural observations were carried out to determine the microstructure of SS316L stainless steel specimens before and after surface treatment. The cutting is done in the lateral direction to obtain a cross section, then the specimen is smoothed with paper polishing with 400, 800, 1200, 2000, and 5000 mesh paper. The next process is to polish the specimen using autosol until it looks like a mirror. After that, it was etched using a mixture of 65% HCl and 35% HNO₃. Then the specimens were observed using a photo microscope and optilab connected to a computer. Surface roughness testing was carried out with a contact stylus profilometer (Surfcom 120 A, Advanced Metrology system, UK) where 2 points were taken on each surface of the specimen. The parameters used in the roughness data collection were cut off 0.800 mm, length 8 mm and meas-mag 2000. The hardness test was carried out using the Vickers micro hardness test method using the ASTM E384 standard by applying a load of 100 grams for 10 seconds. The wettability test uses a camera test tool which is carried out by measuring the average contact angle between the droplets and the surface of the specimen. Droplets are recorded starting when they are about to be dripped up to one minute of dripping water. Droplet image recordings can be analyzed using image software to make contact angles so that they can be measured using a protractor.

The results of microstructure observations showed a reduction in grain size after shot-peening. The results of the hardness test showed a very significant increase in hardness from 407 VHN of raw material to 663 VHN for samples that were rolled and shot peening for 20 minutes. The longer the shot peening time the harder the surface of the sample. The results of the roughness and wettability tests showed that the longer the shot-peening duration, the lower the roughness number and the smaller the droplet contact angle, which indicated that the sample was more hydrophilic.

Keywords; SS316L, cold-rolling, shot-peening, roughness, hardness, droplet contact angle

Keywords: SS316L, cold-rolling, shot-peening, roughness, hardness, droplet contact angle

[42] Farid Irfanuddin (Department of Mechanical and Industrial Engineering Faculty of Engineering Universitas Gadjah Mada) and Priyo Iswanto (Department of Mechanical and Industrial Engineering Faculty of Engineering Universitas Gadjah Mada). *Effect of double plastic deformation on microstructure hardness roughness and wettability of structural biomedical steel.*

Abstract. Indonesia's location which is above the confluence of three world tectonic plates such as the Indo-Australian Plate, the Eurasian Plate and the Pacific Plate makes it prone to disasters such as earthquakes, volcanic eruptions, landslides and tsunamis. This requires the availability of a large number of bone connecting plates, to replace destroyed organs or for the healing process. Orthopedic implants have very strict requirements, namely; The material must be accepted by the body, non-toxic and non-carcinogenic, corrosion resistant, good fatigue resistance, wear resistance, and has a low elastic modulus. There are three metal alloys used for orthopedic implants, namely stainless steel, cobalt-chrome alloy, titanium and their alloys. Compared to titanium or cobalt base alloys, SS316L is very cheap, but has the lowest strength and the highest corrosion rate, so its use is becoming obsolete. SS316L can still be used as a medical implant but needs to improve its mechanical properties and corrosion resistance. Most cases of implant fracture are mainly caused by material fatigue fracture due to dynamic loads of life activities and corrosion attack of body fluids which is characterized by a pattern of crack initiation and flow of striation that is in the same direction as the direction of fatigue crack propagation. Plastic deformation produces compressive residual stresses which can increase material life, increase hardness and strength of materials which in turn will increase resistance to fatigue failure, corrosion fatigue, stress corrosion cracking, hydrogen assisted cracking, fretting, wear and erosion. The purpose of this research is to study the effect of plastic deformation on the microstructure, hardness, roughness and wettability of stainless steel implant materials.

Specimen preparation begins by cutting a 316L stainless steel wide plate into a 100 mm x 25 mm plate. The plate is then deformed plastically by cold rolling it lengthwise with a thickness reduction degree of 10%. After being cold rolled, the samples were cut into small plates measuring 25 cm x 20 cm, which were then plastically deformed with high pressure shot peening of 14 bar with variations in firing duration of 0, 5, 10, 15 and 20 minutes. The steel ball used in the shot peening process has a diameter of 0.6 mm with a hardness value of 45 HRc and a shooting range of 6 cm. The samples were then prepared and polished and etched with HNO₃ and HCl solutions. The chemical composition test was carried out to determine the actual composition of the sample using a spectrometer. The hardness test method refers to the ASTM E 384 standard. The surface roughness test on the specimen was carried out using the portable surface roughness tester brand "Mitutoyo". The parameters used for surface roughness data collection were cut off 0.800 mm, length 8 mm, meas-mag 2000. The wettability test was carried out by calculating the average contact angle between the droplet and the specimen surface. The droplet resulting from the aquades droplet is then taken using a camera at 5 seconds after the drop, then the image is processed using the Corel Draw 2021 image software.

Hardness test results show that plastic deformation increases surface hardness very significantly. Hardness of raw material is 407 VHN increased to 831 VHN if deformed plastically repeatedly with a firing pressure of 14 Bar for 20 minutes. Increasing the hardness will increase the strength and extend the crack initiation time, thus extending the service life of orthopedic implants. The trend line of the roughness test results showed a downward trend to the lowest number of 0.849. All results of the roughness test still qualify as medical implant materials. The trend line from the wettability test shows a downward trend to the lowest level of 70.86. All wettability test results show that samples with plastic deformation are hydrophilic

Key words; biomaterial, plastic deformation, hardness, roughness, wettability, hydrophilic

Keywords: biomaterial, plastic deformation, hardness, roughness, wettability, hydrophilic

[43] Rahmat Doni Widodo (Departemen Teknik Mesin, Fakultas Teknik, Universitas Negeri Semarang), Muchamad Tri Pujiyanto (Departemen Teknik Mesin, Fakultas Teknik, Universitas Negeri Semarang) and Rusiyanto Rusiyanto (Departemen Teknik Mesin, Fakultas Teknik, Universitas Negeri Semarang).

Pengaruh orientasi serat penguat fiberglass dan eceng gondok terhadap kekuatan impact dan bending material komposit bermatrik polyester.

Abstract. This article describes the effect of the orientation of the fiberglass reinforcement material with water hyacinth with polyester matrix on the impact and bending strength. This research was conducted because of the excessive water hyacinth population and the need to find synthetic fiber replacement material in the manufacture of the hull. Fiberglass used is a type of woven roving (WR) which is removed and then rearranged based on the predetermined fiber orientation.

The water hyacinth fiber is given an alkalization treatment using a NaOH solution with a concentration of 5% for 1 hour. The material variants examined are as follows: full polyester (M100), mixed variants ($0^\circ/90^\circ/0^\circ/90^\circ$, $0^\circ/45^\circ/0^\circ/45^\circ$, $45^\circ/90^\circ/45^\circ/90^\circ$, and $45^\circ/-45^\circ/45^\circ/-45^\circ$), and hull material. Making specimen based on volume fraction composite consisting of 30% fiber and 70% matrix, where the fiber composition consists of 15% fiberglass and 15% water hyacinth fiber. The percentage of fiber used is 30% of the total fiber with a ratio of 1:1 to the composite fabrication process using the hand layup method. The impact strength analysis process uses the ASTM D256 standard while the bending strength uses the ASTM D790 standard.

The results of the test show that the $0^\circ/90^\circ/0^\circ/90^\circ$ variant has the greatest impact strength at 0.19718 J/mm². While the highest bending strength is in the $0^\circ/45^\circ/0^\circ/45^\circ$ variant with a value of 326.46 MPa. It can be concluded that the impact and bending strength of composite materials are influenced by the orientation of the reinforcing fibers.

Keywords: fiberglass, water hyacinth, polyester, impact, bending

[44] Sugiarto Sugiarto (Universitas Brawijaya), Mega Nursasongko (Universitas Brawijaya), Moch. Syamsul Ma'Arif (Universitas Brawijaya), Ramadhe Rossy (Universitas Brawijaya) and Muhammad Hariz Dedy Sayogi (Universitas Brawijaya). *TEMPERATURE BEHAVIOR OF ADVANCING SIDE AND RETREATING SIDE DUE TO PREHEATING IN FRICTION STIR WELDING AL 6061.*

Abstract. Retreating side and advancing side are nomenclature to two opposing sides during Friction Stir Welding (FSW) process. On retreating side, heat generated by friction during process tend to spread and transmit evenly to the surrounding material hence heat concentration on certain side of material doesn't occur. In other hand, on advancing side, heat concentration do occurs especially around tool. It has impact on increasing of temperature on material in the vicinity of the tool. By giving preheating on the material will alter the temperature characteristic, thermal cycle and morphology of the advancing side and retreating side regions.

This research use aluminum Al 6061 of 6 mm thick. Preheating temperature was varied on Troom, 50 OC, 75 OC, 100 OC and 125 OC. Dependent variables for the research are thermal cycle on retreating side and advancing side and morphology of weld joint. The other parameters are controlled such as type of joint of square butt joint, spindle speed of 921 rpm, feed rate of 24 mm/min, tool shoulder diameter of 12 mm, pin length of 5 mm, pin diameter of 6 mm, depth of plunge 0,2 mm, and weld angle of 0°. Temperature is measured at 40 mm from the start of weld and 20 mm off weld center.

The results are the peak temperature of weld on advancing side is higher than of retreating side, higher the preheating temperature make peak temperature to be faster to achieve and cooling rate after welding become slower. Peak temperature trend is increase from Troom to 75 OC then decrease on temperature of 100 OC and 125 OC. Based on join morphology in each temperature variation of preheating temperature, tunnel defect is observed on advancing side.

Keywords: FSW, preheating, Al 6061, advancing side, retreating side, thermal cycle

[45] Winarto Winarto (Departemen Teknik Mesin, Fakultas Teknik, Universitas Brawijaya). *Penurunan Kadar Polutan Air Limbah Dengan Kavitas Hidrodinamik.*

Abstract. Salah satu permasalahan lingkungan adalah pencemaran air oleh bahan pewarna dari industri tekstil yang tidak diperlakukan dengan benar. Kontaminan dari zat pewarna tekstil selain membahayakan kesehatan juga mengganggu ekosistem perairan [1,2]. Zat pewarna yang banyak dipakai pada industri tekstil antara lain rhodamine B. Metode penanganan polutan air yang cukup menjanjikan adalah dengan kavitas hidrodinamik yaitu terjadinya penguapan karena tekanan fluida turun sampai di bawah tekanan penguapannya [3-8]. Penurunan tekanan dapat terjadi karena adanya penyempitan luas penampang pipa misalnya ketika melewati orifice [9]. Kavitas menghasilkan bubble yang ikut terbawa oleh aliran dan ketika tekanan fluida di sekitarnya mengalami kenaikan maka bubble tersebut akan pecah atau collapse. Pecahnya bubble dapat menghasilkan temperatur yang sangat tinggi dan mampu mendegradasi polutan dalam air limbah [4,5]. Penelitian ini dilakukan secara eksperimen dengan tujuan untuk mempelajari penurunan polutan rhodamine B dalam air dengan kavitas hidrodinamik menggunakan orifice. Dari hasil eksperimen dapat diamati bahwa orifice dapat menghasilkan kavitas yang dibuktikan dengan terbentuknya bubble dalam aliran (bubbly flow). Pengujian dengan spectrometer UV – Vis menunjukkan bahwa kavitas hidrodinamik dapat menurunkan kadar rhodamine B dalam air limbah. Penurunan konsentrasi rhodamine B dalam air dengan perlakuan kavitas hidrodinamik lebih besar dibandingkan dengan aliran tanpa terjadi kavitas. Bubble collapse dari proses kavitas secara signifikan mampu menurunkan konsentrasi polutan rhodamine B di dalam air.

Keywords: kavitas, orifice, bubble collapse, rhodamine B

[46] Ridwan Abdurrahman (Universitas Riau), Awaludin Martin (Universitas Riau), Asral Asral (Universitas Riau), Ahmad Kafrawi Nasution (Universitas Muhammadiyah Riau) and Abrar Ridwan (Universitas Muhammadiyah Riau). *Studi Numerik Tungku Induksi Portabel Sebagai Solusi Penanganan Limbah Sistem Vaksin COVID-19 Pasca Vaksinasi.*

Abstract. Pemberian massal vaksin COVID-19 telah menjadi langkah penting dalam memerangi pandemi global. Namun, skala kampanye vaksinasi yang signifikan telah menyebabkan peningkatan limbah medis, termasuk jarum suntik bekas, vial, dan benda tajam lainnya. Pembuangan limbah yang tepat dan aman sangat penting untuk mencegah potensi bahaya kesehatan dan lingkungan. Studi numerik ini menyelidiki kelayakan penggunaan tungku induksi portabel sebagai solusi inovatif untuk penanganan limbah vaksin COVID-19 pasca vaksinasi.

Studi ini melibatkan analisis komprehensif kinerja tungku induksi, dengan mempertimbangkan faktor-faktor seperti volume limbah, distribusi panas, dan efisiensi energi. Pemodelan dan simulasi komputasi digunakan untuk menilai kemampuan pemanasan dan perilaku termal tungku induksi selama proses pembuangan limbah.

Simulasi numerik juga menunjukkan bahwa tungku induksi beroperasi dengan efisiensi energi yang tinggi, menghasilkan kehilangan panas yang minimal dan mengurangi dampak lingkungan. Temuan ini menyoroti potensi teknologi ini untuk berkontribusi secara signifikan terhadap praktik pengelolaan limbah berkelanjutan di sektor kesehatan.

Kesimpulannya, studi numerik abstrak ini menghadirkan tungku induksi portabel sebagai solusi yang menjanjikan untuk penanganan limbah vaksin COVID-19 pasca vaksinasi secara efektif dan berkelanjutan. Analisis numerik menunjukkan kemanjurannya dalam melelehkan dan mengolah berbagai bahan limbah, mengurangi volume limbah, dan meminimalkan dampak lingkungan. Dengan menerapkan teknologi penanganan limbah yang inovatif, sistem perawatan kesehatan dapat meningkatkan praktik pengelolaan limbah mereka, berkontribusi pada respons yang lebih aman dan berkelanjutan terhadap krisis kesehatan global yang sedang berlangsung. Namun, validasi dunia nyata lebih lanjut dan analisis biaya-manfaat diperlukan untuk mengevaluasi kepraktisan dan kelayakan ekonomi dari penerapan tungku induksi portabel untuk pembuangan limbah vaksin dalam skala yang lebih besar.

Keywords: Computational fluid dynamic, Furnish, Induction

[47] Femiana Gapsari (Departemen Teknik Mesin, Fakultas Teknik, Universitas Brawijaya), Putu Hadi Setyarini (Departemen Teknik Mesin, Fakultas Teknik, Universitas Brawijaya), Gilang Rausyanfikri (Departemen Teknik Mesin, Fakultas Teknik, Universitas Brawijaya) and Muhamad Irfan Saputra (Departemen Teknik Mesin, Fakultas Teknik, Universitas Brawijaya). *Analisis Evolusi Hidrogen dan Laju Korosi pada Inhibisi Korosi Ekstrak Ampas Tebu dengan Machine Learning.*

Abstract. Organic inhibitors are proven to be able to reduce corrosion rate. The effectivity of organic inhibitors depends on how they are adsorbed on to metal surface and protect the surface. Inhibitor can restrain corrosion reaction which includes oxidation and reduction. Reduction reaction is signified by hydrogen evolution. The inhibitor corrosion is related to chemical composition, concentration, and molecule inhibitor. Effective inhibitor is seen from how it reduces corrosion rate and hydrogen evolution. The standard methods which are usually used for corrosion analysis are weight loss test, potentiodynamic polarization (PP), and Electrochemical Impedance Spectroscopy (EIS). Weight loss test is a type of long-term test, while electrochemical method is short term test type. Corrosion rate analysis that combines the two types of the test is required. Any physical change during the corrosion electrochemical process can be analyzed in real time. The efficiency of an inhibitor in restraining corrosion rate can be seen from how much the physical change in a metal.

The effectivity of a corrosion inhibitor can be analyzed using standard method namely weight loss test and electrochemical test. The change in H₂ bubbles can describe physical changes on the metal surface based on the corrosion inhibitor efficiency. The changes in texture and the H₂ characteristics on the metal surface during polarization process are analyzed using machine learning, gray level co-occurrence matrix (GLCM) and classified using support vector machine (SVM).

Both electrochemical corrosion test and GLCM/SVM analysis confirmed that optimum inhibition was reached by employing inhibitor concentration of sugarcane bagasse of 2000 ppm with the efficiency of 99 % of corrosion steel in 1 M HCl. Based on the analysis of SEM, FTIR, and UV-Vis, the inhibition mechanisms were physisorption and isothermal adsorption. The accuracy of 88 % was obtained by applying the functions of SVM linear kernel. The GLCM/SCM method can be optimized and is really helpful in assisting the electrochemical method and quantification of in-situ H₂ bubbles in analyzing the effectivity of organic inhibitor.

Keywords: bubbles, corrosion inhibitor, electrochemical, hydrogen evolution, machine learning

[48] Muhammad Marsudi (Universitas Islam Kalimantan Muhammad Arsyad Al Banjari). *Peningkatan mutu produk dengan metode Statistical Process Control di industri elektronik.*

Abstract. Statistical Process Control (SPC) is a technique to increase the quality and to ensure the needs or requirement of customers are achieved. SPC is a set of tools for managing processes, determining and monitoring the quality of the output of an organization, and it provides objective means of controlling quality in any transformation process. Besides, SPC is also a strategy for reducing variation in products, deliveries, processes, materials attitudes and equipment which are the cause of most quality problems. This study is conducted in an electronic industry, named ABC Company- manufactures transistors and other electronics parts, where its objective is to observe the implementation of quality management and its performance in the industry. To achieve the objective, the Statistical Process Control technique was applied for the analysis. The tools of SPC consist of check sheet, Pareto analysis, Cause and Effect analysis, and Control Charts. Based on the result analysis, the quality production processes in the company are in control. Although many non-conforming parts happen but they can be detected easily. At the end of study, some action plan and suggestion had been recommended to improve the quality.

Keywords: electronic industry, production process, quality management, SPC

[49] Rahmat Hafiz (Institut Teknologi Bandung) and Sri Raharno (Institut Teknologi Bandung). *Analisis Pengaruh Bentuk Pin Pahat Pada FSW Terhadap Kekuatan Tarik Sambungan Aluminium AA6061-T6 Menggunakan Metode ANOVA.*

Abstract. Fusion welding on aluminum is prone to defects due to welding at high temperatures. It can reduce the performance and quality of the joints. A new method known as solid state welding or friction stir welding (FSW) was introduced by TWI in 1991. The FSW welding method is still being developed to produce efficient welding techniques. One of the factors that can affect the quality of the FSW is the type of tool's pin. In this study, observations were made of the effect of using dissimilar pin on the ultimate tensile strength of joints using three different types of pins. The types of pins used are tapered cylinder, tapered with flats and tapered thread cylinder. The joints is a butt joint and uses AA6061-T6 with the thickness is 8 mm. Welding was carried out at 1200 rpm and 21.5 mm/minute. The tensile test results to the joining was analysis using the Analysis of Variance (Anova) method. Based on the analysis and calculation, dissimilar pins have significant effect on the tensile strength of joints. It can be seen from the significance value between the sample groups is (sig) $0.00 < 0.05$. However, after the Post Hoc test (Tuckey's HSD) to see the level of difference between the sample groups, only the types of pins tapered with flats were significantly different. Meanwhile, there is no difference between pin tapered cylinder and tapered thread cylinder because it has a significance value (sig) $0.30 > 0.05$.

Keywords: AA6061-T6, Anova, FSW, Pin, Post Hoc

[50] Awaludin Martin (Universitas Riau), Dinni Agustina (Universitas Riau) and Ridwan Abdurrahman (Universitas Riau). *Pengering Beku Vakum untuk Pembenihan Padi Berkapasitas 10 kg Menggunakan Evaporator dan Kondenser Ganda.*

Abstract. Produksi padi di Indonesia yang dilaporkan oleh BPS pada tahun 2020 mengalami penurunan 0.43% dari 54,6 juta ton gabah kering giling (GKG), menjadi 54,42 juta ton GKG pada 2021. Bibit merupakan kunci keberhasilan dalam budidaya padi dimana bibit berkualitas mampu beradaptasi, memiliki pertumbuhan yang cepat dan seragam, serta tahan hama. Salah satu tahapan kritis pengolahan pasca panen adalah proses pengeringan. Padi memiliki kadar air sekitar 25-28% pada saat pemanenan, sedangkan kadar air yang cocok untuk tujuan penyimpanan benih atau pengolahan menjadi beras adalah sekitar 9-14%. Metode umum atau klasik untuk mengeringkan padi adalah menjemur dengan memanfaatkan sinar matahari, temperatur dan kelembaban udara sekitar dan kinerja dari metode ini sangat tergantung kepada penyinaran matahari sehingga tidak dapat dikendalikan lama proses pengeringan dan kualitas hasil pengeringannya. Oleh karena itu, metode pengeringan umum ini mulai digantikan menjadi metode mekanik, metode ini lebih efisien karena tidak merusak produk yang dikeringkan dan tidak menguapkan nutrisi dan vitamin yang terkandung pada produk yang dikeringkan serta mampu dikendalikan lama prosesnya.

Salah satu metode pengeringan mekanik adalah pengeringan vakum beku yang diakui sebagai metode pengeringan terbaik tetapi mengkonsumsi energi dalam jumlah yang besar karena pengeringan beku vakum beroperasi dengan mengendalikan tekanan dan temperatur dibawah keadaan triple point air yaitu dibawah suhu 0°C dan tekanan di bawah 610,5 Pa. Untuk mengurangi konsumsi pada proses pengeringan ini beberapa penelitian dilakukan salah satunya adalah dengan pemanfaatan panas buang kondenser sebagai sebuah proses tambahan yaitu pada proses secondary drying.

Penelitian ini bertujuan mengembangkan pengering beku vakum dengan memanfaatkan panas buang kondensator untuk proses pengeringan ke dua (secondary drying) menggunakan kondenser dan evaporator ganda, dimana masing-masing akan diletakkan di ruang pengering untuk mempercepat proses pengeringan ke dua atau secondary drying dan juga mengurangi konsumsi penggunaan energi pada pengeringan beku vakum. Pengering beku vakum yang dikembangkan memiliki 2 buah evaporator dan 2 buah kondenser (indoor, outdoor evaporator dan kondenser), indoor dan outdoor evaporator masing-masing memiliki Panjang tube 23 meter dan 12 meter dengan diameter luar tube 6,35 mm dan 9,525 mm, namun untuk outdoor evaporator dilengkapi dengan 90 buah sirip (fin). Sementara untuk indoor dan outdoor kondenser panjang total tube 44,05 meter dan 11,55 meter dengan diameter tube nya 9,525 mm serta untuk outdoor kondenser dilengkapi dengan 77 sirip (fin).

Pengujian yang dilakukan mampu mengurangi kadar air sebesar 96,5 % pada berat sampel padi 2,5 kg dengan temperatur -12,98°C dan lama proses 4 jam, untuk berat sampel padi 5 kg dengan temperatur -12,41°C dengan lama proses pengeringan 5 jam dapat menghilangkan kadar air sebesar 95% dan pada berat sampel 10 kg dengan temperatur -12°C dengan lama proses pengeringan 7 jam dapat menghilangkan kadar air sebesar 75,8%.

Keywords: Bibit Padi, Freeze Vacuum Drying, Kandungan Air, indoor dan outdoor evaporator, indoor dan outdoor kondenser

[51] Asral Asral (Universitas Riau) and Ridwan Abdurrahman (Universitas Riau). *Kaji Numerikal Pengaruh Inlet Laju Aliran Massa Terhadap Kinerja Pompa Sentrifugal Sebagai Pembangkit Listrik Pico-Hydropower.*

Abstract. Sistem Pico-hydropower telah mendapatkan perhatian yang signifikan sebagai solusi ramah lingkungan dan terdesentralisasi untuk pembangkit listrik skala kecil. Dalam sistem ini, pompa sentrifugal yang dioperasikan sebagai turbin dapat secara efisien memanfaatkan tenaga air dari sumber air head rendah. Kinerja turbin ini dipengaruhi oleh berbagai faktor, dengan laju aliran massa menjadi parameter penting. Studi numerik ini bertujuan untuk menyelidiki dampak laju aliran massa yang berbeda pada saluran masuk terhadap kinerja pompa sentrifugal yang digunakan sebagai sistem pembangkit listrik tenaga air..

Komputasi dinamika fluida (CFD) digunakan untuk melakukan analisis komprehensif. Prototipe virtual pompa sentrifugal sebagai turbin dikembangkan, dan empat laju aliran massa yang berbeda dianggap sebagai kondisi masukan: rendah, sedang, dan tinggi. Laju aliran ini dipilih untuk mewakili skenario tipikal untuk aplikasi pico-hydropower dalam berbagai kondisi sumber daya air.

Hasil awal menunjukkan bahwa laju aliran massa di inlet memiliki pengaruh besar terhadap kinerja turbin. Pada laju aliran massa yang rendah, turbin menunjukkan efisiensi yang lebih rendah karena berkurangnya energi kinetik yang tersedia untuk diubah menjadi tenaga mekanik. Namun, ini menunjukkan peningkatan efisiensi pada laju aliran massa sedang dan tinggi, yang menunjukkan kemampuan pembangkit listrik yang lebih baik dengan peningkatan aliran air.

Karakteristik head-discharge juga dipengaruhi oleh laju aliran massa. Seperti yang diharapkan, head meningkat dengan laju aliran massa yang lebih tinggi, memberikan potensi energi yang lebih tinggi untuk turbin. Selain itu, output daya meningkat secara signifikan seiring dengan peningkatan laju aliran massa di saluran masuk, menyiratkan hubungan langsung antara laju aliran dan pembangkitan daya.

Sebagai kesimpulan, studi numerik abstrak ini menyoroti efek signifikan dari laju aliran massa di saluran masuk pada kinerja pompa sentrifugal yang dioperasikan sebagai turbin tenaga pico-hidro. Memahami interaksi antara laju aliran massa, efisiensi, dan output daya sangat penting untuk mengoptimalkan desain dan pengoperasian sistem pembangkit listrik tenaga air.

Keywords: pompa sebagai turbin, listrik, numerik, k-e model

[52] Kuntang Winangun (Universitas Muhammadiyah Ponorogo), Wawan Trisnadi Putra (Universitas Muhammadiyah Ponorogo), Anas Nurgito (Universitas Muhammadiyah Ponorogo), Yoyok Winardi (Universitas Muhammadiyah Ponorogo) and Munaji Munaji (Universitas Muhammadiyah Ponorogo). *Efek Pencampuran Minyak Plastik Polypropilane (PP) dan Biosolar terhadap Kinerja dan Emisi Mesin Diesel.*

Abstract. Plastic waste is a significant societal problem. If it is hoarded, it will cause odor, and if it is incinerated, it will pollute the atmosphere. Alternative energy is one method for recycling plastic refuse. By pyrolyzing plastic waste, diesel oil, premium, and bitumen can be extracted. Diesel oil is produced through the pyrolysis of plastic waste. Diesel oil derived from plastic waste cannot be used directly in diesel engines due to its low sentane rating. This study seeks to determine the effect of blending diesel oil derived from polypropylene (PP) plastic waste with biodiesel and cetane booster on diesel engine performance and exhaust emissions. The fuel used in this investigation consisted of 100% biodiesel, 25% plastic oil plus 0.5% cetane booster, 75% biodiesel, 50% plastic oil plus 0.5% cetane booster, and 50% biodiesel. The diesel engine is a single-cylinder, four-stroke, 510 cc engine with indirect combustion. The diesel engine is coupled to a generator that is equipped with an incandescent lamp. The test results indicate that the addition of plastic oil and 0.5% cetane booster can enhance engine performance, including an increase in power and torque of 4.4% and a decrease in fuel consumption of 3.5% compared to using 100% diesel fuel. However, the addition of diesel oil derived from plastic waste resulted in a 5.4% increase in smoke opacity emissions. It is anticipated that this investigation will yield information regarding the use of polypropylene (PP) plastic waste for alternative energy.

Keywords: Cetane booster, Engine performance, Exhaust gas emission, Plastic oil, Polypropylene

[53] Yanuar Burhanuddin (Universitas Lampung), Wahyudyatama Wahyudyatama (Jurusan Teknik Mesin, Universitas Lampung), Achmad Yahya Teguh Panuju (Universitas Lampung), Gusri Akhyar (Universiry of Lampung) and Arinal Hamni (Universitas Lampung). *OPTIMASI KEAUSAN PAHAT POTONG PEMESINAN MILLING MAGNESIUM AZ31 TANPA PENDINGIN DENGAN METODE TAGUCHI.*

Abstract. Magnesium alloys are lightweight metallic materials as they offer a number of different interesting mechanical and thermal properties. However, magnesium machining still faces problems because magnesium exhibits poor machining at low temperatures due to the crystal structure of HCP which affect the tool wear out quickly. Therefore it is better to machine magnesium at high temperatures. However, when the machining temperature is close to the melting temperature, magnesium will easily burn when exposed to oxygen. For this reason, it is necessary to conduct research on magnesium in the milling machining process. In this experiment the parameters used are spindle speed, feed rate, depth of cut and tool size. The result data on this experiment was conducted based on experimental design and analysis using the Taguchi L9 Method (34) then an Analysis of Variance was performed. Measuring wear values using a USB microscope and monitoring heat distribution using a thermal camera. The experimental results obtained the highest wear value on Run Order 8 of 0.316 mm with operation using a 10 mm of tool diameter, 1.5 mm of depth of cut, 910 rpm of spindle speed and 220 mm/minute of feed rate. The highest cutting temperature is Run Order 9 with a value of 45.4 ° C, operating using a 10 mm of tool diameter, 2 mm depth of cut, 910 rpm of spindle speed and 75 mm/min feed rate. After using the ANOVA, it can be concluded that the most significant factor in the occurrence of wear is the feed rate

Keywords: Magnesium AZ31, Milling, Tool Wear, Heat Distribution, Taguchi Method

[54] W.Djoko Yudisworo (Universitas 17 Agustus 1945 Cirebon), Endang Prihastuty (Universitas 17 Agustus 1945 Cirebon) and Wasiran Wasiran (Universitas 17 Agustus 1945 Cirebon). *Rancang Bangun Mesin Pencacah kapasitas 10 kg/jam dengan Penggerak mesin Diesel.*

Abstract. Jumlah sampah plastik yang dibuang kelaut oleh Indonesia jumlahnya mendekati 200 jutaton. Jumlah ini berada di bawah Tiongkok yang menghasilkan sampah plastik mencapai 262,9 juta ton. Pada saat yang sama, kebutuhan akan plastik di Indonesia baru terpenuhi sekitar 64% dari total 5 juta ton plastik. Sampah plastik yang dibuang kelaut, seharusnya dapat dimanfaatkan untuk memenuhi kebutuhan tersebut. Sampah plastik yang telah ada, perlu diolah agar dapat dimanfaatkan kembali sebagai plastik produksi. Pengolahan sampah plastik yang paling sederhana adalah dengan mencacah plastik yang telah ada menjadi serpihan-serpihan kecil menggunakan mesin pencacah. Mesin pencacah dapat digunakan dimanapun karena menggunakan mesin diesel sebagai penggerakannya. Metode pencacahan yang digunakan menggunakan tipe gunting. Hasil pemilihan mesin pencacah menggunakan 24 mata pisau dengan spesifikasi, panjang 180 mm, lebar 50 mm, tebal 7 mm dan sudut mata pisau 35° dengan panjang poros penggerak 450 mm, diameter 25 mm. Penelitian berguna untuk berkontribusi dalam penanganan masalah sampah. Terkait masalah sampah anorganik semisal sampah gelas plastik yang makin hari makin menumpuk dan terkait masalah penanganannya. Dengan mendesain mesin pencacah nantinya cacahan plastik akan dilelehkan dengan mesin ekstruder sehingga nantinya akan di daur ulang

Keywords: Desain rancang bangun, mesin pencacah plastik, sampah plastik botol minuman, penggerak mesin diesel, kapasitas 10 kg/jam, penanganan sampah

[55] Rudi Irawan (Program Studi Teknik Mesin, Universitas Gunadarma, Depok, Jawa Barat, Indonesia), Ridwan Ridwan (Program Studi Teknik Mesin, Universitas Gunadarma, Depok, Jawa Barat, Indonesia), Afan Fadillah (Program Studi Teknik Mesin, Universitas Gunadarma, Depok, Jawa Barat, Indonesia), Doni Tri Wijaya Putra (Program Studi Teknik Mesin, Universitas Gunadarma, Depok, Jawa Barat, Indonesia), Johannes Jeremi Badar (Program Studi Teknik Mesin, Universitas Gunadarma, Depok, Jawa Barat, Indonesia) and Rizky Agung Pratama (Program Studi Teknik Mesin, Universitas Gunadarma, Depok, Jawa Barat, Indonesia). *Potensi Pemanfaatan Getaran Mekanik Menggunakan Piezoelektrik Pada Shockbreaker Mobil Sebagai Penunjang Penghasil Listrik.*

Abstract. Global warming has been a main issue. Many actions and policies have been made and implemented to reduce emission of green-house gases. One of the actions to stop emission, some developed countries target to stop selling new cars using fossil fuels. Batteries are used to store electricity for an electric car. Recharging batteries take time depending on battery capacity. Hence, it is required a method or technology that can lengthen the battery mileage, such as by recharging battery while the car is running. This research investigated the potential of harvesting mechanical vibration energy from a running car to produce electricity, particularly harvesting mechanical vibration of car shockbreaker using piezoelectric. Four pieces of piezoelectric were used; two pieces were composed in series and two pieces were composed in parallel. The piezoelectric circuits were installed inside a nylon solid cylinder which was protected by stainless ST41 and then the cylinder was mounted on a car shockbreaker, so that the vibration of shockbreaker was transferred to piezoelectric. The experiment was conducted using a car in a main road with the speed around 70 km/jam. Current and voltage were measured using a multimeter every kilometer and averaged. The experiments yielded average 0,9 watt and 0,5 watt from the serial and parallel circuits respectively. The study concludes that converting mechanical vibration at a car to electricity has potential as supplement electricity source to recharge electric car batteries that can lengthen battery mileage.

Keywords: piezoelectric, shockbreaker, electric car, mechanical vibration, battery, emission

[56] Ridwan Ridwan (Universitas Gunadarma), Afrizal Riyantoro (Universitas Gunadarma) and Rudi Irawan (Universitas Gunadarma). *PENGARUH MASSA DAN KECEPATAN TERHADAP PANAS YANG TIMBUL PADA REM DRUM KENDARAAN MINI BUS.*

Abstract. Rem merupakan sebuah alat untuk memperlambat atau menghentikan kendaraan pada saat kendaraan melaju, rem juga sebagai alat pengaman apabila kendaraan sedang diparkir atau berhenti. Rem dapat mengubah energi kinetik dan potensial menjadi panas melalui proses gesekan permukaan antara brakes pad dengan rotor dengan proses perpindahan panas. Dalam dunia transportasi, analisis panas rem pada kendaraan merupakan proses yang sangat penting untuk menganalisis dan meningkatkan kinerja sistem pengereman. Pada Penelitian ini dilakukan simulasi pada rotor rem (rem drum) pada kendaraan mini bus masing-masing massa kendaraan 3500 kg dan 5000 kg menggunakan software abaqus, dengan lima variasi kecepatan yakni: 60 km/jam, 70 km/jam, 80 km/jam, 90 km/jam, dan 100 km/jam Hasil yang didapatkan dari simulasi untuk kendaraan dengan massa 3500 kg adalah secara berturut-turut menghasilkan temperatur maksimum pada rotor rem sebesar 87.82°C; 106.55°C; 163.69°C; 216.34°C; dan 275.04°C. Pada simulasi dengan massa kendaraan 5000 kg menghasilkan temperatur maksimum pada rotor rem sebesar 108.45°C; 126.33°C; 207.9°C; 269.03°C; dan 299.31°C. Semakin tinggi kecepatan kendaraan pada saat pengereman akan menghasilkan panas yang lebih tinggi pada rotor rem, namun kenaikan temperatur yang terjadi tidak linier terhadap kecepatan kendaraan. Massa kendaraan sangat mempengaruhi panas yang timbul pada rotor saat pengereman dilakukan. Pada kecepatan yang sama dengan massa yang lebih tinggi akan memberikan/menghasilkan panas yang lebih tinggi.

Keywords: Abaqus, speed, massa, rem drum, panas

[57] Agung Premono (Universitas Negeri Jakarta), Wardoyo Wardoyo (Universitas Negeri Jakarta) and Kartiko Nugroho (Universitas Negeri Jakarta). *Desain Bracket Motor Listrik untuk Kendaraan Hemat Energi/Design of electric motor bracket of the energy-efficient car.*

Abstract. Indonesia is currently encouraging the development of energy-efficient cars using electric motors. To reduce the weight of the vehicle, the design of the car's structure is needed. One component to support this car is the electric motor bracket. This component is used as the stand of the electric motor so it must be rigid. The bracket design must also be lightweight to reduce the overall car load. This research is aimed to design the electric motor bracket for Turnigy Rotomax 50cc Size Brushless Outrunner Motor. The Finite Element Method (FEM) is used to simulate the model using the Ansys software. Linear static analysis is selected to carry out the Von Mises Stress and the Safety factor numbers of the bracket. The model used is four brackets with differences in the bracket's support construction. Two bracket models use an overhang construction while two others use an extended arm construction. The material is Aluminum 6061 series with a thickness of 8 mm. The load consists of two load sources. The first load is caused by the moment due to the electric motor's weight of 7950 Nmm. The second one is the tensile force of the chain on the motor sprocket of 705.4 N. The results show that the fourth bracket model with extended arm support construction is the best construction. It produced the Safety Factor number of 2.98, the Von Mises Stresses of 92.593 MPa, and a total deformation of 0.02 mm. This model also is the lightest mass of 534 grams

Keywords: Bracket, Electric motor, Finite Element Method, The Ansys Software

[59] Syafri Syafri (Riau University), Ade Alwi Wardana (Universitas Riau), Nazaruddin Nazaruddin (Universitas Riau) and Dedi Rosa Putra Cupu (Universitas Riau). *Perancangan dan Analisis Struktur Rangka Mesin High Speed Spinner Pemisah Cairan Lateks Kapasitas 1liter/ Jam.*

Abstract. Riau Province is the third largest producer of rubber (natural rubber) from *Hevea Brasiliensis* in Indonesia. Latex is a thick, milky rubber-like sap that comes from plants. Latex consists of colloid-shaped rubber particles dispersed in serum (water) with a dry rubber content (KKK) ranging from approximately 30% to 40%. Concentrated latex with a dry rubber content of 55%-60% is a type of processed material with high commercial value that can be used to manufacture specific items such as vehicle tires, medical gloves, catheters, rubber adhesive, hoses, foam rubber, and other finished goods. To produce concentrated latex, several methods can be used, including centrifugation, creaming, evaporation, and electro decantation. In practice, centrifugation is a suitable choice because the drying process can be relatively fast and the quality of the latex produced is also very good. However, some challenges in the centrifugation process include the relatively expensive cost of the rubber spinner drying machine, limited drying capacity of up to 400 ml/hour, and the machine's rotational speed reaching only up to 500 rpm. To overcome these issues, it is necessary to design and create a spinner machine with a larger capacity of up to 1000 ml/hour and a higher rotational speed of up to 1000 rpm. To build a high-speed rubber spinner machine with higher capacity and speed (high-speed spinner), a strong frame system is required to withstand the workload and prevent work accidents on the machine. Therefore, this research aims to design and analyze the frame of the high-speed spinner machine according to the necessary requirements.

The high-speed spinner machine is designed with dimensions of 955mm×560mm×700mm, a rotational speed of 1000 rpm, and a capacity of 1 liter/hour. With these specifications, the load to be supported by the frame is 196 N. The frame analysis is performed by dividing the frame into 5 sections according to their respective loads. The frame experiencing the highest load is frame no 2, with a load of approximately 115.64 N. After performing manual calculations, the maximum stress occurring in frame 2 is determined to be 12.96 MPa. Considering a safety factor of 5, material availability, and ease of production process, ST37 is identified as the suitable material for the spinner machine frame. Furthermore, an analysis is conducted to determine the deflection occurring in the frame. Through manual calculations, the maximum deflection is found to be 0.041 mm in frame 2.

The frame analysis is then followed by stress analysis using Autodesk Inventor. From the simulation results, the maximum stress occurs in frame no. 2 with a value of 14.66 MPa, and the deflection is 0.064 mm with a safety factor of 7.54. Considering the manual calculation results, stress analysis using Autodesk Inventor, and validation with the prototype machine that has been constructed, the high-speed spinning machine frame is deemed safe to be used as a support for the machine with a capacity of 1 liter per hour and a rotation speed of 10000 rpm

Keywords: latex, stress analysis, safety factor

[60] Nazaruddin Nazaruddin ([Universitas Riau](#)), Syafri Syafri ([Universitas Riau](#)), Rizki Rahman ([Universitas Riau](#)), Kaspul Anuar ([Universitas Riau](#)) and Feblil Huda ([Universitas Riau](#)). *Analisis Konstruksi Dogging Device pada Tailrace Gate pada PLTA Koto Panjang dengan Menggunakan Metode Elemen Hingga.*

Abstract. Stress and strain analysis is important in understanding beam behavior. Finite element method (FEM) offers a powerful tool for achieving accurate and efficient results. This study provides a comprehensive overview of the analysis of nodal displacements in beams using the finite element method, explaining the basic principles, numerical techniques, and practical implications. By exploring this topic, engineers can increase their understanding of beam deformation and make informed design decisions. At the Koto Panjang hydropower plant, there is a problem with the tailrace gate mechanical system, namely the sluice itself must be supported by 4 supporting devices (2 storage frames and 2 dogging devices). However currently, the 2 previously used storage frames are inoperable and will affect other devices. The Tailrace Gate has a weight of 11.6 tf which will be distributed between the 2 dogging sets and each dogging set will take half of that weight. Using finite element method (FEM) manual calculations, we found that the maximum nodal displacement is located at the dogging end of the device and has a displacement of 192.846 μm in the y-axis. When compared with the simulation analysis of Autodesk Inventor Professional 2024, we found that the maximum nodal displacement is at the same place (nodal) and has 234.8 μm in the same direction. Then we found that the error that occurred was 17.87%. From the same software we find that the maximum working voltage of the dogging device is 174.1 MPa and the factor of safety is 1.19. And when compared with the reference material properties and safety factor, we found that 2 dogging devices can be used to support the weight of the tailrace gate without 2 storage frames, but it will lower the safety factor and increase the risk of failure. In case of failure, the gate will be forced closed while the turbine is operating, and it will make big damage to the turbine. Then, we recommend that other supporting devices be repaired and maintained to increase the safety factor and reduce the risk of failure.

Keywords: Stress, Strain, failure, safety factor, dogging device

[61] Agung Premono ([Universitas Negeri Jakarta](#)) and Ragil Sukarno ([Universitas Negeri Jakarta](#)). *Evaluasi Program Magang Industri Merdeka Belajar Kampus Merdeka pada Program Studi Teknik Mesin Universitas Negeri Jakarta dengan Metode Quality Function Deployment (QFD).*

Abstract. Kampus Merdeka adalah bagian dari kebijakan Merdeka Belajar oleh Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi (Kemendikbudristek) yang memberikan seluruh mahasiswa kesempatan untuk mengasah kemampuan sesuai bakat dan minat dengan terjun langsung ke dunia kerja sebagai langkah persiapan karier. Salah satu program yang ditawarkan adalah Magang Industri. Magang ini dilaksanakan selama enam bulan di dunia industry sehingga mahasiswa meninggalkan dunia kampus untuk belajar secara langsung di dunia industry. Durasi waktu selama satu semester mengharuskan adanya program ekivalensi atas pengalaman magang di dunia industry dengan mata kuliah sebanyak 20 SKS. Dalam perjalanannya, proses ekivalensi tersebut menjadi perdebatan karena pengalaman yang diperoleh selama magang belum dapat dipastikan sesuai dengan capaian pembelajaran mata kuliah atau kompetensi yang ditetapkan oleh program studi. Studi ini ditujukan untuk mengevaluasi program magang industry khususnya pada proses ekivalensi antara kompetensi yang diperoleh selama magang dengan kompetensi mata kuliah yang menjadi tujuan ekivalensi dari program magang tersebut. Metode yang digunakan adalah Quality Function Deployment (QFD) untuk melihat kesenjangan kompetensi mahasiswa antara tuntutan pengguna (program studi) dengan pemenuhan dari industry. Hasil dari evaluasi menunjukkan bahwa perlu adanya kesepakatan bersama antara industry dengan perguruan tinggi tentang pengalaman yang harus diperoleh mahasiswa selama di industry agar kompetensi utama lulusan sesuai dengan yang telah ditetapkan.

Keywords: Magang industri, Merdeka Belajar Kampus Merdeka, Teknik Mesin, Quality Function Deployment (QFD)

[62] Ekha Panji Syuryana (Doctoral Study Program, Mechanical Engineering Dept. Faculty of Mechanical & Aerospace Engineering, ITB), Bagus Budiwantoro (Mechanical Engineering Dept. Faculty of Mechanical & Aerospace Engineering, ITB), Mardiyati Mardiyati (Material Engineering Dept. Faculty of Mechanical & Aerospace Engineering, ITB) and Muhammad Agus Kariem (Mechanical Engineering Dept. Faculty of Mechanical & Aerospace Engineering, ITB). *Uncertainty Analysis of Stress Cycle and Force-Moment Frequency Effect on Corroded Armor and Carcass Layer of Flexible Pipe in Indonesian Deepwater* .

Abstract. Flexible pipes required for deepwater oil and gas exploitation. Its application have many challenges from operation conditions and environment. Indonesian deepwater range approximately from -400 to -1800-meter depth. The depth potentially deteriorated the pipe in any form of damage mechanism. For example, polymer layer cracking, armor bird caging, deformation of the armor layer, erosion on the surface of the carcass, and other forms. Those defects in flexible pipes are driving factors to high-risk failure probabilities. Flexible pipes material development for deepwater application also required methodology for integrity analysis. Considered factor for assessment based on corroded metallic layer degradation criteria. Due to operation, uncertainty of wave current and flow direction crosses the cylinder body of flexible pipe. Selection and comparison of its specified minimum yield strength to stress cycle in range from 3 MPa to 278 MPa. Further calculation force-moment condition in three orientations for estimated the remaining performance of flexible pipe.

Keywords: Deepwater, Flexible Pipe, Carcass, Armor, Corroded

[64] Kaspul Anuar (Universitas Riau), Nazaruddin Nazaruddin (Universitas Riau), Mia Nurkholizah (Universitas Riau), Dedy Rosa Putra Cupu (Universitas Riau), Warman Fatra (Universitas Riau), Febliil Huda (Universitas Riau), Herisiswanto Herisiswanto (Universitas Riau) and Syafri Syafri (Universitas Riau). *Analisis Prestasi Terbang Wahana Quadcopter SA-1*.

Abstract. Quadcopter adalah salah satu wahana terbang tanpa awak tipe rotary wing yang memiliki empat buah motor penggerak untuk terbang dan bermanuver. Adapun tujuan dari penelitian ini adalah untuk mengetahui kinerja sistem pendorong (propulsion system) dan prestasi terbang wahana quadcopter terkait kecepatan terbang secara horizontal, kecepatan terbang vertikal, flight time dan payload yang dapat dibawa. Penelitian ini diawali dengan studi literatur yang kemudian dilanjutkan dengan pengujian nilai static trust. Nilai static thrust diukur untuk mengetahui gaya dorong yang dihasilkan oleh sistem tenaga pendorong mulai dari throttle 10% sampai 100%. Selain itu pengujian static thrust juga berguna untuk mengetahui daya listrik yang digunakan oleh sistem tenaga pendorong pada setiap variasi bukaan throttle. Hasil uji static thrust kemudian digunakan untuk menghitung prestasi terbang wahana quadcopter terkait laju tanjak, kecepatan horizontal, flight time dan muatan yang mampu dibawa. Terakhir, proses dilanjutkan dengan uji terbang wahana. Dari hasil uji static thrust pada throttle 100% diperoleh gaya maksimum didapat sebesar 32,17 N dan daya listrik yang digunakan sebesar 700 watt. Dari hasil perhitungan, laju tanjak (kecepatan vertikal) diperoleh sebesar 4,36 m/s pada bukaan throttle 45%. Flight time wahana didapat sebesar 17 menit 57 detik pada bukaan throttle 50%, kecepatan horizontal sebesar 20,9 m/s dan muatan yang bisa dibawa sebesar 1500 gram. Selanjutnya dari pengujian diperoleh nilai laju tanjak sebesar 4,21 m/s, kecepatan horizontal yang dapat dicapai oleh wahana pada throttle 50% sebesar 20 m/s. Waktu terbang yang dibutuhkan oleh wahana untuk menyelesaikan misi terbang, adalah 16 menit 43 detik, serta payload yang dapat dibawa adalah 1350 gram.

Keywords: Quadcopter, prestasi terbang, static thrust

[65] Supriyadi (Universitas Trisakti), Larasati Rizky Putri (Universitas Trisakti), Abigunto Amoro Adji (Universitas Trisakti) and Sentot Novianto (Universitas Trisakti). *Analisis Penggunaan Pengarah Sudut/Tracker Dengan Mikrokontrol ATmega 328 (Arduino Uno) Untuk Meningkatkan Efisiensi Panel Surya.*

Abstract. Energi surya (matahari) saat ini menjadi salah satu topik yang hangat dibicarakan. Potensi energi surya di Indonesia sangat besar untuk dimanfaatkan, khususnya dengan menggunakan panel surya yang dapat berfungsi mengonversi energi surya menjadi energi listrik. Usaha untuk meningkatkan efisiensi penggunaan panel surya masih terus dikembangkan, hal ini karena energi surya adalah energi yang ramah lingkungan dan sangat menjanjikan sebagai energi masa depan. Tujuan dari penelitian ini adalah mempelajari efisiensi panel surya berdasarkan sudut panel surya dengan menggunakan pengarah/tracker yang dikendalikan dengan mikrokontrol Atmega 328. Metode yang digunakan bervariasi sudut panel surya terhadap arah datangnya sinar matahari berdasarkan waktu rotasi bumi pada pukul 08.00, 10.00, 14.00 dan 16.00. Variasi sudut panel surya diperoleh dari pergerakan motor yang ditransmisikan menggunakan rangkaian roda gigi dan puli V-belt untuk mereduksi putaran. Mikrokontrol ATmega 328 dalam penelitian ini digunakan untuk mengatur waktu pergerakan motor, dan juga menggerakkan motor untuk bergerak searah jarum jam atau bergerak berlawanan arah jarum jam. Hasil penelitian ini menunjukkan bahwa penggunaan tracker sebagai pengarah panel surya dapat meningkatkan efisiensi hingga 22,1 persen, dimana sudut panel surya yang diujikan adalah minus 60 derajat, minus 20 derajat, 20 derajat dan 60 derajat terhadap pusat putaran panel. Implikasi dari penelitian ini adalah penggunaan tracker pada panel surya sangat signifikan untuk diterapkan didalam penggunaan/pemasangan panel surya.

Keywords: Efisiensi, Tracker, Atmega328

[66] Andri Hermawan (Universitas 17 Agustus 45 Cirebon), Achmad Tohasan (Universitas 17 Agustus 45 Cirebon) and W. Djoko Yudisworo (Universitas 17 Agustus 45 Cirebon). *Perencanaan Tata Letak Pabrik Meja Kursi Anak Sekolah Dasar.*

Abstract. Posisi duduk yang tidak ergonomis diakibatkan oleh rancangan alat yang tidak sesuai dengan anthropometry penggunaannya, sehingga mempengaruhi kinerja penggunaannya. Salah satu contoh posisi dalam proses belajar mengajar, sebagian besar aktivitas belajar siswa dilaksanakan dengan duduk. Dalam arti duduk, mendengarkan dan menulis. Sehingga kenyamanan dan efektivitas gerak siswa tidak bisa dikesampingkan begitu saja, karena rancangan kursi yang baik dan menunjang kenyamanan dan efektivitas gerak siswa, yang pada akhirnya merupakan salah satu mendukung keberhasilan proses belajar siswa. Oleh karena itu rancangan kursi sekolah yang lebih ergonomis yang disesuaikan dengan ukuran tubuh manusia/siswa dan atribut kursi yang diinginkan sehingga diperoleh dimensi kursi yang sesuai dengan kemampuan dan keterbatasan siswa pada posisi duduk. Dengan itu sekolah wajib memperhatikan tentang kesehatan serta kenyamanan murid dengan cara menyesuaikan fasilitas sekolah seperti meja dan kursi sesuai kebutuhan penggunaannya. Pendekatan ini dikenal dengan istilah pendekatan ergonomi. Salah satu peralatan yang biasa digunakan yaitu meja dan kursi yang harus sesuai ukuran tubuh penggunaannya, sehingga membuat nyaman dalam menggunakannya. Perancangan meja kursi belajar ini menggunakan metode Quality Function Deployment (QFD) merupakan metode yang digunakan untuk pengembangan produk-produk yang berada diperusahaan-perusahaan besar yang ada di Indonesia maupun di dunia. Manfaat penggunaan kursi belajar yang ergonomis untuk para siswa sekolah dasar negeri ini agar para siswa mudah dalam mengikuti proses belajar di dalam kelas. Membiasakan siswa untuk cara belajar yang benar dan sehat untuk tubuhnya. Sehingga siswa tidak membudayakan belajar dengan sikap yang salah di dalam kelas maupun di rumah. Jika perancangan Meja Kursi ini telah dibuat akan ditindak lanjuti melalui penjabaran Struktur Produk, Bill of Material dan Peta Proses. Dari hasil Peta Proses tersebut akan dilakukan perencanaan Line of Balancing yang menghasilkan pengelompokan Stasiun Kerja masing-masing kelompok kerja. Dengan penentuan SK (Stasiun kerja) maka akan dilakukan pengukuran kebutuhan luas setiap SK dengan memperhitungkan Allowance. Setelah memperhitungkan Luas Produksi yang dibutuhkan maka selanjutnya menghitung luas Barang jadi, WIP, dan Bahan baku. Setelah memperhitungkan Luas pabrik yang akan dibangun maka selanjutnya dilakukan perancangan Organisasi, dan perhitungan kedekatan antar jabatan melalui metode ARC (Activity Relationship Chart) dan ARD (Activity Relationship Diagram). Dengan hasil dari metode tersebut maka dilakukan perancangan tata letak kantor dan Pabrik. Maka desain berikutnya adalah tata letak Pabrik secara Total Luas yang dibutuhkan dalam pembangunan pabrik Meja Kursi sekolah ini.

Keywords: anthropometry, ergonomi, Quality Function Deployment, Struktur Produk, Bill of Material, Peta Proses, Line of Balancing, Allowance, Activity Relationship Chart, Activity Relationship Diagram

[67] Muftil Badri (Jurusan Teknik Mesin, Fakultas Teknik Universitas Riau). *Mode Kegagalan Impak Komposit Bermatriks Polimer Diperkuat Serat yang Dianyam*.

Abstract. Mode kegagalan dinamik akibat impact kecepatan tinggi terhadap material komposit matriks polimer diperkuat serat alam dan sintetik yang dianyam sedang diinvestigasi. Komposit dengan serat alam yang digunakan adalah serat tandan kosong sawit (TKS), sedangkan serat sintetik yang digunakan adalah serat kaca. Serat tipe anyam dengan jenis anyaman yang sama pada serat TKS maupun serat kaca. Kecepatan impact yang ekuivalen berasal dari energi kinetik yang sama dengan beban impact yang berbeda sedangkan area kontak yang sama. Peralatan berupa pendulum baja dengan massa bervariasi sebagai beban impact, terdapat bola yang berkontak di permukaan komposit.

The dynamic failure modes due to high-speed impact of natural and synthetic fiber-reinforced polymer matrix composite materials are investigated. The natural fiber composite used is oil palm empty fruit bunch (OPEFB) fiber, while the synthetic fiber used is glass fiber. The woven type fibers are the same in both OPEFB and glass fibers. Equivalent impact velocities were derived from the same kinetic energy with different impact loads and the same contact area. The apparatus is a steel pendulum with varying mass as the impact bodies, there is a contacting ball on the composite surface.

Keywords: failure mode, woven fiber, OPEFB, glass fiber

[68] Toto Supriyono (Universitas Pasundan), Mi'Raj Novahardi (Pasundan University), Fachrul Sidik Riantono (Universitas Pasundan), M. Rizki Sumartono (Universitas Pasundan) and Hery Sonawan (Universitas Pasundan). *Pembuatan Alat Pengisi Fluida Kerja Untuk Heat Pipe*.

Abstract. Heat pipe adalah suatu alat penghantar kalor yang memiliki tahanan termal sangat tinggi. Penghantaran kalor dilakukan oleh penguapan fluida kerja. Pengisian fluida kerja ke dalam heat pipe dilakukan pada tekanan vakum. Tujuan penelitian ini adalah membuat alat pengisi fluida kerja untuk heat pipe agar proses pengisian fluida kerja menjadi lebih mudah dan fluida kerja tidak terhisap oleh pompa vakum. Pembuatan alat pengisi fluida kerja heat pipe dilakukan dengan beberapa tahap dimulai dari pemotongan pipa tembaga, pipa akrilik dan lembar akrilik. Penyambungan komponen-komponen yang terbuat dari material tembaga menggunakan metode penyambungan brazing dengan menggunakan kawat tembaga, sambungan ulir ditambahkan seal tape dan penggabungan bagian atas dan bawah tangki menggunakan lem epoxy. Adapun pembuatan meja penyangga tangki air menggunakan proses 3D printing. Pipa tembaga dipotong dengan panjang 50 mm sebanyak lima buah, pipa akrilik dipotong sepanjang 48,1 mm dan ada juga lembar akrilik dipotong melingkar dengan diameter 60 mm sebanyak dua buah dan diberi lubang serta alur ditengahnya dengan ukuran M6 dan M16. Setelah proses pemotongan selesai, dilanjutkan dengan proses penyambungan komponen menggunakan proses brazing, sambungan ulir dan pengeleman pada tangki dan sambungan ulir. Pembuatan meja penyangga tangki menggunakan proses 3D printing. Meja penyangga memiliki dimensi 150 mm x 150 mm dan tinggi 125 mm.

Keywords: heat pipe, proses pembuatan, fluida kerja, brazing, Pengisi Heat Pipe, Vakum

[69] Fahmi Zoelfan Fauzi (Teknik Mesin Universitas Pasundan), Muki Satya Permana (Teknik Mesin Universitas Pasundan), Djoko Hadi Prajitno (BRIN) and S Sugiharto (Teknik Mesin Universitas Pasundan). *Pembuatan Austenitic Stainless Steel AISI 321 Menggunakan Material Ferronickel Lokal*.

Abstract. Austenitic Stainless Steel AISI 321 adalah material penyempurnaan AISI 304 dengan menambahkan unsur titanium untuk mereduksi sensitisasi. Penambahan unsur titanium akan menghasilkan butir yang mengandung titanium carbide (TiC) dan mereduksi endapan chromium carbide (Cr₂₃C₆) pada batas butir. Penelitian ini bertujuan untuk merancang dan membuat paduan material AISI 321 yang sesuai dengan standar. Metode pengujian yang digunakan yaitu pengujian struktur mikro, pengujian komposisi (Optical Emission Spectrometer), pengujian kekerasan Vickers. Pengujian struktur mikro menunjukkan adanya struktur austenite pada permukaan spesimen paduan. Pengujian komposisi (Optical Emission Spectrometer) menunjukkan hasil rancangan paduan spesimen yang sudah mendekati standar, namun terjadinya penurunan persentase unsur seperti chromium (Cr) dan titanium (Ti). Hal ini dapat disebabkan oleh area penguapan pada saat pengujian komposisi kurang menyeluruh. Pada pengujian kekerasan Vickers menunjukkan bahwa spesimen paduan FeNi-Cr 19%-Ti 0,7% memiliki nilai kekerasan dengan rata-rata 249 HV. Spesimen paduan FeNi-Cr 17%-Ti 0,5% memiliki kekerasan dengan rata-rata 137,6 HV. Hal ini menunjukkan bahwa spesimen paduan FeNi-Cr 19%-Ti 0,7% memiliki nilai kekerasan yang lebih tinggi dibandingkan dengan FeNi-Cr 17%-Ti 0,5%, yang dapat diakibatkan oleh kandungan chromium (Cr) pada spesimen paduan FeNi-Cr 19%-Ti 0,7% lebih tinggi dan dapat meningkatkan nilai kekerasan pada paduan.

Keywords: Pembuatan AISI 321, titanium carbide, chromium carbide, ferro nickel chrome

[70] Muhammad Ramdan Taufik Kurnia (Teknik Mesin Universitas Pasundan), Muhammad Bagja Shaleh (Teknik Mesin Universitas Pasundan), S Sugiharto (Teknik Mesin Universitas Pasundan), Rachmad Hartono (Teknik Mesin Universitas Pasundan), Ade Bagdja (Teknik Mesin Universitas Pasundan), Syahbardia Syahbardia (Teknik Mesin Universitas Pasundan) and Endang Achdi (Teknik Mesin Universitas Pasundan). *Perancangan dan Pembuatan Prototipe Mesin Pemotong Styrofoam Otomatis untuk Kebutuhan Dekoratif*.

Abstract. Pemotongan styrofoam untuk kebutuhan dekoratif umumnya dilakukan secara manual sesuai dengan bentuk dan dimensi yang diinginkan. Pemotongan secara manual, membutuhkan waktu yang relatif lama dan keterampilan orang yang melakukannya. Untuk meningkatkan produktivitas dan keterulangan kualitas memerlukan suatu mesin yang dapat mengerjakan hal tersebut. Untuk mencapai keinginan tersebut dirancang sebuah mesin yang dapat mengerjakan proses pemotongan styrofoam dengan waktu yang cepat dan keterulangan yang tepat. Tahapan awal perancangan mesin pemotong styrofoam diawali dengan studi literatur yaitu melihat mesin pemotong styrofoam yang ada dipasaran mulai dari bentuk, ukuran, jenis rangka, sistem transmisi gerak, pencekam styrofoam, jenis motor penggerak, jenis mikrokontroler, dan perangkat lunak pengoperasian. Prototipe mesin yang sudah dibuat memiliki area kerja P x L x T yaitu 350 x 350 x 350 mm. Sistem kendali motor menggunakan Arduino UNO yang dipadukan dengan CNC Shield. Mesin pemotong styrofoam yang dibuat memiliki sumbu 2.5 aksis. Sumbu X untuk gerak horizontal, sumbu Y untuk gerak vertikal, dan setengah sumbu Z untuk gerak rotasi terhadap sumbu Y. Prototipe dibuat untuk membuktikan hasil rancangan dapat bekerja sesuai dengan parameter perancangan yang diinginkan. Hasil pengujian terhadap prototipe mesin pemotong styrofoam untuk mengetahui kinerjanya dilakukan pengujian gerak, faktor konversi gerak, tingkat kesalahan, dan pengujian pemotongan secara berulang.

Keywords: prototipe mesin, pemotong styrofoam, otomatis, 2.5 aksis

[71] Rendy Gunawan (Universitas Muhammadiyah Riau), Sunaryo Sunaryo (Universitas Muhammadiyah Riau) and Ahmad Kafrawi Nasution (Universitas Muhammadiyah Riau). *Measurement of the Adhesion of PCL/Hydroxyapatite Nanofibrous Composite Coatings in Relation to the Roughness of Metal Implant Materials.*

Abstract. Composite coatings have been widely used to modify the surface of materials to improve material properties alongside chemical modification, ion implantation, anodic oxidation, physical vapor deposition, chemical vapor deposition, plasma spray deposition, sol-gel, and thermal oxidation. Modifying the surface coating of bio-implants must employ suitable materials to enhance the interaction between bone cells and the material and provide structural support for forming new tissue. Coating requirements in metal implant material engineering include fiber diameter, porosity, mechanical properties (adhesion), biodegradability, and bioactivity. This study's most recent innovation consisted of modifying the bio-implant surface layer with a polymer (polycaprolactone, PCL) and bioactive ceramic (hydroxyapatite, HA) to meet the requirements of metal implant material application. During the spraying procedure, parameters derived from previous studies are used to determine fabrication parameters. In addition, the adhesion (mechanical properties) will be measured at multiple levels of implant material roughness. The results indicate that the rougher surface of the substrate has a higher adhesion value than the finer surface of the material.

Keywords: Nanofiber composite, polycaprolactone, hydroxyapatite, bio-implant, implant coating

[72] Dody Yulianto (Universitas Islam Riau), Dedikarni Panuh (Universitas Islam Riau), Rieza Aldio (Universitas Islam Riau) and Hardiyanto Muslim (Universitas Islam Riau). *PENGARUH CAMPURAN AMPAS SAGU DENGAN GETAH DAMAR SEBAGAI MATERIAL BOKOMPOSIT PAPAN PARTIKEL.*

Abstract. Provinsi Riau merupakan penghasil komoditi sagu terbesar di Indonesia, dari pengolahan tanaman sagu selain menghasilkan komoditi sagu untuk bahan makanan juga dapat menghasilkan limbah yang bersifat lignoselulosik yang tersusun dari selulosa, hemiselulosa dan lignin. Potensi limbah yang dihasilkan dari industri pengolahan sagu dapat dimanfaatkan menjadi material yang lebih mempunyai nilai ekonomis tinggi, salah satunya adalah untuk bahan dasar pembuatan komposit papan partikel. Komponen lignoselulosa memiliki sifat hampir sama dengan sifat kayu, sehingga limbah ampas sagu memungkinkan untuk dibuat komposit papan partikel. Matriks komposit papan partikel menggunakan resin alami yaitu dari getah damar yang lebih ramah lingkungan daripada resin sintetis. Selain campuran filler dan matriks digunakan juga zat aditif berupa compatibilizer maleic anhydride dengan beberapa variasi campuran 60%F 35%M 5%A (SP1), 70%F 25%M 5%A (SP2), dan 80%F 15%M 5%A (SP3). Diharapkan dengan memanfaatkan limbah tanaman sagu dapat mengurangi pengaruh buruk dampak lingkungan serta dapat digunakan sebagai material penyusun komposit papan partikel agar lebih memiliki nilai ekonomis. Metode yang dilakukan pada penelitian ini adalah metode eksperimental analisis, dengan melakukan beberapa pengujian sifat fisik: kerapatan, pengembangan tebal, kadar air dan sifat mekanik: ketangguhan elastisitas (MOE), dan ketangguhan pecah (MOR) yang mengikuti proses Standard Nasional Indonesia. Adapun hasil yang di peroleh pada pengujian kerapatan tertinggi pada SP2 sebesar 0.67 gr/cm³, pengembangan tebal seluruh spesimen sebesar 0,1%, MOE tertinggi pada SP2 sebesar 2,05 . 104kgf/cm² dan MOR tertinggi pada SP2 sebesar 104,65 kgf/cm² telah memenuhi standar SNI 03-2105-2006. Sedangkan pengujian kadar air masih belum memenuhi standar yang diharapkan sebesar 14% kadar air.

Keywords: Papan partikel, ampas sagu, getah damar, compatibilizer

[73] Muhammad Syahid (Departemen Teknik Mesin Unhas), Falah Raditya (Universitas Hasanuddin) and Renreng Ilyas (Universitas Hasanuddin). *Pengaruh Karburisasi Cair Terhadap Sifat Mekanik dan Struktur Mikro Baja AISI 1005.*

Abstract. Liquid carburizing is a process of hardening the steel surface by dipping the steel that has been placed into a molten salt solution to enrich the carbon element on the steel surface. This study aims to determine the effect of liquid carburizing on increasing the hardness value, wear resistance, and microstructure of AISI 1005 steel. This liquid carburizing process uses a variation of carburizing time of 2 hours, 3 hours, and 3.5 hours at a temperature of 850 °C with water cooling. The carburizing media used are a mixture of a) 50% Na₂CO₃ (250 grams), 45% NaCl (225 grams), 5% SiC (25 grams) and b) 75% Na₂CO₃ (375 grams), 15% NaCl (75 grams), 10% SiC (50 grams). The results show that the liquid carburizing process can increase the hardness value and wear resistance of AISI 1005 steel. The highest increase in hardness value occurred in liquid carburizing using chemical composition (b) with a carburizing time of 3.5 hours is 827.93 HV. The wear rate value of the material before carburizing processing was 0.21 mg/s. The lowest wear rate value occurs in liquid carburizing using chemical composition (b) with a carburizing time of 3.5 hours is 0.025 mg/s. The results obtained can be seen that the more SiC composition and the longer the carburizing time followed by rapid cooling cause an increase in the hardness value and wear resistance of the material. The microstructure observation before carburizing shows ferrite and pearlite phases while after carburizing shows ferrite, pearlite, and martensite phases.

Keywords: AISI 1005 Steel, Liquid Carburizing, Hardness, Wear

[74] Fandi Rahmat Ramadhan (Universitas Pasundan), S Sugiharto (Universitas Pasundan), Dedi Lazuardi (Universitas Pasundan), Farid Rizayana (Universitas Pasundan), Ade Bagdja (Universitas Pasundan), Gatot Santoso (Universitas Pasundan) and Reza Hermawan (Universitas Pasundan). *Pengembangan Model Blade pada Tractorpack Buatan Prodi Teknik Mesin Universitas Pasundan.*

Abstract. Penelitian blade merupakan salah satu komponen utama dari tractorpack. Blade itu sendiri memiliki bentuk yang cukup rumit sehingga diperlukan desain blade yang sesuai dengan kondisi tanah agar mendapatkan pengolahan tanah yang maksimal. Blade ini merupakan bagian dari tractorpack yang berfungsi menerima gerak (putar) pada poros penggerak. Tujuan dari penelitian ini adalah merancang dan membuat prototipe blade dengan mengacu pada model blade sebelumnya. Tahapan perancangan diawali dengan mempelajari bentuk dan ukuran blade sebelumnya dilanjutkan dengan merancang model blade baru dengan dimensi utama yang sama dengan dimensi utama sebelumnya. Bentuk dan model blade baru diidentifikasi setelah dilakukan analisis kekuatan dan pendefinisian jenis materialnya, selanjutnya dilakukan pemilihan proses pembuatannya. Untuk memastikan kekuatan dari model blade yang baru dilakukan pengujian spectrometer untuk mengetahui komposisi material, pengujian kekerasan untuk mengetahui kekuatan blade dan pengujian metalografi untuk melihat struktur mikro pada material blade yang digunakan. Untuk melihat kekuatan dilakukan pengujian fungsional, dengan parameter; (1) kecepatan gerak tractorpack 0,54 m/s, (2) Panjang lintasan lahan 10 m, dan (3) lebar lahan 1 m. Hasil pengujian dilakukan dengan 10 kali pengujian; (1) blade tidak terdeformasi, (2) tanah hasil gemburan ke satu area, (3) hasil cangkulan pengukuran kedalaman cangkul pada lahan didapatkan rata-rata kedalam cangkul blade 9,2 cm.

Keywords: Blade, Tractorpack, Pengembangan, Teknik Mesin Unpas

[75] Jhonni Rahman (Islamic University of Riau), Bakri Bakri (Tadulako University), Sutan Lazrisyah (Prodi Teknik Mesin UIR) and Purwo Subekti (Prodi Teknik Mesin UPP). *Blower Speed Influence on Separation Effectiveness of Empty Rice in Modified HW 60 AN Machine.*

Abstract. The quality of rice harvests often becomes unsatisfactory due to the presence of empty rice mixed in the rice harvest. So that separating filled rice and empty rice becomes a problem that needs to be solved. The solution can be done to facilitate this separation is by modifying the existing rice grinding machine into a rice separation machine. In its implementation, there are several parameters that greatly determine the results of the rice separation. One important parameter that greatly determines the quality of separation of filled rice and empty rice is the blowing strength of the blower, which in this case is regulated based on the rpm speed of blower. Therefore, this study was conducted to find out and analyze how the blower rotation affects the effectiveness of rice separation in the rice separation machine. This research was conducted by varying the rotation of the blower into 5 variations of rotation from 1000 rpm to 1400 rpm, and testing was carried out 3 times each rotation in order to obtain accurate data. The raw materials used were a mixture of 45 kg of filled rice and 5 kg of empty rice, a total of 50 kg. The experimental result shows that the higher the rotation of the blower given to the rice separation machine, the better the separation process that occurs. And at 1300 rpm, the machine is able to separate perfectly between filled rice and empty rice. However, after exceeding this rpm, the effectiveness of the separation becomes worse. This happens because high rotation on the machine not only flied out empty rice, but also push out the filled rice that is inserted into the machine.

Keywords: Empty rice, rice-separation, blower, effectiveness

[76] Muhammad Ridlwan (Universitas Islam Indonesia). *Sifat Mekanik Komposit Sandwich Skin Serat Karbon Menggunakan Core Polylactic Acid (PLA) Tipe Infill Gyroid.*

Abstract. Sandwich composites are composed of three layers, a thick core in the middle and two thin skin at outer parts. In this research, carbon fiber was used as skin and polyactic acid (PLA) material, results from additive manufacturing, was used as a core. The carbon fiber used was carbon fiber kevlar fiber fabric 3k 2x2 200 gsm PLAIN & TWILL Grade A. PLA core material made using the Fused Deposition Modeling (FDM) process with variations in density of 10% - 50% gyroid type infill. Sandwich composites fabrication using the vacuum infusion method. This study aims to determine tensile strength and bending rigidity of sandwich composites. Based on the results of the tensile test on the PLA core, the tensile strength at a density of 10% was 9.43 MPa and at 50% was 15.76 MPa. Meanwhile, the PLA bending core rigidity of 10% infill density was 1,092,987 N.mm² and 50% infill density of 3,375,232 N.mm². The addition of carbon fiber skin to the sandwich composite increased its tensile strength by 192% and its bending rigidity increased by 406%. However, if the weight of the sandwich composite is taken into account, the highest specific tensile strength is at 20% infill density of 0.61 MPa/gr and specific bending rigidity of 97,701 N.mm²/gr. From the test results it can be concluded that carbon fiber skin plays a significant role in the mechanical properties of the sandwich composite. In addition, cores with gyroid infill density of 20% have better specific mechanical properties than other infill core densities.

Keywords: sandwich composite, PLA core, carbon fiber skin, tensile strength, rigidity

[77] Made Suarda ([Universitas Udayana](#)), Made Sucipta ([Universitas Udayana](#)), Ni Putu Rika Anindya Wahyuni ([Universitas Udayana](#)) and Ni Ketut Restia Dewi ([Universitas Udayana](#)). *Kajian Literatur Dimensi-Dimensi Utama Turbin Air Vortex Aliran Gravitasi*.

Abstract. Since the beginning of 2000, the use of gravity vortex flow to generate hydropower for very low head of water flow sources using gravitational water vortex turbines. This paper investigates the main dimensions of a vortex flow type water turbine based on previous published research results. The main dimensions of the water turbine are designed based on the flow rate and head of the driving water flow source. Based on the maximum water flow rate, the outlet diameter of the basin can be calculated using Bernaulli's equation. Furthermore, the outlet diameter is used as a reference parameter for other vortex turbine dimensions, such as: the dimensions of the water flow canal; basin dimensions include inlet diameter, height and conical angle; turbine runner dimensions include the diameter, height, width and geometry of the runner blades. For instance, the ratio of the outlet and inlet basin diameters is 14% - 18%, the conical angle of the basin is 64°, the ratio of the height and diameter of the inlet basin is 1.5, the ratio of the height of the turbine runner and the basin is 0.31 - 0.32, the notch angle of the canal is 11° and the angle of the runner blade within 50° - 60° range. The optimum value of the design parameters is expected to be used as a guideline in the further development of vortex turbine research for the improved power output of the vortex turbine.

Keywords: vortex turbine, turbine sizing, basin, runner geometric

[78] Fadhlih B Amaral ([Universitas Islam Indonesia](#)), Donny Suryawan ([Universitas Islam Indonesia](#)), Agung Nugroho Adi ([Universitas Islam Indonesia](#)) and Purtojo Purtojo ([Universitas Islam Indonesia](#)). *Rancang Bangun Kunci Pintu Pintar Berbasis NFC (Near Field Communication)*.

Abstract. The use of technology in home security systems has yet to be implemented significantly. One of the important home security systems to develop is the security system for doors, namely smart door locks. Most of the existing smart door locks are complicated to implement because they require replacing all the door locking mechanisms that are already installed. It is inefficient to replace all the doorlock mechanisms in the house. So, it is necessary to design a plug-and-play smart doorlock that does not require replacing the existing doorlock. The design of the smart door lock uses NFC P2P as one of the security systems. The research results show that the smart door lock can work to open and lock the doors with a success percentage of 100%.

Keywords: NFC P2P, 3D print, pintu, smartlock.

[79] Erina Nurmawanti (Institut Teknologi Bandung), Agung Wibowo (Institut Teknologi Bandung) and Muhammad Fatchul Hikmawan (LIPI). *TOLERANCE STACK UP ANALYSIS OF GENERATOR MAGNET PERMANENT USING WORST CASE METHOD.*

Abstract. Tolerances and dimensions play a key role in the manufacturing process as it is possible to have some deviations from the designed values which have a very significant impact on the functional quality of a product. On the other hand, it is known that the correlation between cost and precision is that the more precise/tighter the tolerance value required, the more expensive it is. In a permanent magnet generator, the gap between the stator and the rotor/air gap is an important requirement so that the permanent magnet generator can function optimally. The air gap is formed from a pile of components with certain dimensional values and tolerance values from a permanent magnet generator. This paper presents an analysis of the tolerance piles on generators and proposes to reduce the contributing variables to the air gap tolerance piles to reduce the tight tolerance values on the components. The proposal is based on consideration of the ISO 2768-1 and 2768-2 standard approaches. The details of the nominal dimensions of the permanent magnet generator, and the allowable gap range obtained from the electrical and mechanical design of LIPI (Indonesian Institute of Sciences) are used as input parameters for the tolerance analysis. The tolerance value resulting from the initial design is used as a comparison for the final tolerance value allocation. The worst case method was chosen to carry out the tolerance stack analysis process. Referring to the allowable air gap distance range of 0.8 - 1.2 mm, the result of the calculation of the air gap tolerance pile distance is 0.81 - 1.18 mm. The smallest tolerance value obtained is found on the rotor shaft which is 0.011 mm which in the initial design was 0.001 mm. This tolerance value can be done with a machining center (CNC) in the manufacturing process.

Keywords: Dimension Tolerance, Geometri Tolerance, Stack Tolerance, Worst Case Method, Gap

[80] Ari Prasetyo (Program Studi Teknik Mesin Universitas Islam Riau), Satria Khalis Utama (Program Studi Teknik Mesin Universitas Islam Riau), Eddy Elfiano (Program Studi Teknik Mesin Universitas Islam Riau) and Jhonni Rahman (Program Studi Teknik Mesin Universitas Islam Riau). *Uji Performa Bio-briket dari Kotoran Sapi dengan Serbuk Kayu Sebagai Bahan Bakar Alternatif.*

Abstract. Alternative fuels made from organic materials are called bio-briquettes. bio-briquettes can be made from cow dung with high calorific value. In this research, sawdust is used as a mixture of bio-briquettes and tapioca starch as a bio-briquettes adhesive. The characteristics of bio-briquettes are influenced by the variation of raw materials in their composition. The dimensions of the bio-briquettes are cylindrical with a diameter of 19 mm and a height of 50 mm with the composition of cow dung, wood powder, and tapioca starch used as an adhesive to make bio-briquettes, which consists of 90 percent cow dung and sawdust and 10 percent adhesive. The material composition was varied as a percentage of its total volume with five variations of cow dung and sawdust 75:15, 55:35, 45:45, 35:55, and 15:75, respectively. In addition, the bio-briquettes were varied with a pressing load when molding the bio-briquettes of 3 kg and 5 kg. Parameters tested on the bio-briquettes included moisture content, density, burning rate, and calorific value. From the test results, the best water content value was obtained in the variation of 15% cow dung to 75% sawdust and 5 kg press load with a value of 1.46%. The best density value was obtained in the variation of 75% cow dung to 15% wood powder and 5 kg load with a value of 0.813 gr/cm³. The best combustion rate value is obtained in the variation of 75% cow dung to 15% sawdust and 5 kg load with a value of 0.075 gr/min. The highest calorific value was obtained in the variation of 75% cow dung to 15% sawdust and 5 kg load with a LHV value of 6664.15 cal/gr, while the highest HHV value was obtained in the variation of 75% cow dung to 15% sawdust and 5 kg load with a value of 7441.75 cal/gr.

Keywords: Bio-briquettes, Cow Manure, Sawdust, Biomass

[81] Hendri Dwi Saptioratri Budiono (Department of Mechanical Engineering, Faculty of Engineering, Universitas Indonesia, Kampus Baru UI Depok, 16424 ID), Rahman Muhamad Zuhuda (Department of Mechanical Engineering, Faculty of Engineering, Universitas Indonesia, Kampus Baru UI Depok, 16424 ID), Mohammad Anindya Fausta (Department of Mechanical Engineering, Faculty of Engineering, Universitas Indonesia, Kampus Baru UI Depok, 16424 ID), Oka Widiantara Suputra (Department of Mechanical Engineering, Faculty of Engineering, Universitas Indonesia, Kampus Baru UI Depok, 16424 ID) and Trimitra Mahesa Aditya (Department of Mechanical Engineering, Faculty of Engineering, Universitas Indonesia, Kampus Baru UI Depok, 16424 ID). *Model Kompleksitas Proses Sangrai Kopi Menggunakan Biji Kopi Tradisional Indonesia.*

Abstract. The manufacturing process involves converting raw materials into usable products, and this is applicable not only in industries but also in others like coffee roasting. Coffee roasting can be considered a manufacturing process as it involves transforming green coffee beans into roasted coffee beans. Coffee roasting defines 20% - 25% of coffee quality, making variation in process is impactful. Due to various influential parameters, achieving specific bean specifications adds complexity to the process. Indonesia, a major coffee producer, emphasizes research for enhancing coffee quality, specifically for varieties like Arabica Gayo, Arabica Solok Radjo, Robusta Bengkulu, and Robusta Temanggung. Another underlying factor for this research is the lack of studies related to the complexity process of coffee roasting. This research aims to use the model for performing complex calculations of the manufacturing system's complexity in coffee roasting process. This model used as a tool to assess the existing process. Furthermore, this model simplifies the calculation of the process complexity, and the resulting index can be used to estimate initial costs during the design phase for the roasting process. This research adopts the method by W.H. El Maraghy regarding complexity modelling and applies it to the scope of coffee roasting. Based on the conducted research, the most important aspects that influence the complexity of roasting coffee beans based on roast level are roast colour, mass, and dimensions resulting from the roast profile of coffee beans. The complexity index will be used for cost estimation with consideration of constituent aspect.

Keywords: Manufacture, Indonesia Coffee Beans, Process Complexity, Coffee Roasting

[82] Berli Kamiel (Department of Mechanical Engineering, Universitas Muhammadiyah Yogyakarta), Miftaql Arif (Universitas Muhammadiyah Yogyakarta) and Sunardi Sunardi (Universitas Muhammadiyah Yogyakarta). *Spektral Kurtosis Sinyal Getaran Untuk Mendeteksi Cacat Pada Bantalan-Gelinding*.

Abstract. Bantalan adalah salah satu komponen penting pada mesin-mesin rotari yang berfungsi menopang poros dan mengurangi gesekan pada saat poros berputar. Akibat beban terus menerus dan kondisi lingkungan yang ekstrim bantalan dapat mengalami kerusakan dalam bentuk cacat lokal yang berpotensi menurunkan kinerja mesin secara keseluruhan. Oleh karena itu penting untuk memonitor kondisi bantalan pada saat mesin beroperasi sehingga tindakan perawatan dapat dilakukan segera jika terjadi kerusakan. Analisis envelope adalah metode utama untuk mendeteksi cacat pada bantalan namun metode ini membutuhkan informasi tentang frekuensi resonansi. Informasi ini tidak selalu tersedia dan membutuhkan prosedur yang tidak praktis untuk mendapatkannya dimana bantalan harus dilepas dari mesin dan frekuensi resonansinya didapat dari repons pukulan hammer. Penelitian ini mengusulkan nilai kurtosis untuk mendeteksi kerusakan bantalan. Nilai kurtosis sinyal getaran efektif mendeteksi sinyal non stasioner akibat benturan elemen gelinding bantalan dengan cacat lokal pada lintasannya. Nilai kurtosis dihitung untuk setiap tentang frekuensi tertentu dan disajikan dalam bentuk spektral kurtosis. Tentang frekuensi dengan nilai kurtosis maksimal pada spektral kurtosis dipilih sebagai tentang frekuensi resonansi pada analisis envelope. Validasi metode dilakukan menggunakan sinyal getaran dari sebuah gearbox roda gigi. Cacat lokal lintasan-dalam bantalan gelinding dibuat dengan menggunakan mesin EDM dengan lebar goresan 0.1 mm. Kecepatan sampling diatur sebesar 25 kHz dengan durasi 10 detik untuk memastikan resolusi frekuensi yang memadai. Hasil penelitian menunjukkan bahwa analisis envelope dengan menggunakan tentang frekuensi resonansi dari spektral kurtosis memberikan performa deteksi yang lebih unggul dibandingkan dengan analisis envelope konvensional.

Keywords: Analisis envelope, bantalan, kurtosis, spectral kurtosis

[83] Citra Asti Rosalia (Program Doktorat Teknik Dirgantara, Fakultas Teknik Mesin dan Dirgantara, Institut Teknologi Bandung), Yahya Abdullah Azzam (Fakultas Teknik Mesin dan Dirgantara, Institut Teknologi Bandung), Annisa Jusuf (Kelompok Keahlian Struktur Ringan, Fakultas Teknik Mesin dan Dirgantara, Institut Teknologi Bandung), Leonardo Gunawan (Kelompok Keahlian Struktur Ringan, Fakultas Teknik Mesin dan Dirgantara, Institut Teknologi Bandung), Ichsan Setya Putra (Kelompok Keahlian Struktur Ringan, Fakultas Teknik Mesin dan Dirgantara, Institut Teknologi Bandung) and Tatacipta Dirgantara (Kelompok Keahlian Struktur Ringan, Fakultas Teknik Mesin dan Dirgantara, Institut Teknologi Bandung). *Kaji Numerik Kelaikan Tabrak Struktur Crashbox Hibrid Aluminum/GFRP Dikenai Beban Impak Aksial.*

Abstract. Kasus kecelakaan tabrak depan pada kendaraan menjadi kasus tabrakan yang paling banyak terjadi di Indonesia. Oleh karena itu, diperlukan suatu kendaraan yang menerapkan konsep kelaikan tabrak pada desain strukturnya. Struktur laik tabrak yang didesain berupa struktur crash box yang dapat menahan dan menyerap energi kinetik akibat beban impact arah aksial. Crash box menyerap energi tabrak melalui deformasi pada strukturnya dengan mekanisme lipatan pada crash box yang terbuat dari logam, atau modus splitting, splaying maupun fragmentation pada crash box yang terbuat dari komposit. Sampai dengan saat ini sebagian besar struktur crash box terbuat dari material logam karena sifatnya yang kuat dan ulet, sehingga energi impact dapat diserap dengan baik dengan cara berdeformasi plastis melalui mekanisme lipatan berulang dan stabil, atau dikenal dengan progressive buckling. Pada saat ini, salah satu alternatif solusi yang dipercaya dapat meningkatkan kapasitas penyerapan energi struktur crash box dan dengan tetap mempertahankan efisiensi berat strukturnya adalah dengan menggabungkan logam dan komposit sebagai material penyusunnya. Crash box seperti ini dikenal dengan crash box hibrid, dimana crash box yang berbahan dasar logam akan dilapisi atau dibungkus dengan komposit di permukaan luarnya. Pada penelitian ini, akan dilakukan kaji numerik pada struktur crash box aluminum dan crash box hibrid aluminum/GFRP berpenampang segi-empat yang dikenai beban impact aksial. Kaji numerik dilakukan dengan menggunakan perangkat lunak eksplisit non linier LS-Dyna untuk memprediksi respon crash box. Hasil penelitian menunjukkan bahwa Mean crushing force (P_m) crash box hibrid aluminum/GFRP 3 lapis dan 5 lapis memiliki nilai 29% dan 32% lebih tinggi jika dibandingkan dengan crash box aluminum. Dapat disimpulkan bahwa crash box hibrid memiliki kemampuan penyerapan energi dan parameter kelaikan tabrak lebih baik jika dibandingkan dengan crash box aluminum saja.

Keywords: Kelaikan tabrak, Crash box, Hibrid, Aluminum/GFRP, Beban aksial

[84] Agung Sudrajad (Universitas Sultan Ageng Tirtayasa), Mekro Permana Pinem (Universitas Sultan Ageng Tirtayasa), Suryo Prayogo (Universitas Sultan Ageng Tirtayasa) and Sunardi Sunardi (Universitas Sultan Ageng Tirtayasa). *Distribution Analysis of Particulate Matter from Exhaust Gas Incinerator*.

Abstract. The Incinerator is equipment for waste processing technologies through direct combustion with sufficient air and at high temperatures. Using an incinerator, it can convert waste material into residual combustion gas and ash (bottom ash and fly ash). Electrostatic Precipitator (ESP) is a filtration medium to minimize particles such as fly ash from flue gas during the combustion process. The ESP concept uses an induced electrostatic charge to catch the small particles such as fly ash and other particles in the plate of the ESP system. The sample test is analyzed by Scanning Electron Microscope (SEM) to determine the size of the exhaust gas particulate matter from the combustion of the incinerator. The sampling of exhaust gas is taken from the combustion of the incinerator through filter paper. The results analysis of the SEM test without using the ESP filter shows that total area of 13470.4 μm^2 and an average particulate area of 1036.2 μm^2 . Moreover, while using the ESP filter the total area was 15621.2 μm^2 and the average particulate area is 1201.6 μm^2 . It concluded that using an Electrostatic Precipitator (ESP) filter is effective to catch the very small ash particle to protect our environment.

Keywords: particulate matter, incinerator, SEM, ESP

[85] Mega Fetria Santoso (Universitas Nurtanio Bandung), Sezsy Yuniorrta Yusuf (Universitas Nurtanio Bandung) and R. Evi Sofia (Universitas Nurtanio Bandung). *ANALISIS PENGARUH PROFIL SAYAP PESAWAT DENGAN MENGGUNAKAN VORTEX LATTICE METHOD*.

Abstract. In designing aircraft, the shape of the wing is one of the design considerations to produce optimal aerodynamic forces with minimal structural loads. This research is focused on analyzing the effect of wing planform on aerodynamic characteristics using the Vortex Lattice Method software VLAERO+. Several types of wing planform are varied, namely rectangular, swept-back, tapered, and swept-back and tapered. Although the analysis using VLAERO+ does not model thickness and ignores viscosity, so the simulation results cannot describe CL_{max} and the CD values generated by VLAERO+ are induced drag values only. The difference in wing planform shows the difference in the slope of the CL -alpha curve, where the tapered wing planform has the highest CL while the CL is the lowest in the swept-back wing planform. Future research will analyze how wing load distribution and bending moments occur on aircraft wings.

Keywords: Aerodynamics, Wing Planform, Vortex Lattice Method, VLAERO+

[87] Riky Adhianto (Program Studi Rekayasa Perancangan Mekanik, Politeknik Manufaktur Bandung, Bandung), Meri Rahmi (Program Studi Gambar Rekayasa Mesin, Politeknik Manufaktur Bandung, Bandung) and Nurul Zahra Zalzabila (Program Studi Teknologi Rekayasa Perancangan Manufaktur, Politeknik Manufaktur Bandung, Bandung). *Perancangan Konveyor Pindah Sampah dari Trash Skimmer ke Tepi Sungai: Studi Kasus di Sungai Citarum Dayeuhkolot, Bandung.*

Abstract. Tumpukan sampah yang tidak tertangani di Daerah Aliran Sungai (DAS) Citarum, Bandung menjadi latar belakang penelitian ini. Trash skimmer merupakan salah satu solusi untuk proses penanganan sampah yang dapat dilakukan secara cepat dan membantu petugas membersihkan sungai tanpa melibatkan banyak tenaga operator. Perancangan trash skimmer telah dibuat sebelumnya menggunakan sistem konveyor untuk mengatasi masalah sampah di Sungai Citarum Dayeuhkolot, Bandung. Penelitian ini bertujuan untuk merancang alat pemindah berupa konveyor untuk memindahkan sampah dari trash skimmer ke container di tepi sungai secara efektif. Metode perancangan yang digunakan adalah VDI 2222 dengan tahapan kerja yaitu merencana, mengkonsep, merancang, dan penyelesaian. Konstruksi alat memiliki tujuh fungsi bagian: penyangga, pengarah, pembawa, penggerak, pembersih, sistem transmisi, dan coating. Dipilih alternatif fungsi bagian, antara lain fungsi penyangga menggunakan rangka baja profil dengan model mobile, fungsi pengarah menggunakan hopper, fungsi pembawa menggunakan wiremesh, fungsi penggerak menggunakan gasoline engine Honda GX100 dengan motor reducer CNH-6090DA dari Sumitomo Cyclo 6000, fungsi pembersih menggunakan strip brush, fungsi sistem transmisi menggunakan rantai dan sproket, dan fungsi coating menggunakan tipe paint dengan tiga jenis lapisan: primer (Seaguard 5000), intermediate (Shearglass FF), dan finishing (Aliphatic acrylic modified polyurethane). Berdasarkan tuntutan yang diharapkan, didapatkan beberapa hasil perhitungan teknis seperti ukuran utama konveyor dengan panjang 6695 mm, lebar 1925 mm, dan tinggi 2487 mm. Konstruksi rancangan alat pemindah sampah bekerja secara kontinu yang memiliki kapasitas mencapai 5000 kg/hari dengan daya yang bekerja sebesar 0,104 kW, torsi 195,076 Nm, putaran 5,081 rpm dan kecepatan pemindahan 0,267 m/s.

Keywords: konveyor, sampah, vdi2222

[88] Dedi Rosa Putra Cupu (Universitas Riau), Efi Afrizal (Universitas Riau) and Ibnu Kaldum (Universitas Riau). *Perancangan Alat Uji Roda Gigi Menggunakan Metode VDI 2221.*

Abstract. Transmission system is a vital component in automotive and industrial applications, including gears. Gears are the most widely transmission components used to transmit the power and rotational speed from the driver component to others. Power is transmitted by contact rolling between two contacting gear surfaces. The contacting area is relative tiny to transmit the very high power resulting in the high pressure on the contact surface of the gears. This causes failure on the gear surface such as pitting and scuffing. To investigate the failures and their causes, a gear test rig is utilized and this work aims to design a gear test rig using VDI 2221 method. VDI 2221 is used due to its efficient and systematic method to design from the variants of the product concepts. Calculation and design of the components referred to Kiyokatsu Suga and Sularso. Static structural analysis was conducted to determine the strength and safety of the designed gear test. The result of this study is a design of gear test rig which has a maximum von mises stress of 19,47 MPa at the main frame. Then, dynamic simulation has been carried out and the friction coefficient of 0,342 produced by this designed gear test rig.

Keywords: perancangan alat uji rodagigi, gear test rig, VDI 2221, analisis struktur dinamik

[89] Dinni Agustina (Universitas Indonesia) and Nandy Putra (Departemen Teknik Mesin FTUI). *Investigation of Wick Fabrication with Atomic Diffusion Additive Manufacturing Technology.*

Abstract. A key to optimizing the performance of heat pipes is to ensure that the wick structure performs within its original thermal-physical design specifications. Sintering is the most commonly used technique, due mainly to the economic costs. However, it presents a drawback associated with the randomness of the internal wick structure that can result from an irregular pore, penalizing its permeability and causing unsteady fluid-thermal behavior in the whole device. This research implemented 3D printing technology for the manufacturing of wick, which is known as Atomic Diffusion Additive Manufacturing. The advantage is to control the geometric size of the wick passages, aiming to achieve an optimal design according to the specified requirements. Based on this, this study aims to provide a solution in the form of a wick manufacturing process on heat pipes using 3D printing technology to overcome the unevenness of pores formed in the sintering process and can provide good performance results in thermal conductivity. The final result expected in this test is to be able to make a heat pipe with good performance through a 3D printing manufacturing process.

Keywords: wick, 3d printing, thermal resistance

[90] I Made Parwata (Mechanical Engineering, Engineering Faculty, University of Udayana), I Nyoman Citta Diatmika (Mechanical Engineering, Engineering Faculty, University of Udayana), I Made Widiyarta (Mechanical Engineering, Engineering Faculty, University of Udayana), I Putu Lokantara (Mechanical Engineering, Engineering Faculty, University of Udayana) and I Made Gatot Karohika (Mechanical Engineering, Engineering Faculty, University of Udayana). *Studi 3 Dimensi Kontak Hertzian Berbentuk Elips Menggunakan Metode Elemen Hingga.*

Abstract. Wear is a common issue that often occurs when two objects experience relative motion. Efforts to prevent and reduce wear rates, such as lubrication, hardening, coating, and surface smoothing, are highly effective and efficient when applied to the contact area. Ansys is a Finite Element Method tool commonly used in relation to Hertzian contact. This paper will analyze the contact stress and contact area on two objects with different lateral and longitudinal curvatures. Contact analysis will be carried out using Ansys Workbench. The modeling involves two objects made of steel. Both objects have different curvatures. The lateral curvature of object 1 is 13 mm, while for object 2, it is 16 mm, and the longitudinal radius of both objects is 21 mm. The meshing of both objects uses solid tetrahedral elements. A normal force of 300 N is applied along the axis connecting the centers of curvature of both objects. Then, the analysis results, including contact stress and dimensions obtained, are compared with the calculations using the Hertz theory approach. The results obtained with the Finite Element Method show a maximum contact stress of 30.57 MPa, and the contact area is elliptical with a major axis of 1.3573 mm and a minor axis of 1.236 mm. The results obtained from the Hertz calculation show a contact stress of 2700 MPa, and the contact area is elliptical with a major axis of 0.442 mm and a minor axis of 0.12 mm.

Keywords: Hertzian contact, contact stress, contact dimensions, finite element method

[91] Indra Adriansyah (Politeknik Manufaktur Bandung), Asep Indra Komara (Politeknik Manufaktur Bandung), Ery Hidayat (Politeknik Manufaktur Bandung) and Sidik Permana (Politeknik Manufaktur Bandung). *Rekayasa Balik Komponen, Simulasi Proses Manufaktur dan Perancangan Cetakan High Pressure Die Casting: Studi Kasus Bottom Body Converter.*

Abstract. The government is encouraging the optimization of the use of domestic components in a product or machine at this time so that the competitiveness and productivity of the national industry will increase. Thus, the mastery of reverse engineering and the development of a product must be well mastered. The high cost of reverse engineering facilities and the lack of mastery of product design and manufacturing technology is one of the obstacles faced by the industry in Indonesia today. This paper will discuss the stages of the reverse engineering process using 3D scan technology and additive manufacturing, also simulating the manufacturing process using high-pressure die casting (HPDC) to determine the success rate of products to save costs and production time. Case studies on the engineering and development of converter kit components are carried out using the Bill Andersen method. This study classifies development activities into two parts, namely product design and tooling design. Product design activities will discuss problem identification, reverse engineering, design optimization, and product strength analysis using finite element analysis. The tool design activity will discuss the injection machines used, the calculation of design parameters, fluid flow analysis, thermal analysis, and mold design. Based on the results of the studies that have been carried out, the most optimal product designs are obtained in accordance with the list of demands. In addition, this study has also resulted in an optimal HPDC design in accordance with the existing engine specifications at POLMAN Bandung.

Keywords: Reverse engineering, Manufacturing Process Simulation, HPDC

[92] Ainul Ghurri (Program Studi Teknik Mesin, Universitas Udayana), I Made Parwata (Program Studi Teknik Mesin, Universitas Udayana) and I Wayan Adi Usada (Program Studi Magister Teknik Mesin, Universitas Udayana). *Karakteristik Panjang dan Sudut Semprotan Bahan Bakar Berdensitas Tinggi Pada Nosel Burner.*

Abstract. The high-viscosity fuel raises challenges due to the poor atomization process, and then the poor mixing of air and fuel in the burner. However due to the availability of high viscosity fuels such as biofuels; and waste materials such as cooking oil and used oil which have the potential to be used, their development and optimization need to be continued to improve its combustion performance. The present study reports an experimental test to observe the spray of air-fuel mixture from a burner using an air-assisted atomizer. In an air-assisted atomizer, air and liquid fuel are supplied into the fuel nozzle before being sprayed into the ambient environment. The fuel used is waste engine oil that has been precipitated and filtered. The fuel is sent to the atomizer gravitationally. Air is delivered using a compressor to the atomizer. The experiment was carried out using atomizer with diameter of 0.5 mm, 1 mm, and 1.5 mm, respectively. Air is supplied from the compressor with varied pressure 0.8-2.2 bar, produced AFR (air-fuel ratio) 11.1 – 12.7 during the experiment. The fuel spray was recorded using a video camera with 1000 fps speed and images size of 1244x240 pixels. The fuel spray image is then extracted from the video recording to be observed the changes in length and angle of the spray. The results of image processing of fuel spray were presented in the form of changes in length and angle of the spray up to 525 milliseconds since it appeared at the tip of the atomizer. The spray penetration results showed the two stages of spray and atomization as seen in the tilt of the spray growth line which was sharp at the beginning, and then sloping in the next section. This represented an atomization process such that the growth of the spray slowed down in the second part of spray. The spray angle graph showed that a larger angle occurred at larger atomizer diameter, which is also in accordance with the results of the spray penetration length as a result of the atomization process. The overall the test results showed that the diameter of the nozzle and the operating conditions of fuel spraying are very influential on the atomization of the fuel.

Keywords: Fuel, spray, length, angle, atomization

[93] Ainul Ghurri (Udayana University). *Penerapan Pembelajaran Berbasis Kasus pada Mata Kuliah Aplikasi dalam Bidang Teknik Mesin.*

Abstract. Case-based learning method (CBLM) is one of the student-centred learnings to stimulate students' independence and critical thinking skills. In this learning method, students are requested to find problems, discuss it in groups, and find the solutions to those problems. This paper reports on the implementation of case-based learning for the Fuel and Combustion Technique course, one of the applied level courses in mechanical engineering. The CBLM implementation included the formation of 6 student groups, presentation of the proposed topic of the case study, conducting discussions, receiving evaluations from lecturers, presentations of the revised reports, and the assessments. The assignment given to the students was firstly to find a real problem in a combustion application, then to make an analysis and propose a modifications or new combustion techniques to solve the problem. The implementation of CBLM showed that students were motivated to prepare by themselves independently and worked very well in groups. The students generally could master the material from their own learning effort and strengthened by discussions between groups, and also from input sessions from the lecturer. From the 6 student groups, there were 5 different topics. Furthermore, 5 of the 6 groups of students demonstrated an excellent mastery of basic theory, analysis skill, and good responses to the questions from other groups, including in the final test given by the lecturer. The deficiencies that occurred are more due to students' lack of skill in discussions, worried of making mistakes, and the lack of confidence in arguing during discussions, rather than a lack of understanding of the basic topics related to assignments. This study showed that the implementation of CBLM could be applied as an effective method in learning of the applied engineering courses, by still paying attention and assisting students who have weak skills in discussing and arguing.

Keywords: Case-based, learning, combustion, technique

[94] Ahmad Syihan Auzani (Departemen Teknik Mesin, Fakultas Teknik, Universitas Indonesia, Kampus UI Depok 16424, Indonesia), Sheila Tobing (Fakultas Teknik, Universitas Indonesia, Kampus UI Depok 16424, Indonesia), Muhammad Ridhwan Sunandar (Departemen Teknik Mesin, Fakultas Teknik, Universitas Indonesia, Kampus UI Depok 16424, Indonesia), Muhammad Daffa Fachturrohan (Departemen Teknik Mesin, Fakultas Teknik, Universitas Indonesia, Kampus UI Depok 16424, Indonesia), Riesta Anggarani (Departemen Aplikasi Produk, Balai Besar Pengujian Minyak dan Gas Bumi Lemigas (LEMIGAS), Indonesia), Cahyo Setyo Wibowo (Departemen Aplikasi Produk, Balai Besar Pengujian Minyak dan Gas Bumi Lemigas (LEMIGAS), Indonesia) and Dedi Sutarma (Fakultät für Physik, Universität Duisburg-Essen, Lotharstr. 1 - Raum MG 368, 47057, Duisburg, Germany). *Studi Eksperimen dan Pemodelan Struktur Nyala Api Difusi Dimethyl Ether dan LPG .*

Abstract. Dimethyl Ether (DME) is one of the fuels prepared as an alternative to LPG to meet household energy needs. DME can be produced by utilizing coal available in Indonesia. DME is expected to be utilized by using burners designed to burn LPG. This research aims to characterize the diffusion flame of DME and LPG through experimental studies and CFD simulations. The parameters varied include the fuel flow rate and nozzle size used in the flame area. Then the measured and observed parameters include temperature, color, height, and flame area. From the measurements, it can be seen that an increase in the flow rate of both DME and LPG gas affects the increase in temperature, height and flame area of both gases. The average flame temperature of DME is greater than the flame temperature of LPG. While the average flame height of LPG is greater than the flame height of DME gas. The average flame area of LPG is greater than the flame height of DME gas. The blue color in DME is greater in percentage than LPG gas. Additional parameters such as the chemical structure of the flame can be determined from CFD simulations.

Keywords: DME, LPG, nyala api, difusi, CFD

[95] Febby Fauziah (Fakultas Teknik Mesin dan Dirgantara, Institut Teknologi Bandung), Sri Raharno (Fakultas Teknik Mesin dan Dirgantara, Institut Teknologi Bandung) and Rachmat Hartono (Jurusan Teknik Mesin, Universitas Pasundan). *DAMPAK PENERAPAN SISTEM PENGELOLAAN PERKAKAS PADA INDUSTRI PADAT KARYA BERBASIS KONSEP CONFIGURABLE VIRTUAL WORKSTATION.*

Abstract. The manufacturing industry in Indonesia is predominantly labor-intensive, with information flow relying on paper or manual processes. Manual information flow leading to non-value-added activities in product manufacturing results in production delays and customer order fulfillment issues. On the production floor, operators distribute tools to workstations based on manual information systems, making real-time monitoring of operator movements challenging. This study applies the Configurable Virtual Workstation framework to tool management, including requirement planning, tool distribution, borrowing, and return. The concept of Configurable Virtual Workstation technology simplifies tool distribution by allowing operators to detect tool availability through an integrated information system. The objective of developing this system is to reduce movement, time, and activities involved in tool management. With this framework, tool availability information can be accessed through an interface and distributed as per the requirements of a single workday. This research concludes that activities replaced by the information system can significantly reduce tool management time. Implementing this system has the potential to reduce tool management process time by up to 98%.

Keywords: Configurable Virtual Workstation, Manufacturing Industry, Manual Information System, Tool Management System

[96] Lies Banowati (Universitas Nurtanio), Aditiya Vebo Suhendra (Universitas Nurtanio) and Moch. Daddy Ma'Mun (Universitas Nurtanio). *Analisis Variasi Bilah Blade Terhadap Horizontal Axis Wind Turbin (HAWT) Pembangkit Listrik Tenaga Angin Dengan Software Q-Blade.*

Abstract. Energy demand in Indonesia continues to increase along with the addition of population. While Indonesia currently still depends on conventional energy sources such as coal and petroleum which are limited in quantity and not environmentally friendly. Therefore, research was conducted that aims to use micro-scale wind turbines that are useful for electricity needs to advance Renewable Energy in Indonesia.

This research was conducted with the aim of obtaining electricity needs to advance Renewable Energy in Indonesia, this research uses Q-Blade software which is software with various aspects needed for the design, prototyping, simulation, and certification of wind turbines. This study was conducted to see power efficiency by comparing variations in airfoil types on taper blades, namely NACA 2412, NACA 4412, NACA 6412 and USA 40 with variations in the number of blades 3, 4 and 5.

The conclusion of this study shows that NACA 4412 blades (airfoil) with the number of blades 3 are more efficient with a Coefficient Power of 53% compared to airfoil variations and the number of other blades that on average have a Coefficient Power of 50.2% (NACA 2412), 52.9% (NACA 6412) and 52.6% (USA 40). While at a wind speed of 12 m / s the variation of the NACA 6412 airfoil type has the highest average power of 1.127 watts against a rotation speed of 1.003 RPM.

Keywords: renewable energy, horizontal axis wind turbine, electricity output, coefficient power

[97] Suryadiwansa Harun (Jurusan Teknik Mesin, Universitas Lampung) and Yanuar Burhanuddin (Jurusan Teknik Mesin, Universitas Lampung). *Analisis Termal Proses Pengeboran Tulang dengan Metode Statistik Full Factorial untuk Pengontrolan Nekrosis Tulang*.

Abstract. Bone drilling is usually done to create holes in bone when joining fractured bone parts with bolts. The bone temperature can increase during the bone drilling, causing osteonecrosis and reducing stability and fixation strength. The success of an orthopedic surgical procedure depends on many factors, one of which is heat control during bone drilling. With appropriate or controllable bone drilling parameters, the bone temperatures resulting in dead bone cells can be avoided.

This study examines the effect of drilling parameters during the bone drilling process. The experimental testing method with Full Factorial experimental design was used to analyze the effect of bone drilling parameters (drill speed, drill bit diameter, and point angle) on the drilling temperature. The selected test material is bovine bone because its mechanical properties are similar to human bone. Measuring the temperature of bone drilling uses two temperature measuring instruments, namely a thermocouple (type K) for the inside of the bone and a Thermal Camera (Flir) for the bone/drill bit interface area and bone chips.

The results of this study show that the drill speed significantly impacts the drilling temperature. In contrast, the other parameters have no significant impact on drilling temperature. The Increasing in drill speed increased the drilling temperature. In addition, the temperature of bone necrosis (> 47 deg. Celsius) was found mainly in bone chips and the bone/drill bit interface area when the drill speed was 2800 rpm. The drilling temperature prediction model was also made and can be declared valid (with an absolute error rate of about 3%) to predict the effect of drilling parameters on drilling temperature. This model will later help control the temperature of bone necrosis and the design of biodegradable drill bits with magnesium-titanium alloy material which will be worked on for future research.

Keywords: Bone, Bone fracture, Bone drilling, Drill bit, Drilling temperature

[98] Fariz Nuansa Kharisma (Institut Teknologi Bandung), Yunendar Aryo Handoko (Institut Teknologi Bandung) and Indria Herman (Institut Teknologi Bandung). *Simulasi Dinamika Kereta Api Batubara Rangkaian Panjang pada saat Pengereman*.

Abstract. The long coal train is the main transportation used for coal distribution in South Sumatra. To increase the carrying capacity, PT KAI plans to add the number of wagons in a series to 120 wagons from around 60 wagons. This addition impacts the dynamic performance of the train during braking. In the use of pneumatic brakes, the braking signal takes time from the locomotive to reach the end of the train. The delay time that occurred causes nonuniformity in the application of braking in each wagon along the train. Consequently, there is a collision of rear vehicles into front vehicles so that the coupler force increases during braking and this also increases the risk of derailment. This study aims to investigate the impact of braking on the coupler force distribution along the train. In this study, the modeling and simulation process of the long coal train were carried out using Universal Mechanism software. The model built is a train that consists of 4 locomotives and 120 wagons. The simulation results with an initial speed of 50 km/h and a curve radius of 500 m show that the position of the wagon that experiences the largest coupler force is the 66th wagon after braking is done. Based on standard, the coupler force value is still below the minimum load required by the standard for coupler equipment. With the occurring coupler force, the long train is still safe against derailment because its derailment coefficient value is still below the maximum standard limit.

Keywords: long coal train, wagon, braking, coupler forces, derailment

[99] Rafil Arizona (Islamic University of Riau), Muhammad Satria (Islamic University of Riau), Shandy Kurniadi (Islamic University of Riau), Eddy Elfiano (Islamic University of Riau) and Sehat Abdi Saragih (Islamic University of Riau). *Pengaruh Tekanan Vakum Terhadap Laju Perpindahan Panas dan Efektifitasnya pada Kondensor di PLTU Tenayan Raya.*

Abstract. Steam Power Plant (PLTU) has equipment that supports the operation of a steam turbine associated with a generator, including a condenser. The condenser is a heat exchanger whose function is to condense the used steam from the turbine or working fluid. In it, the process of heat transfer occurs between the cooling fluid which is passed in the pipes and then the steam from the low-pressure turbine flows outside the pipes. This study aims to determine the effect of vacuum pressure on the rate of heat transfer and the effectiveness of the condenser operated at PLTU Tenayan Raya. This is done because the vacuum pressure greatly influences performance of the condenser at PLTU Tenayan Raya. Analysis of heat transfer and condenser effectiveness was completed using the Effectiveness-NTU and LMTD methods. The calculation results show that the vacuum pressure value is -87.73 Kpa, will increase the heat transfer rate and the effectiveness value of the condenser with values of 49.63 MW and 0.9969.

Keywords: PLTU, Vacuum Pressure, Heat Transfer Rate, Condenser, Effectiveness-NTU, Log Mean Temperature Difference (LMTD)

[100] Muhammad Satria Utama Rizkillah (Republic of Indonesia Defense University), Andry Wiranata (Republic of Indonesia Defense University), Eka Irianto Bhiptime (Republic of Indonesia Defense University) and Ariyo Nurachman Satiya Permata (Republic of Indonesia Defense University). *Numerical Simulation of Impact Tests on Composition of SiCp and TiB to Composite Al7Si Mg-SiCp Semi Solid StirCasting.*

Abstract. Nowadays, the Aluminum Matrix Composite (AMC) applications are sprouting quickly. The semi solid stir casting method was the easiest way to produce SiCp particles to reinforce the AMC. It could be placed at fatal points on military vehicles to secure from projectile attacks. The numerical simulations were able to help any other possibility practice such as in military areas. In this work, the AMC product worthiness of fuel guard of military vehicles was addressed. Various concentrated loads will be given on a certain point as an image of bullet strikes to the mixture of SiCp and TiB to the composites Al7Si-Mg-TiB-SiCp to investigate its performance. Then, the numerical outcome compares with the experimental results served in this paper, such as impact force in different circumstances. By observing the numerical product, certain significant behavior of these materials is obtained. Furthermore, composite production is proven to be adopted for guarding the critical points in military vehicles. The conclusion of the study namely, Simulation revealed that the Al7Si Mg-SiCp composite showed significant structural deformation during the impact test. The deformation is most visible in the area around the SiCp and TiB particles, which experience plastic deformation and stress redistribution. The simulation shows that the Al7Si Mg-SiCp composite has good strength and stability during the impact test. The energy distribution along the composite shows the ability to disperse impact energy efficiently through SiCp and TiB particles.

Keywords: Finite element method, aluminium matrix composites, composite, military vehicle

[101] Zulkifli Amin (Andalas University), Iskandar Ridwan (Universitas Andalas) and Muhammdad Mikhael Tizanovc (Universitas Andalas). *Perbandingan Performansi Kolektor Surya Point Parabolic Concentrating Reflektor Aluminium Foil Sistem Statis dan Tracking.*

Abstract. One type of solar collector is point parabolic concentrating. This type of solar collector requires a reflector to reflect the intensity of the sun to the absorber. The reflector used must be made of a material that can reflect sunlight such as aluminum foil. The efficiency generated from solar collectors using static-type aluminum foil reflectors is still small. This is because the intensity of sunlight obtained is less than optimal. Because of this, the use of solar collectors that use reflector tracking systems is developed.

In this test, control variables are determined to compare the efficiency between collectors with static type reflectors and tracking system type reflectors. In this study, experiments are carried out, for both types of solar collectors, namely those using static type aluminum foil reflectors and those using tracking system type aluminum foil reflectors. The test is conducted at 10.00 a.m to 14.00 p.m at intervals of 25 minutes for 3 days.

From the test results, it is found that the average temperature change of the tracking system type solar collector (which is 31.55 °C) is higher than the static type collector (which is 20.52 °C). Likewise, the highest efficiency of the tracking system type solar collector (91.08%) is higher than the highest efficiency of static type solar collector (62.43%). So it can be concluded that solar collectors of tracking system type reflectors are better than static type reflector solar collectors.

Keywords: solar, collector, reflector, tracking, static

[102] Samuel J. Harjanto (FTMD ITB), Ferryanto Ferryanto (Mechanical Design Research Group, Institut Teknologi Bandung) and Sandro Miharadi (FTMD ITB). *Simulating Musculoskeletal Activities during Squat Movement using OpenSIM.*

Abstract. Human beings need to be able to monitor their muscle health. Muscle health can be assessed by directly measuring its signal using an electromyography sensor or, recently, from a musculoskeletal modeling software such as OpenSIM. OpenSIM is an open-source platform for modeling, simulating, and analyzing the neuromusculoskeletal system. This work aims to simulate muscle forces during squat movement using OpenSIM simulation and validate the results using electromyography sensors attached to the body. The squat movement data generated from the optical motion capture system and the force plate will be used as inputs for the OpenSIM software. OpenSim can provide output, such as a graph of the working muscle forces. That graph will be compared and analyzed with a surface electromyography sensor results graph. Based on the analysis results, the chart of working muscle forces generated by the OpenSIM software has shown a similar trend to the graph of muscle activity resulting from surface electromyography sensor reading. Therefore, it validated the results from OpenSIM software and implied that the data collection process was done correctly.

Keywords: optical motion capture, force plate, surface electromyography, OpenSIM, musculoskeletal activities

[103] Eka Irianto Bhiptime (Department of Military Mechanical Engineering, Indonesia Defence University, Sentul Bogor - West Java, Indonesia), Annisa Ariesta (Department of Military Mechanical Engineering, Indonesia Defence University, Sentul Bogor - West Java, Indonesia) and Muammar Pierre A. Ferriyana (Department of Military Mechanical Engineering, Indonesia Defence University, Sentul Bogor - West Java, Indonesia). *Investigation of Gnetum Gnemon Fiber on the Mechanical Properties of Composites with the Combination of Aramid and Carbon Fiber as Reinforcement for Military Personnel Applications.*

Abstract. Every equipment infrastructure in a TNI unit will be needed to support an operation in the defense system in order to maintain the integrity of the Unitary State of the Republic of Indonesia. As for personal protective equipment that is really needed for the safety or continuity of a war operation. Protective components made from composite fibers have the advantage of being resistant to corrosion caused by the environment. The natural fibers and carbon fibers will be mixed/reinforced with epoxy resin so that they will become composite materials. The purpose of this study is to identify Gnetum Gnemon fiber composites with carbon fiber and aramid fiber to determine the mechanical properties of the composite material resulting from a collision. Natural fiber Gnetum gnemon has not been widely studied as a reinforcing material for polymer composites. Gnetum gnemon fiber chemical composition is hemicellulose approx. 25%, 40% alpha cellulose, 10% lignin and 3-5% benzene extractive. Its density is quite light, namely, 1.2087 g/cm³ - 1.8069 g/cm³. Because this fiber has a continuous fiber structure and a strong natural weave, its use is still very limited. Special treatment such as alkali treatment on Gnetum gnemon can increase the strength of natural fibers. Kevlar or aramid fiber due to its exceptional mechanical properties, are extensively used in industrial and military applications. The aramid fiber exhibited the transversely anisotropic nature in a small strain range, with its stress-strain behavior as linear and elastic. The anisotropic nature of the aramid fiber was due to its high ratio of tensile to shear modulus. The high strength and modulus were also found to be scattered due to the larger distribution of defects in the longer fiber. The epoxy resin is a type of polymer characterized often with one or more epoxide functional group with at least one of the epoxide functional group acting as a monomer and terminal unit of the polymer within the structural chain. Epoxy resins are extensively used in the production of lightweight carbon fiberreinforced composites (CRFC) to deliver desired engineering properties such as high modulus and strength, low creep, superb chemical and thermal stability.

Keywords: Aramid, Carbon, Composite, Epoxy, Gnetum gnemon, Natural fiber

[104] Apriliandi Nurhidayat (Republic of Indonesia of Defense University), Raja Akbar (Republic of Indonesia of Defense University), Ridho Al Fahrizi (Republic of Indonesia of Defense University) and Ariyo Nurachman Satiya Permata (Republic of Indonesia of Defense University). *Electromagnetic Force Simulation of Coil Gun*.

Abstract. Military industries are competing to intensify the arms production using rapid manufacturing recently. Some countries employ commonly used stuff such as propellant to promote a thrust to eject a projectile out towards the target. While others develop unconventional approaches, the electromagnetic force. The winding copper that electrified is able to generate electricity that push a missile by utilizing its force. In this paper, the potential of exploiting magnetic force to trigger projectile in hand gun was delivered. Moreover, it presents the various simulations of coiled copper arrangements to observe its thrust power by exercising finite element method. These arrangements glide a projectile through the barrel without application of any propulsion. This phenomenon can save the recoil time and explosive impact than the conventional weapons. Then, criteria which affect its power were copper dimensions and electric currents. The mathematical model is derived with the finite element method simulations to acquire desired result. Furthermore, this work has a feasibility to contribute the non-propellant arms development technology.

Keywords: Finite element method, military industries, non-propellant firearms

[105] Wilan Raenaldy Tasmaya (Universitas Pasundan), S Sugiharto (Universitas Pasundan), Djoko Hadi Prajitno (BRIN) and Muki Satya Permana (Universitas Pasundan). *Pembuatan Biomaterial Fe Cr Ag Untuk Material Implan*.

Abstract. Salah satu persyaratan material implan adalah ketahanan korosi yang tinggi. Untuk meningkatkan ketahanan korosi pada material implant ditambah unsur paduan Cr dan Ag dengan komposisi material Fe-Cr-Ag. Tujuan penelitian ini adalah mengetahui sifat paduan Fe-Cr-Ag, paduan yang dibuat pada penelitian ini adalah Fe-17Cr-1Ag dan Fe-17Cr-5Ag. Peleburan menggunakan Single Arc Melting Furnace dengan lingkungan atmosfer gas argon. Paduan hasil peleburan dianalisis dengan menggunakan mikroskop optik, SEM-EDS, uji kekerasan Vickers, dan uji korosi. Hasil uji Vickers Ag dapat mempengaruhi tingkat kekerasan, terbukti bahwa spesimen Fe-Cr-5Ag lebih keras dibanding Fe-Cr-1Ag dengan nilai masing-masing kekerasan Vickers rata-rata 268.31 HV dan 159.78 HV. Hasil pengujian SEM Fe-Cr-1Ag memiliki butir lebih kasar dibanding Fe-Cr-5Ag. Hasil pengujian EDS persentase komposisi Fe Cr pada kedua paduan tidak jauh berbeda dengan komposisi awal paduan tetapi pada komposisi Ag memiliki nilai error tinggi. Hasil pengujian korosi menunjukkan data laju korosi tertinggi dalam larutan ringer laktat adalah paduan Fe-Cr-1%Ag, dengan laju korosi 112.1 mpy, sedangkan spesimen dengan laju korosi terendah adalah spesimen Fe-Cr-5%Ag, dengan laju korosi 0.923 mpy.

Keywords: Biomaterial, implan, peleburan, pengujian SEM-EDS, pengujian Vickers, pengujian korosi.

[106] Thio Rifqi (Mechanical Engineering Department, Universitas Malikussaleh), Siti Nurjannah (Renewable Energy Engineering Magister Program, Faculty of Engineering, Universitas Malikussaleh), Adi Setiawan (Mechanical Engineering Department, Universitas Malikussaleh), Alchalil Alchalil (Mechanical Engineering Department, Universitas Malikussaleh), Ahmad Nayan (Mechanical Engineering Department, Universitas Malikussaleh), Muhammad Daud (Electrical Engineering Department, Universitas Malikussaleh) and Faisal Faisal (Mechanical Engineering Department, Universitas Malikussaleh). *Pengaruh Penambahan EM4 pada Substrat Nasi Sisa Rumah Makan Terhadap Unjuk Kerja Biodigester.*

Abstract. Anaerobic digester is one method of processing organic waste that has high potential in producing biogas, by breaking down organic compounds in waste with the help of microorganisms without the need for oxygen. The aim of this research is to utilize food waste left over from restaurants as a raw material for producing biogas, by adding EM4 to investigate the effect of the biogas production. The method used in this research is by preparing a pilot scale biodigester with a capacity of 5 liters. The feedstock was rice waste left over from the restaurant and added EM4 bioactivator with variations of 0%, 11% and 15%. Based on the experiments which have been done for 20 days, the addition of EM4 bioactivator showed a decrease in the rate of gas formation. The biogas production with EM4 variations of 0%, 11% and 15%, exhibited respectively the rate of 73.75 ml/day, 55.75 ml/day and 55.25 ml/day. The addition of EM4 also does not have a significant effect on the content of methane in biogas. The concentration of carbon dioxide in biogas increased with increasing the amount of EM4.

Keywords: Biogas, Restaurant waste, EM4, Biodigester

[107] Angesta Romano (*bandung*), Toto Supriyono (*bandung*) and Muhamad Rizki Sumartono (*bandung*). *Pengukuran kinerja solar modul tipe monokristal dan polykristal kapasitas 120 Wp.*

Abstract. Cahaya matahari dapat dimanfaatkan energinya untuk keperluan sehari-hari yaitu diubah menjadi energi listrik dan atau dimanfaatkan panasnya. Untuk mengubah energi cahaya matahari menjadi listrik arus searah digunakan solar modul. Solar modul terbuat dari bahan semikonduktor yang apabila tersinari cahaya matahari menghasilkan energi listrik arus searah. jenis solar modul yang tersedia dipasaran adalah solar modul tipe monokristal dan polykristal. tujuan penelitian ini adalah untuk mengukur kinerja solar modul tipe monokristal dan polykristal kapasitas 120 Wp. Metode pengukuran dilakukan secara eksperimen untuk mengamati keluaran daya solar modul kedua tipe tersebut. Alat yang digunakan untuk mengukur kinerja solar modul adalah solar power meter, solar panel multimeter, datalogger temperatur, dan anemometer. Hasilnya menunjukkan efisiensi solar modul monokristal lebih tinggi jika temperaturnya rendah (kurang dari 30 °C) dan solar modul tipe polykristalin efisiensi lebih rendah. Sebaiknya, pada temperatur operasi tinggi solar modul tipe polykristal efisiensinya lebih tinggi daripada solar modul tipe monokristal. Pada temperatur kerja di bawah 30 °C, efisiensi solar modul tipe monokristal dapat mencapai 20% sedangkan efisiensi solar modul tipe polykristal 17%. Pada temperatur kerja tinggi di atas 30 °C, efisiensi solar modul tipe monokristal sebesar 10%, sedangkan polykristal sebesar 13%.

Keywords: solar modul, efisiensi, monokristal, polykristal

[108] Toto Supriyono (Universitas Pasundan), Hery Sonawan (Universitas Pasundan), Fachrul Sidik Riantono (Universitas Pasundan), Miraj Novahardi (Universitas Pasundan) and Muhamad Rizki Sumartono (Universitas Pasundan). *Kalibrasi Sensor Termokopel Tipe K dengan Metode Perbandingan*.

Abstract. Pengukuran merupakan proses membandingkan nilai objek ukur (measurand) dengan standar yang relevan. Sebelum melakukan pengukuran, alat ukur yang digunakan harus mempunyai ketelitian yang tinggi. Untuk mengetahui ketelitian dari suatu alat ukur perlu dilakukan kalibrasi. Menurut ASTM E 220-86 kalibrasi dapat dilakukan dengan teknik perbandingan (comparison techniques). Dalam penelitian ini telah dilakukan kalibrasi termokopel tipe K dengan teknik membandingkan besaran temperatur yang dihasilkan termokopel tipe K dengan termometer kaca (glass thermometer). Kalibrasi dilakukan dengan cara memanaskan air pada ketel pemanas air mulai dari temperatur ruangan (25 °C) hingga mencapai 100°C. Termokopel tipe K yang dikalibrasi berjumlah 9 (sembilan) buah, sementara termometer kaca sebagai pembanding yang digunakan berjumlah 2 (dua) buah. Temperatur air diukur oleh termokopel yang dihubungkan dengan data logger temperature, sementara pembacaan pada termometer kaca menggunakan video recorder dari handphone agar meningkatkan readability. Pencatatan temperatur dilakukan setiap 30 detik mulai dari awal pengukuran hingga akhir pengukuran. Pengukuran dilakukan sebanyak 9 (sembilan) kali pengukuran. Hasil pengukuran temperatur diolah untuk mengetahui ketelitian atau ketidakpastian hasil pembacaan temperatur dari termokopel tipe K. Hasil pengolahan data temperatur menunjukkan harga ketidakpastian 9 (sembilan) termokopel yang dikalibrasi adalah antara 0.3 °C hingga 0.6 °C. Adapun hasil pengolahan data temperatur menunjukkan nilai akurasi termokopel adalah 0.53% hingga 1.10%. Menurut ASTM E 220-86, ketidakpastian kalibrasi termokopel menggunakan metode komparasi dengan pengukuran yang benar memberikan ketidakpastian sebesar 0.5 °C pada titik pengamatan (pembacaan).

Keywords: kalibrasi, termokopel tipe K, termometer kaca, ketidakpastian, ketelitian

[109] Endang Achdi (Universitas Pasundan), Toto Supriyono (Universitas Pasundan) and Egiandi Purwanto (Universitas Pasundan). *ANALISIS DISTRIBUSI KECEPATAN ANGIN SEBELUM DAN SESUDAH MELALUI FLOW STRAIGHTENER DALAM TEROWONGAN ANGIN.*

Abstract. Penggunaan utama terowongan angin yaitu untuk menunjang penelitian tentang karakteristik aerodinamika komponen mekanikal dan performansi turbin angin. Angin dalam terowongan angin dibangkitkan oleh energi mekanik putaran fan atau blower dengan kecepatan tertentu. Putaran fan ini menyebabkan angin yang mengalir dalam terowongan angin kondisinya acak. Kondisi aliran angin acak ini dapat diatasi dengan memasang perangkat flow straightener di penampang terowongan angin. Dalam penelitian ini ukuran penampang flow straightener sama dengan ukuran penampang terowongan angin yaitu 1 x 1 m. Flow straightener yang digunakan adalah jenis vane tube flow straightener. Setiap tube yang digunakan memiliki diameter seragam yaitu sekitar 10 mm dan panjang sekitar 100 mm. Flow straightener ditempatkan di bagian ujung dekat sisi keluar terowongan angin. Penempatan flow straightener ini mempertimbangkan penggunaan terowongan angin ke depan yaitu untuk pengujian performansi model turbin angin. Pengaruh flow straightener ini terhadap karakteristik distribusi kecepatan angin dalam terowongan angin didapat dengan pengujian. Pengujian distribusi kecepatan angin di dalam terowongan angin dilakukan pada putaran fan 1028, 1285, dan 1538 rpm. Pengukuran distribusi kecepatan angin dilakukan pada penampang sebelum dan setelah melewati flow straightener. Jumlah titik pengukuran kecepatan angin pada penampang terowongan angin sebanyak 121. Kecepatan angin rata-rata pada putaran fan 1028, 1285, dan 1538 rpm sebelum melewati flow straightener adalah masing-masing sebesar 6,01, 6,78, dan 7,81 m/s, dan setelah melewati flow straightener masing-masing sebesar 4,77, 4,83, dan 6,88 m/s. Distribusi kecepatan angin setelah melewati flow straightener lebih seragam dibandingkan sebelum melewati flow straightener. Kecepatan angin sebelum dan setelah melewati flow straightener memiliki korelasi sedang.

Keywords: Distribusi kecepatan angin, Flow straightener, Keseragaman kecepatan angin, Korelasi kecepatan angin.

[110] Weriono Weriono (Sekolah Tinggi Teknologi Pekanbaru) and Rinaldi Rinaldi (Sekolah Tinggi Teknologi Pekanbaru). *STRENGTH OF BABBITT ASTM B23 GRADE 2 COATING ON PLAIN BEARINGS THROUGH OXY-ACETYLENE WELDING.*

Abstract. A reciprocating pump is one of the pumping devices frequently used in the steam injection process to support the operation of the DIF (Disposal Injection Facility) plant. The plain bearing, a part of the pump, is frequently damaged. Plain-bearing materials are always softer than those that will directly contact the crankshaft. Babbitt white metal is applied to the damaged surface of used plain bearings in order to save costs on maintenance. According to ASTM B23, the babbitt metal used in the sliding bearings is grade 2 babbitt metal. 7.298% antimony (Sb) and 88.649% Sn compose the composition. Grade 2 is utilized in bearing applications requiring low pressure and high rotational speed. Babbitt coating is available in thicknesses of 2.85 mm and 3.0 mm and pressures of 6 psi, 8 psi, and 10 psi. The thickness welding pressure is 3.0 mm, 8 psi is at 37.91 M.Pa, and the thickness welding pressure is 3.0 mm, 8 psi is at 33.16 M.Pa, which results in the highest ultimate strength at 2.85 mm thickness, 6 psi is at 64

Keywords: Plain bearing, babbitt, pressure acetylene, ultimate Strength, wear

[111] Dian Anisa Rokhmawati (Universitas Hasyim Asy`ari Jombang). *ANALISIS VARIASI DIAMETER PIPA KONDENSOR ALAT DESTILASI BIOETANOL AMPAS TAHU.*

Abstract. ABSTRAK

Ampas tahu merupakan salah satu limbah industri pembuatan tahu yang banyak dijumpai di kabupaten Jombang. Jumlahnya berlimpah dan akan menjadi lebih bermanfaat jika bisa digunakan sebagai salah satu energi alternatif arena dalam ampas tahu tersebut terdapat kandungan bioetanol. Untuk mendapatkan bioetanol tersebut dapat di ekstrak dengan proses destilasi. Proses destilasi merupakan proses pemisahan larutan dari campurannya berdasarkan perbedaan titik didih. Penelitian ini akan membuat alat destilasi bioetanol limbah ampas tahu dengan dua variasi kondensor. Tujuan perancangan ini untuk mengetahui alat destilasi dengan kondensor yang manakah yang dapat menghasilkan volume bioetanol terbanyak.

Metode yang digunakan dalam penelitian adalah metode eksperimental, dengan memberikan perlakuan variasi kondensor 1 diameter $\Theta 9,5$ mm dan kondensor2 diameter $\Theta 8$ mm. Panjang masing-masing kondensor adalah 2000 mm. Volume tetes fermentasi ampas tahu yang digunakan adalah 3 liter. Waktu pemanasan 90 oC dan lama waktu yang digunakna adalah 60 menit.

Pengujian destilasi pada tetes fermentasi ampas tahu 3 liter pada kondensor 1 menghasilkan bioetanol sebanyak 0,420 liter. Pada kondensor 2 menghasilkan minyak sebanyak 0,530 liter. Dengan hasil uji tersebut dapat disimpulkan bahwa kondensor 2 lah yang menghasilkan volume bioetanol terbanyak.

Kata Kunci: Destilasi, Variasi kondensor, Ampas Tahu, Bioetanol

Keywords: condensor, destilation, bioethanol

[112] Maulana Hayu Jarwadi (Program Pascasarjana Teknik Dirgantara, Fakultas Teknik Mesin dan Dirgantara, Institut Teknologi Bandung), Annisa Jusuf (Kelompok Keahlian Struktur Ringan, Fakultas Teknik Mesin dan Dirgantara, Institut Teknologi Bandung), Pramudita Satria Palar (Kelompok Keahlian Fisika Terbang, Fakultas Teknik Mesin dan Dirgantara, Institut Teknologi Bandung) and Leonardo Gunawan (Kelompok Keahlian Struktur Ringan, Fakultas Teknik Mesin dan Dirgantara, Institut Teknologi Bandung). *Optimizing Crash Box Design for Enhanced Vehicle Safety: A Gaussian Process Regression Approach* .

Abstract. Transportation is a fundamental human need that permits mobility, allowing for economic, social, and cultural advancements. The crash box structure, a vital component for crashworthiness, is designed to deform during car collisions to absorb considerable impact energy plastically. This design concept attempts to prevent potential injuries to drivers and passengers. Crash boxes are constantly being developed to optimize their configuration to match needed crashworthiness features. The mean crushing force (Pm), crushing force efficiency (CFE), and specific energy absorption (SEA) are the critical crashworthiness variables that are calculated. With the advancement of data modeling tools, better crash box design can be achieved by revealing recognizable patterns and trends inherent in the data. To that end, this research uses LS-DYNA software to perform a numerical simulation of a hexagonally designed crash box that impacted under axial loading. The simulation includes the variation of thickness and perimeter of the crash box. Following the simulation, the data is modeled using the Gaussian Process Regression (GPR), often known as Kriging. This modeling approach yields surface and contour plots that show the impacts of thickness and perimeter on crashworthiness performance. The results show that the Pm value increases as the structure's thickness and perimeter increase. In comparison, the SEA and CFE values increase when the structure's thickness increases while the perimeter decreases. In summary, the simulation results show that the crash box with a thickness of 3 mm and a circumference of 400 mm has the highest Pm value. In contrast, the crash box with a thickness of 3 mm and a circumference of 120 mm achieves the highest CFE and SEA values.

Keywords: Optimization, Gaussian Process Regression, Crash box, Hexagonal

[113] Feblil Huda (Jurusan Teknik Mesin, Fakultas Teknik, Universitas Riau), Yusron Afrialson Surbakti (Jurusan Teknik Mesin, Fakultas Teknik, Universitas Riau), Nazaruddin Nazaruddin (Jurusan Teknik Mesin, Fakultas Teknik, Universitas Riau), Syafri Syafri (Jurusan Teknik Mesin, Fakultas Teknik, Universitas Riau) and Kaspul Anuar (Jurusan Teknik Mesin, Fakultas Teknik, Universitas Riau). *Prototype Pembangkit Listrik Memanfaatkan Rumble Strip pada Jalan Berbasis Piezoelectric* .

Abstract. Energy is an essential requirement for human life. Humans need the energy to support their activities as living beings with high mobility. Indonesia is one country that uses the most private transport globally, ranked 11th. This condition has the potential to be developed by utilizing mechanical energy from passing vehicles by utilizing rumble strips on the highway, where rumble strips are handy to remind drivers that there is something to watch out for. This study converts the mechanical energy generated from vehicles passing through the resulting rumble strip into electrical energy using piezoelectrics. A set of rumble streets with 60 piezoelectrics is constructed for that purpose. The electricity from the rumble streets loaded as a voltage with acquisition data connected to a PC laptop. The maximum electric voltage generated in this study is 22.6 Vac. Where the heavier the vehicle, the higher the voltage generated. The results show the potential use of the proposed system to generate electricity.

Keywords: Piezoelectric, Mechanical energy, Rumble Strip, Vehicle, Electrical energy

[114] Herisiswanto Herisiswanto ([Universitas Riau](#)), Dedi Rosa Putra Cupu ([Universitas Riau](#)), Nazaruddin Nazaruddin ([Universitas Riau](#)), Syafri Syafri ([Universitas Riau](#)), Kaspul Anuar ([Universitas Riau](#)), Vindo Dwi Refki ([Universitas Riau](#)) and Annisa Wulansari ([Universitas Riau](#)). *Perancangan Mesin Pencacah Limbah Medis Padat dengan Metode French.*

Abstract. Hospital solid waste can be in the form of medical and non-medical solid waste where medical solid waste includes infectious waste, pharmaceutical waste, sharp objects, chemical waste, heavy metal content waste, and pressurized containers. Regulation of the Minister of Health of the Republic of Indonesia number 1204 of 2004 states that solid medical waste may not be disposed directly into a final disposal site before it is safe for health. One of the tools used is a solid medical waste chopping machine. Prior to the process of making the tool, a design is needed with the final result in the form of technical drawings and material specifications. This study aims to design a solid medical waste chopping machine using the French design method. The French design concept begins with the product concept design, in which three concepts are produced in this study. With the design concept criteria decision matrix, one concept is chosen based on the highest score. The design of the components on this machine refers to the design of Sularso. From the results of this design, a technical protective drawing for a medical waste chopping machine is produced that is safe, easy to assemble and portable.

Keywords: medical waste chopping machine, French method design, solid medical waste, syringes

[115] Husen Asbanu ([Teknik Mesin Universitas Darma Persada Jakarta](#)) and Risky Prastyo Wibowo ([Teknik Mesin Universitas Darma Persada Jakarta](#)). *RANCANG BANGUN JIG CLAMPING PROSES PART BRACKET ENGINE MOUNTING SISTEM PNEUMATIC HIDROLIK.*

Abstract. Jig merupakan alat bantu yang memegang, menyangga atau ditempatkan pada komponen yang akan dimesin, alat ini merupakan alat bantu saat manufacturing produk yang di rancang sehingga ia tidak hanya menempatkan dan memegang benda kerja tetapi juga mengarahkan alat yang akan di cutting ketika operasi berjalan, Jig ini biasanya dilengkapi dengan bushing baja keras untuk mengarahkan perkakas potong lainnya. Jig yang didesain terdiri dari Arm clamp tebal 10 mm, jig, Base jig clamping tebal 15 mm panjang 145 mm, Pin lock jig clamping terdiri dari 4 buah dengan diameter 10,5 mm, 13.3 mm, 14 mm, dan 10,8 mm serta base dengan ukuran tebal 20 mm lebar 30 mm dengan panjang 70 mm, perbandingan Cycle Time Proses Finishing holder dan pemasangan manual 30.41 detik dan operasi Cycle Time Proses Finishing holder dan pemasangan dengan jig pneumatik 28.8 detik. Sedangkan Cycle Time proses Impact Assy Mirror dengan waktu manual 18.41 detik sedangkan lama nya waktu Cycle Time proses Impact Assy Mirror dengan jig penumatik yaitu 2 detik, gaya tekanan yang dibutuhkan yaitu 738 N.

Keywords: Jig, Desain, Pneumatik

[116] Monica Ayu Wibowo ([Universitas Indonesia](#)), Agus Sentana ([Universitas Indonesia](#)) and Ario Sunar Baskoro ([Universitas Indonesia](#)). *DESAIN DAN ANALISIS WELDING TORCH DENGAN WIRE FEEDER PADA PENGLASAN TUNGSTEN INERT GAS (TIG) PADA APLIKASI WIRE ARC ADDITIVE MANUFACTURING (WAAM)* .

Abstract. Tungsten Inert Gas (TIG) welding is a popular and widely used welding method in the manufacturing industry. One of the applications of TIG welding is the Wire Arc Additive Manufacturing (WAAM) method. WAAM is a welding method that utilizes an electric arc welding process with an additional wire feeder. A TIG-WAAM machine consists of components such as a TIG power source, welding torch, wire feeder, and control system to regulate welding parameters. Therefore, the welding torch is an important component in this research on welding. The design in this research will then be analyzed through analytical calculations and simulations using Autodesk Inventor 2021 software to verify the construction of the TIG welding machine can withstand the load of the designed welding torch. This research will primarily focus on the strength of the TIG welding machine's construction to withstand the load after the welding torch is designed and then compare the results with the simulation calculations using Inventor software. Analytical load calculations are essential to ensure the safety and strength of the equipment in performing its function. The results of the Von Mises stress through analytical and simulation before welding torch is 1,49 MPa and 0,24 MPa. Meanwhile, the analytical and simulation after welding torch are 0,167 MPa and 0,27 MPa.

Keywords: Tungsten Inert Gas (TIG), Wire Arc Additive Manufacturing (WAAM), Welding Torch, Wire Feeder, Design, Analysis

[117] Eko Prasetyo ([Universitas Indonesia](#)), Tedi Veradino ([Universitas Indonesia](#)) and Ario Sunar Baskoro ([Universitas Indonesia](#)). *Pengaruh Kecepatan Weaving Terhadap Lebar Manik Las dan Kekuatan Tarik Pipa Stainless Steel 316L pada Tungsten Inert Gas (TIG) Orbital Pipe Welding dengan Pola Pengelasan Zig-Zag*.

Abstract. Welding is essential in the construction, manufacturing, and oil and gas industries. One application of welding technology in the industry is pipe welding. In this study, welding of orbital pipes was carried out with Tungsten Inert Gas (TIG) Welding without filler metal (autogenous) on SS316L type stainless steel pipes with an outer diameter of 114 mm and a thickness of 3 mm. Welding tests were carried out to determine the quality of the weld (bead width) and tensile strength. The welding parameters used are constant current with variations in weaving speed (zigzag) of 0.150 mm/s, 0.154 mm/s, and 0.161 mm/s, as well as 4 pipe angle positions during welding namely 0°, 90°, 180°, and 270°. The stages of testing carried out include the preparation of tools and specimens, welding of the test material, and testing of the tensile strength and width of the weld bead. The welding tool used is a prototype orbital pipe welding tool with the 5G method with SS316L pipe material. After welding, the tensile test specimens are formed with the standard shape of the test material using the ASTM section 9 standard with the E-8M test method. From the results of measuring the width of the weld bead, the widest result occurs at a welding speed of 0.154 mm/s with a bead width of 12.14 mm at a position 90°. The highest tensile strength test results occurred at a welding speed of 0.150 mm/s with a maximum tensile strength of 571.07 MPa at 180° with a current of 100A.

Keywords: Tungsten Inert Gas (TIG), orbital pipe welding (OPW), kecepatan weaving, lebar manik las, tensile stress

[118] Hadi Prayitno (Mechanical Engineering, Universitas Lampung), Amrul Amrul (Mechanical Engineering, Universitas Lampung), Harmen Harmen (Mechanical Engineering, Universitas Lampung) and Ahmad Yonanda (Mechanical Engineering, Universitas Lampung). *Analysis of Fuel Characteristics of Torrified Mangosteen, Cocoa and Coffee Pod Shell Waste* .

Abstract. Consumption of coal as the primary energy source in Indonesia is increasing in line with the rising energy demand. One emerging and abundant alternative energy source in Indonesia is biomass. Biomass serves as a substitute option for coal due to its potential to reduce greenhouse gas emissions. Cocoa pod husks, categorized as biomass, can be utilized as an alternative solid fuel to replace coal due to their abundant availability throughout the year. However, the high moisture content in cocoa pod husks requires a thermal process known as torrefaction to enhance their quality. Residues from mangosteen, cocoa, and coffee husks, after undergoing torrefaction at a temperature of 275°C, were analyzed for calorific value and proximate content. This study examines how the mixture of fruit husk waste from plantation products influences the calorific value and proximate content. The most optimal mixture based on calorific value and proximate content serves as an alternative fuel source in power generation systems. The utilization of fruit husk waste can substitute for coal or act as a complement alongside coal in power generation.

Keywords: Fruit pod shells waste, Cofiring, Emissions

[119] Achmad Widodo (Universitas Diponegoro), Toni Prahasto (Universitas Diponegoro) and Endhy Priambodo (Undergraduate Program, Universitas Diponegoro). *EARLY DETECTION OF ROLLER BEARING DAMAGE USING MACHINE LEARNING APPROACH TO SUPPORT VECTOR REGRESSION (SVR)*.

Abstract. Bearings are mechanical components used to reduce friction between two moving parts. Due to their function, bearings are employed in various types of machinery and equipment, such as industrial machines, vehicles, and heavy equipment. Poor conditions of bearings can lead to machine damage and reduce the machine's lifespan. Therefore, proper monitoring and maintenance of bearings are crucial to ensure optimal machine performance and avoid unwanted breakdowns. Predicting the potential for failures and determining the remaining useful life (RUL) of a component is pivotal. With the use of machine learning, such predictions can be achieved. The National Aeronautics and Space Administration (NASA) bearing dataset is used as a reference for predicting failure potential. Feature extraction from this dataset serves as input for machine learning algorithms. Utilizing support vector regression (SVR) algorithm, 12 models are generated with varying levels of accuracy. From the outcomes of these models, a reference can be established for predicting failure potential in other bearing datasets. Consequently, engineers can predict failures in other bearings using the trained dataset as a basis. This enables early maintenance and repairs to prevent more severe damage when initial signs of failure are detected. As a result, excessive losses from the use of machinery or equipment can be anticipated and mitigated.

Keywords: Bearing, Machine learning, Remaining useful life (RUL), Support vector regression (SVR)

[121] Paryana Puspaputra (Indonesia Islamic University), Muhammad Taufiqur Rahman (Universitas Islam Indonesia) and Arif Rahman Hakim (Indonesia Islamic University). *Design of Small Capacity Tensile Test Machine for Low Strength Material.*

Abstract. This paper deals with an attempt to develop small capacity Tensile Test Machine especially data acquisition and data storing & displaying. Most machines are designed to test metal and other high-strength materials so that the machines are big-sized, heavy-weight, and installed at fixed locations. Today's trend of utilization of 3D printing for prototyping the model should be supported with proper information of material which depend on material and infill parameter used during prototyping process. This information are important to ensure that the model is properly scaled, geometrically and strength. Concerning those mentioned before, a tensile testing machine is designed for a 1-ton capacity. Control is designed to allow the machine to perform tensile tests and data acquisition. Data can be displayed or transferred in text format. In preliminary development, this machine can be operated but data acquisition and structure precision should be improved. Moreover, safety related operation panel and ergonomic design should be provided. This small capacity machine will increase testing efficiency for low power, simple and cheaper cost. This machine is also hoped to be used widely in research activity especially in development of composite, plastic and resin-based material.

Keywords: mini tensile test machine, composite, modeling scale, PLA material

[122] Rahmat Iman Mainil (Universitas Riau), Junior Jonathan Panjaitan (Universitas Riau), Azridjal Aziz (Universitas Riau) and Afdhal Kurniawan Mainil (Universitas Bengkulu). *Karakteristik Konversi Plastik Polipropilena (PP) untuk Produksi Miyak dengan Metode Pirolisis.*

Abstract. One approach to solving the environmental issues brought on by garbage accumulation is to recycle plastic waste. The pyrolysis technique is a highly promising method for recycling plastic waste. In this work, pyrolysis was used to heat polypropylene (PP) plastic at a temperature range of 250–350 °C and residence time of 30-90 minutes. The effect of temperature and holding time was used to determine the reaction rates of pyrolytic oil, solis and gas production by comparing experimental results with numerical calculations. These results showed that higher temperatures and longer residence times increased pyrolysis oil production. The numerical model developed was fit well with the experimental data. Understanding the pyrolysis process and degradation mechanism is essential for scale-up and reactor design.

Keywords: pyrolysis, polypropylene, pyrolytic oil, reaction rates

[123] Alif Fiqih Almahri ([universitas trisakti](#)) and Muhammad Sjahrul Annas ([universitas trisakti](#)). *Risk Analysis in Internal Combustion Engine Maintenance at the Machine Testing Laboratory of Trisakti University Using the Failure Mode and Effects Analysis (FMEA) Method.*

Abstract. One of the technologies that is still being developed in the automotive industry is the internal combustion engine. In order for the internal combustion engine to work at maximum performance, regular maintenance is necessary. Even after maintenance has been performed, potential damage to the internal combustion engine can still occur. An analysis of potential damage is necessary to determine what types of damage may occur. In this study, the case focuses on the Robin EY- 08 internal combustion engine at the Testing Laboratory of the Faculty of Industrial Engineering, Trisakti University, using the Failure Mode and Effects Analysis (FMEA) method. The FMEA method begins with an analysis of potential damage and the predicted and corrective impact that may occur in all supporting components of the internal combustion engine, resulting in Severity (S), Occurrence (O), and Detection (D) values. The Risk Priority Number (RPN) is then determined by multiplying the Severity (S), Occurrence (O), and Detection (D) values. The highest RPN value is 288 for the Piston Ring component, with potential damage of leakage in the combustion chamber and component wear. The recommended preventive maintenance activity is to adjust the maximum engine speed during operation, minimizing the heat generated by friction between the Piston Ring and Cylinder Block.

Keywords: Internal Combustion Engine, Failure Mode and Effects Analysis (FMEA), Risk Priority Number (RPN)

[124] Azridjal Aziz ([Teknik Mesin Universitas Riau](#)), Nurman Saputra ([Teknik Mesin Universitas Riau](#)), Afdhal Kurniawan Mainil ([Teknik Mesin Universitas Bengkulu](#)) and Rahmat Iman Mainil ([Teknik Mesin Universitas Riau](#)). *Evaluasi Kinerja Pembangkit Listrik Termoelektrik Memanfaatkan Panas Jalan Raya dengan Plat Tembaga Model I Sebagai Penyerap Panas.*

Abstract. Thermoelectric generators (TEGs) are promising devices that can convert waste heat into electricity through the Seebeck effect. This study investigates the performance of a TEG installed on a highway to utilize the heat generated by exposure to solar radiation. The aim is to explore the feasibility of utilizing TEG as a sustainable energy source and to analyze its efficiency and application potential. In this study, TEG modules were planted below the roadway surface to capture the temperature gradient between the ground and the pavement surface. The heat collector, thermoelectric generator, heat conductor (I-type), and cooling part (heatsink with cooler) of the power generation system were designed and fabricated. During four days of testing, the effectiveness of the TEG system was checked for two different collectors (concrete and asphalt). As a result, the electricity generated is sufficient and can be used for various purposes, such as powering street lights, sensors, or even feeding into the power grid.

Keywords: thermoelectric generator, roadway, heat conductor, solar radiation

[125] Indra Nasution ([Universitas Sumatera Utara](#)). *Pengaruh Proses Thermomechanics Terhadap Sifat Mekanis Baja Bohler VCN 150 Untuk Mata Pisau Pemanen Sawit.*

Abstract. Proses termomekanik adalah teknik perlakuan logam untuk meningkatkan sifat mekanis pada material dengan proses deformasi plastis. Termomekanik terdiri dari pemanasan awal dan proses mekanik. Tujuan penelitian ini adalah untuk mengamati pengaruh proses termomekanik terhadap sifat mekanis baja bohler vcn 150 seperti kekerasan, kekuatan tarik, dan struktur mikro bahan. Mengetahui pengaruh pemanasan awal terhadap ukuran butir dan hubungan butir terhadap sifat mekanis bahan. Mengevaluasi apakah baja bohler vcn 150 setelah dilakukan proses termomekanik memiliki sifat mekanis lebih baik dari bahan awal (raw material). Perbaikan sifat mekanis baja bohler vcn 150 untuk mata pisau pemanen sawit ini dilakukan dengan metode deformasi plastis dengan variasi suhu pemanasan awal 700°C, 750°C, 800°C, 850°C, 900°C dan mesin hammer GLASER GSH51 sebagai alat pendeformasi dengan variasi waktu pukulan hammer 5s, 10s, 15s, 20s per suhu. Hasil pengujian kekerasan memperlihatkan bahwa nilai optimum terjadi pada suhu 700°C/10s/20% sebesar 506,6 BHN. Tiga nilai optimum yang diambil dari hasil uji kekerasan untuk uji tarik diperoleh hasil pengujian tarik optimum dengan tegangan batas sebesar 18,279 Kg/f dan tegangan luluh 14,800 Kg/f pada suhu dan waktu pukulan yang sama 700°C/10s. Korelasi ukuran butir terhadap sifat mekanis yaitu dimana semakin kecil ukuran butir maka kekerasan dan kuat tariknya akan meningkat. Sedangkan untuk hubungan pemanasan awal antara deformasi dan ukuran butir, dimana pada waktu pukulan yang sama 10s semakin tinggi suhu pemanasan awal maka deformasi semakin meningkat dan diikuti diameter butir membesar. Proses termomekanik dapat memperbaiki sifat mekanis dan memperkecil ukuran diameter butir pada bahan baja bohler vcn 150.

Keywords: Proses Termo-mekanik, Baja Karbon, Sifat Mekanis, Diameter Butir

[126] Zulkifli Amin ([Andalas University](#)), Iskandar Ridwan ([Universitas Andalas](#)) and Rian Kurnia ([Universitas Andalas](#)). *Alat Analisis Rugi- Rugi Aliran dalam Pipa Otomatis Berbasis Arduino menggunakan Sensor Ultrasonic.*

Abstract. Flow losses are one of the phenomena that occur in piping systems, namely the loss of mechanical energy due to friction between fluid or friction of pipe walls with fluid. Flow losses are divided into two, namely major losses and minor losses. Major losses are flow losses caused by friction between the fluid and the walls of a straight pipe that has a fixed cross-sectional area. While minor losses are flow losses caused by changes in flow direction due to fittings, elbows, expansions and contractions. Fluid friction apparatus is a tool to analyze flow losses that occur both major losses and minor losses.

In this study, modifications were made to the fluid friction apparatus into an automatic-based tool using Arduino Uno Atmega 328P as a microcontroller and ultrasonic sensor HCSR-04 for water volume reading. The Arduino-based fluid friction apparatus is expected to be more accurate and can avoid small errors that occur in manual data retrieval. This research is broadly divided into two, namely calculating major flow losses and minor flow losses. Data collection of loss research is carried out by flowing fluid from the water pump to the pipe type PVC 3/4 inch, stainless steel 3/4 inch, aluminum 1/2p inch, PVC 1/2 inch, globe valve and gate valve until the volume of water reaches 5 liters where each pipe varies the inflow valve opening to full opening.

The test results that have been carried out show that the highest major loss is found in a 1/2 inch aluminum pipe at full opening using Arduino Uno with a value of 0.2003204641 m. The value continues to fall as the variation of openings decreases. As for the 1/2 inch aluminum pipe full opening without using Arduino Uno, the smallest value is 0.17987976 m. The results of this test show different values, but the value of using Arduino Uno produces values that are closer to theoretical values.

Keywords: Fluid, friction, ultasonic, sensor, arduino

[127] Mahruri Arif Wicaksono (PS Magister Teknik Mesin, FT Universitas Lampung, Jl. Prof. Sumantri Brojonegoro 1, Bandar Lampung 35144, Indonesia), Irza Sukmana (PS Magister Teknik Mesin, FT Universitas Lampung, Jl. Prof. Sumantri Brojonegoro 1, Bandar Lampung 35144, Indonesia), Sugiyanto Sugiyanto (PS Magister Teknik Mesin, FT Universitas Lampung, Jl. Prof. Sumantri Brojonegoro 1, Bandar Lampung 35144, Indonesia), Dwi Gustiono (Center for Materials Technology, BRIN, Jl. Kw Puspipetek, Kec. Setu, South Tangerang City, Banten 15314, Indonesia) and Rizal Nur Safii (PS Magister Teknik Mesin, FT Universitas Lampung, Jl. Prof. Sumantri Brojonegoro 1, Bandar Lampung 35144, Indonesia). *Pengaruh Konsentrasi Sodium Hidroksida (NaOH) Pada Perlakuan Permukaan Magnesium AZ31B Terhadap Sifat Fisik dan Mekanik Untuk Aplikasi Implan Tulang.*

Abstract. Anodizing adalah salah satu teknik pelapisan logam dengan mengubah permukaan logam dengan lapisan oksida melalui teknik kimia elektrolisis. Teknik pelapisan ini salah satunya bertujuan untuk meningkatkan sifat ketahanan korosi logam. Meskipun itu, teknik anodizing dapat mempengaruhi sifat fisik dan mekanik bahan dalam konteks aplikasinya. Penelitian bertujuan untuk menguji pengaruh variasi konsentrasi larutan elektroli terhadap kekerasan dan sifat fisik lapisan hasil proses pelapisan. Elektrolit yang digunakan adalah larutan NaOH (Sodium Hidroksida) dengan konsentrasi larutan 1 M dengan kemurnian 68%. Benda uji yang digunakan magnesium AZ31 dan tegangan proses elektrolisa adalah 10 Volt dengan lama perendaman 10 menit pada suhu ruang. Berdasarkan hasil analisis data, nilai kekerasan lapisan magnesium pada waktu 10 menit pada tegangan 10 volt adalah 69HV, dengan ketebalan lapisan $6\mu\text{m}$. Pada konsentrasi larutannya 0,5M menghasilkan kekerasan permukaan 67HV, dengan ketebalan lapisan $4\mu\text{m}$. Dengan adanya variasi tegangan dan waktu pada konsentrasi larutan yang berbeda maka akan terjadi perbedaan nilai kekerasan dan nilai ketebalan dari bahan pelapis magnesium AZ31 dan sekaligus akan membatasi potensi aplikasi bahan sebagai alternatif implan tulang mampu terdegradasi (biodegradable bone implant).

Keywords: anodizing, pelapisan, elektrolisa, kekerasan permukaan, implan tulang

[128] Irfan Taufiq (Universitas Pasundan), S Sugiharto (Universitas Pasundan), Widiyanti Kwintarini (Universitas Pasundan), Farid Rizayana (Universitas Pasundan), Bambang Ariantara (Universitas Pasundan), Endang Achdi (Universitas Pasundan) and Reza Hermawan (Universitas Pasundan). *Perancangan Welding Fixture Untuk Rangka Tractorpack V3* .

Abstract. Salah satu proses dalam pembuatan rangka tractorpack adalah proses pengelasan. Pada proses ini dibutuhkan suatu alat bantu pegang dan pemosisi benda kerja yang berupa welding fixture. Alat bantu ini digunakan saat proses penyambungan sehingga distorsi yang terjadi akibat pemanasan tidak mengubah dimensi benda kerjanya. Tujuan dari penelitian ini adalah menghasilkan welding fixture yang bisa digunakan pada proses pembuatan rangka tractorpack. Tahapan perancangan dimulai dengan mendefinisikan komponen yang akan dilas mulai dari bentuk, geometri, dan jenis material. Tahapan berikutnya adalah mendefinisikan jenis dan ukuran lokator serta pemegang komponen-komponen yang akan dilas. Hasil perancangan welding fixture dipasang pada sebuah meja dengan ukuran meja baja dengan panjang 1000 mm, lebar 600 mm, tinggi 800 mm. Dimensi ini disesuaikan dengan dimensi rangka tractorpack yang akan dilas dan persentil tubuh orang Indonesia yang akan menggunakannya. Jenis lokator yang digunakan adalah v-blok magnetik, dan v-blok non magnetik. V-blok magnetik berukuran panjang 60 mm, lebar 70 mm, tinggi 70 mm berjumlah empat unit digunakan untuk dudukan pipa bagian rangka setang dan pipa bagian rangka tengah. V-blok non magnetik yang digunakan ada tiga model yang digunakan untuk dudukan rangka setang, rangka tengah, rangka bawah. Penjepit yang digunakan ada tiga unit yang digunakan untuk menjepit bagian tengah pada tiap rangka. Hasil pengujian pada welding fixture untuk rangka tractorpack v3, menghasilkan jarak antara kedua pipa dan pelat sambungan yang sesuai gambar rancangan dengan toleransi 0,2 mm, dikarenakan adanya penjepit (clamping) pada welding fixture yang baru atau hasil perancangan yang meminimalisir terjadinya benda kerja bergeser.

Keywords: Fixture, Welding Fixture, Tractor Pack

[129] Muhammad Irsyad (Universitas Lampung), Agus Sugiri (Jurusan Teknik Mesin Universitas Lampung), Jorfri B Sinaga (Jurusan Teknik Mesin Universitas Lampung), M Dyan Susila (Jurusan Teknik Mesin Universitas Lampung) and Ahmad Jarkasih Mada (Jurusan Teknik Mesin Universitas Lampung). *PENYIMPANAN ENERGI TERMAL PADA PARAFIN DARI ENERGI SURYA UNTUK APLIKASI PEMANAS AIR DENGAN SIKLUS KOLEKTOR PLAT DATAR –TABUNG PARAFIN.*

Abstract. Potensi energi matahari di Indonesia termasuk tinggi dan cukup stabil sepanjang tahun dengan rentang waktu penggunaan 10-12 jam sehari dan dengan radiasi matahari rata-rata 4,8 kWh/m²/hari. Potensi ini dapat dimanfaatkan untuk berbagai keperluan seperti: energi listrik, pengering dan untuk pemanasan air. Teknologi pemanas air menggunakan kolektor surya sudah banyak diproduksi secara komersial, dan secara umum air panas hasil pemanasan tersimpan dalam tabung. Penyimpanan langsung pada air pada saat energi matahari belimpah butuh volume yang besar. Teknologi penyimpanan energi termal menggunakan material fasa berubah (phase change material disingkat PCM) merupakan salah satu solusi yang tepat dalam penyimpanan energi termal untuk aplikasi ini. Penelitian ini menggunakan kolektor plat datar yang dilengkapi pipa tembaga untuk aliran air sebagai media pembawa kalor ke alat penukar kalor yang berisi paraffin dengan variasi laju aliran air 2 lpm, 4 lpm dan 6 lpm. Hasil penelitian dengan rentang radiasi matahari 700 w/m² – 960W/m² diperoleh temperatur kolektor saat air mengalir rata-rata 52°C, dan temperatur paraffin mencapai 49°C dengan waktu 2 jam, 38 menit. Peningkatan radiasi matahari dapat mempercepat proses penyimpanan energi dan meningkatkan kapasitas energi yang tersimpan

Keywords: Penyimpan energi termal, Energi surya, parafin, pemanas air

[130] Rivaldo Anderson Robert (University of Udayana), Made Sucipta (University of Udayana), I Made Widiyarta (University of Udayana), Cindy Dwi Meylinda (University of Udayana) and Betty Florensia Sinaga (University of Udayana). *Aerodynamic Analysis of Obhi-Mec Unud Bio-Hybrid Electric Vehicle Using Computational Fluid Dynamics*.

Abstract. The aerodynamic properties of a vehicle are a factor in vehicle body development, such as the drag force, lift force, and flow pattern that occurs on the vehicle body. Using computational fluid dynamics (CFD), such as ANSYS Fluent, those properties can be investigated to design and analyze in many applications. Obhi-Mec Unud Bio-Hybrid is one of the electric vehicles developed to support the decarbonization program investigated through the fluid flow phenomenon to evaluate the drag and lift forces. The ANSYS Fluent with a realizable k-epsilon flow model with a pressure-based solver and steady flow was simulated with various vehicle velocities of 30, 40, and 50 km/h. It is found that the increase in vehicle velocity increases the drag and lift forces experienced by the vehicle. These results are due to the flow disturbance phenomena observed around the vehicle body, such as flow stagnation points, boundary layers, flow separation, and wake and vortex formation.

Keywords: Aerodynamics, Computational Fluid Dynamics, Drag Force, Lift Force

[131] Muhammad Rifky Prasetyo (Universitas Sebelas Maret), Fahmi Imanullah (Universitas Sebelas Maret), Hammar Ilham Akbar (Universitas Sebelas Maret), Eko Surojo (Universitas Sebelas Maret) and Dody Ariawan (Universitas Sebelas Maret). *Pengaruh Panjang Baffle Pada Proses Stir Casting Terhadap Sifat Mekanik Komposit AA6061-Pasir Pantai*.

Abstract. Stir casting is the simplest and most economical method of manufacturing aluminum composites. The stir casting process has several parameters, such as stirring speed, mixing time, preheating time, and the effectiveness of baffles. Stir casting parameters will affect material properties, like mechanical properties. This study aims to determine the effect of baffle length on the stir casting process on the tensile strength and hardness of the Al6061-Sea sand composite. Specimen preparation was carried out at 720–740 °C and stirred at 600 rpm for 10 minutes. Fraction by weight of sea sand: 2%, and additions: 1% mg. The highest hardness and tensile strength results were obtained from specimens without baffles (56.38 BHN and 241.22 MPa). For the half baffle variation, the mechanical value decreases due to the reduction in vertical motion of the particles during the agitation process at the bottom crucible so that the particles settle to the bottom of the crucible. Besides that, the turbulence that occurs causes an increase in porosity. Based on the type of insulation, The hardness and strength values of the round baffle type are higher than those of the flat baffle type (54.67 BHN and 219.77 MPa). This is influenced by differences in the level of turbulence that occurs during the casting process. Turbulence ensues when air enters the metal casting.

Keywords: AA6061, baffle, sea sand, stir casting

[132] Iis Siti Aisyah (Jurusan Teknik Mesin, Fakultas Teknik Universitas Muhammadiyah Malang), Disto Ryanto Nugroho (Jurusan Teknik Mesin, Fakultas Teknik Universitas Muhammadiyah Malang), Ali Saifullah (Jurusan Teknik Mesin, Fakultas Teknik Universitas Muhammadiyah Malang) and Wahyono Suprpto (Departemen Teknik Mesin, Fakultas Teknik, Universitas Brawijaya, Malang). *EFFECT OF VARIATION OF SINTERING TEMPERATURE OF HOT ISOSTATIC PRESSING PROCESS ON HARDNESS, POROSITY VALUE, AND MICRO PHOTO OF Al-SiC-Mg COMPOSITE BY FIBER METALURGY METHODS.*

Abstract. The objective of this study was to determine the effect of variations in sintering temperature on aluminum mixed with silicon carbide and magnesium alloys using the powder metallurgy method. In this study, 5 variations of sintering temperature were used, which is 350°C, 375°C, 400°C, 425°C, 450°C. With a powder composition of 70% aluminum, 24% silicon carbide, and 6% magnesium mixed with 70% alcohol evenly and then put into the mold of the Hot Isostatic Pressing (HIP) machine with a compacting pressure of 3000 psi and a holding time process for 20 minutes. The tests carried out were Rockwell hardness, porosity, and microphoto tests. The results of this study show that the hardness value increases with increasing sintering temperature, the highest hardness value is 33.5 HRB at a temperature of 450°C. The porosity value decreased with increasing sintering temperature, with the lowest porosity being 1.1015% at a temperature of 450°C. Variation of temperature on the microstructure affects the results of the microstructure. As the sintering temperature increases, the pores become smaller and the powders will bond with each other.

Keywords: Powder metallurgy, variation of sintering temperature, aluminium, silicon carbide, magnesium

[133] Johni Jonatan Numberi (Universitas Cenderawasih), Joni Joni (Universitas Cenderawasih) and Tiper Unipaia (Universitas Cenderawasih). *Experimental Diffusion Laminar Jet Flame Bioethanol Ampas Sagu Papua Clean Stove .*

Abstract. Sago is the most productive carbohydrate and cellulose producing plant which can be used as bioethanol fuel. Each stem of the sago plant can produce around 200-500 kg of wet sago starch per year or 25 to 30 tons per hectare, which can be used as energy fuel. Experimental diffusion laminar jet of flame bioethanol sago dregs the stove honai burner consists of pre-experimental and experimental. The purpose of pre-experimental to analyze sago dregs material using (SEM), Where the carbon value (CK) 76%, proximate 82,4% carbohydrate content very feasible in the process as bioethanol fuel. Experimental objectives characterizing fuel include Viscosity 1.03 (cp), density 0.82 (g/L), gas chromatography 61.04%, low heating value 80%=16.166 MJ/Kg, heat release rate 140 kW/m². The originality of the research shows that 80% sago bioethanol is very feasible as fuel. Novelty of research is honai burner with variations in the number of holes 1-16. 14 hole 45 ° more optimal temperature 750°C-480°C, mass of the fuel at a rate of 60 ml/min, gas combustion products (CO) 0.01%, (CO₂) 0.2% and (HC) 27 ppm. The CFD computation results show the velocity distribution velocity of bioethanol fluid present in the combustion chamber for atmospheric air condition is ignored and the fuel flow rate of 60 ml/s. Contribution of this research as one solution in answer energy problem, energy needs, access to energy, energy availability, and create a regional energy independence to be applied on the burning process of the stove using honai burner for household energy needs of the people of Papua in an isolated area.

Keywords: Sago, Dregs, Bioethanol, Diffusion, Laminar, Jet, Flame, Clean, Stove, Papua

[134] Muhamad Irfan Hasan (Nurtanio University), I Gusti Ngurah Sudira (Lecture on PT Dirgantara Indonesia) and Herlina (Nurtanio University). *ANALISIS STATIS MODEL FUSELAGE BERLUBANG DENGAN PENGUAT GRID MATERIAL METAL MENGGUNAKAN METODE ELEMEN HINGGA.*

Abstract. Material aluminium telah digunakan pada konstruksi pesawat terbang dari waktu ke waktu karena memiliki berat jenis yang ringan serta ductility yang cukup baik. Selain material pada pesawat terbang, konfigurasi struktur juga merupakan hal yang penting. Salah satu konfigurasi struktur yang mampu mendistribusikan beban dan momen secara merata adalah struktur grid. Pada pesawat terbang terdapat lubang pada strukturnya, hal tersebut tidak dapat dihindari karena memiliki peran yang penting salah satunya sebagai lubang jendela. Penelitian ini bertujuan untuk menganalisis model fuselage dengan struktur grid variasi ketebalan frame pada jendela terhadap deformasi, tegangan, dan margin of safety di bawah pembebanan statis. Struktur fuselage memiliki 8 lubang jendela pada setiap sisi dengan stringer sebanyak 60 buah dan sudut 45°. Material yang digunakan adalah aluminium alloy 2024-T3. Model fuselage dibuat sebanyak 6 model dengan variasi ketebalan frame dan membandingkan struktur grid dan konvensional. Analisis dilakukan dengan pemberian beban bending dan beban torsi sebesar 10.000 N serta kondisi batas yang diasumsikan sebagai cantilever beam. Analisis perhitungan statis menggunakan metode elemen hingga (MEH) dengan software MSC. Patran/Nastran. Dari hasil penelitian diperoleh bahwa dengan adanya lubang menyebabkan nilai max. deformation dan max. stress meningkat, tetapi massa pada struktur menjadi berkurang. Selain itu, Peningkatan ketebalan pada frame jendela berpengaruh pada hasil nilai max. deformation dan max. stress yang semakin menurun tetapi massa struktur bertambah. Selain itu, berdasarkan nilai max. stress yang menurun didapatkan nilai MOS yang meningkat. Nilai margin of safety pada seluruh model struktur dikatakan aman karena nilai margin of safety lebih besar dari 0 ($MOS > 0$). Dari hasil penelitian ini diketahui bahwa struktur grid lebih kaku dan kuat dibandingkan struktur konvensional karena memiliki nilai deformasi dan tegangan maksimum yang lebih rendah.

Keywords: Struktur Grid Berlubang, Analisis Statis, Fuselage Berlubang

[135] Hendri Dwi Saptioratri Budiono (Universitas Indonesia). *Model Perhitungan Kompleksitas Proses Sangrai Kopi Menggunakan Biji Kopi Tradisional Indonesia .*

Abstract. The manufacturing process involves converting raw materials into usable products, and this is also applicable in others sector like coffee roasting. Coffee roasting can be considered a manufacturing process as it involves transforming green coffee beans into roasted coffee beans. Coffee roasting defines 20% - 25% of coffee quality, making variation in process is impactful. Due to various influential parameters, achieving specific bean specifications adds complexity to the process. Indonesia, a major coffee producer, emphasizes research for enhancing coffee quality, specifically for varieties like Arabica Gayo, Arabica Solok Radjo, Robusta Bengkulu, and Robusta Temanggung. Another underlying factor for this research is the lack of studies related to complexity process of coffee roasting. This research aims to use the model for performing complex calculations of manufacturing system's complexity in coffee roasting process. This model used as a tool to assess the existing process. Furthermore, this model simplifies the calculation of the process complexity, and the resulting index can be used to estimate initial costs during the design phase for the roasting process. This research adopts the method by W.H. El Maraghy regarding complexity modelling and applies it to the scope of coffee roasting. Based on the conducted research, the most important aspects that influence the complexity of roasting coffee beans based on roast level are roast colour, mass, and dimensions resulting from the roast profile of coffee beans. The highest complexity index was found in Temanggung Robusta coffee beans with an RPM of 90 and a dark roast level of 9.21.

Keywords: Indonesia Coffee Beans, Process Complexity, Coffee Roasting

[136] Dian Anisa Rokhmah Wati (Universitas Hasyim Asy`ari Jombang), Retno Eka Pramitasari (Universitas Hasyim Asy`ari Jombang), Mohammad Munib Rosadi (Universitas Hasyim Asy`ari Jombang), Basuki Basuki (Universitas Hasyim Asy`ari Jombang), M A Irfai (Universitas Negeri Surabaya), Fajar Satriya Hadi (Universitas Hasyim Asy`ari Jombang) and M Lufti Al Akbar (Universitas Hasyim Asy`ari Jombang). *ANALISIS VARIASI DIAMETER PIPA KONDENSOR ALAT DESTILASI BIOETANOL AMPAS TAHU.*

Abstract. Ampas tahu merupakan salah satu limbah industri pembuatan tahu yang banyak dijumpai di kabupaten Jombang. Jumlahnya berlimpah dan akan menjadi lebih bermanfaat jika bisa digunakan sebagai salah satu energi alternatif arena dalam ampas tahu tersebut terdapat kandungan bioetanol. Untuk mendapatkan bioetanol tersebut dapat di ekstrak dengan proses destilasi. Proses destilasi merupakan proses pemisahan larutan dari campurannya berdasarkan perbedaan titik didih. Penelitian ini akan membuat alat destilasi bioetanol limbah ampas tahu dengan dua variasi kondesor. Tujuan perancangan ini untuk mengetahui alat destilasi dengan kondensor yang manakah yang dapat menghasilkan volume bioetanol terbanyak. Metode yang digunakan dalam penelitian adalah metode eksperimental, dengan memberikan perlakuan variasi kondensor 1 diameter $\Theta 9,5$ mm dan kondensor2 diameter $\Theta 8$ mm. Panjang masing-masing kondensor adalah 2000 mm. Volume tetes fermentasi ampas tahu yang digunakan adalah 3 liter. Waktu pemanasan 90°C dan lama waktu yang digunakna adalah 60 menit. Pengujian destilasi pada tetes fermentasi ampas tahu 3 liter pada kondensor 1 menghasilkan bioetanol sebanyak 0,420 liter. Pada kondensor 2 menghasilkan minyak sebanyak 0,530 liter. Dengan hasil uji tersebut dapat disimpulkan bahwa kondensor 2 yang menghasilkan volume bioetanol terbanyak.

Keywords: Destilasi, Variasi kondensor, Ampas Tahu, Bioetanol

[137] Sunaryo Sunaryo (Universitas Indonesia) and Yose Satyanegara (Universitas Indonesia). *Standard Operating Procedure Kesehatan Dan Keselamatan Kerja Pada Fasilitas Penutuhan Kapal Ramah Lingkungan .*

Abstract. Since the implementation of the cabotage principle in 2005, the number of Indonesian flagged ships has increased significantly from 6,041 units in 2005 to 32,587 in 2019, with 60 percent of them being over 20 years old. This creates a significant potential for the existence of old ships that need to be recycled. On the other hand, there is a continuous increase in domestic steel demand. One of the raw materials for the steel industry is steel scrap obtained from recycled ships. Therefore ship recycling industry could play significant role in fulfilling the need for raw materials of the steel industry. But in fact, most of the recycling activities in Indonesia are still far from complying with the existing standards and regulations for safe and environmentally friendly ship recycling facilities. The study aims to arrange a health and safety standard operating procedure for green ship recycling facilities to be used by ship recycling facilities in Indonesia to comply with the requirements of the Hong Kong Convention. Literature study particularly in reviewing the standards and regulations, such as the Hong Kong Convention, Basel Convention, International Labour Organization's Safety and Health in shipbreaking: Guidelines for Asian countries and Turkey, and field investigation are carried out in conducting the gap analysis, as the basis for arranging the standard operating procedure. Five standard operating procedures were proposed in relation to the work health and safety of the green ship recycling facility, namely: standard operating procedure for Personal Protective Equipment, standard operating procedure for Medical Check Up, standard operating procedure for Evacuation and Emergency Signs, standard operating procedure for Gas Vessels Storage, and standard operating procedure for Steel Cutting.

Keywords: standard operating procedure, green ship recycling, work health and safety, Hong Kong Convention

[138] Zulhanif Zulhanif (Universitas Lampung), Adi Saputra (Universitas Lampung) and Harnowo Supriadi (Universitas Lampung). *PENGARUH WAKTU PELAPISAN PROSES ELEKTROPLATING PADA BAJA AISI 1020 YANG DILAPISI KROM DAN NIKEL.*

Abstract. The mechanical properties and appearance of a material are essential factors in the current selection of materials for specific purposes. To change the properties of a material to achieve both high wear resistance and appealing aesthetics requires treatment. One of the treatments for such materials is electroplating. Electroplating is a process of depositing a desired protective metal on top of another metal by means of electrolysis where electrolysis is carried out in a vessel called an electrolytic cell containing an electrolyte solution or a bath immersed in at least two electrodes where each electrode is connected to an electric current, divided into The positive and negative poles are known as the cathode and anode poles. This study examines how the effect of immersion time on the results of chrome and nickel plating on the surface roughness and hardness of the chrome and nickel coating in the electroplating process. The material used in this study was AISI 1020 Steel which was cut to a size of 50×50×10 mm. This study varied the length of immersion time of 5, 10, 15 and 20 minutes into the chrome electrolyte solution and nickel electrolyte solution. The result of this research is the length of time of coating affects the value of surface roughness and hardness value but at 20 minutes of coating time the coating fails. The surface roughness value for a coating time of 15 minutes is the most optimal coating time where nickel plating produces a surface roughness value of 0.237 μm (54% decrease) and chrome plating produces a surface roughness value of 0.155 μm (70% decrease). The hardness value for 15 minutes plating time is the most optimal coating time where nickel plating produces a hardness value of 225 HV (23% increase) and chrome plating produces a hardness value of 245,3 HV (34% increase).

Keywords: Electroplating, Rouhgness Test, Hardness Test.

[139] Arif Budi Wicaksono (Universitas Islam Indonesia) and Amir Kamal (Universitas Islam Indonesia). *Pengaruh Runner System dan Temperture Terhadap Fill Time dan Quality Prediction pada Proses Injection Molding, Studi Kasus Produk Litter Box.*

Abstract. This study aims to determine the effect of variations in the runner system and melting temperature on fill time and quality prediction in 3 parts of plastic products that have geometric shape characteristics that tend to be similar to litter box products. The focus parameters in this study are the location and number of gates, runner layouts, and runner dimensions. The injection simulation was carried out using CAE Autodesk Moldflow Adviser software. In this study, there were three variations of runner dimensions for each litter box part and more than four variations in the number and location of gates and runner layouts. The results of the simulation state that the four-gate mold variant with a runner star layout with runner diameters of 8 mm and 5 mm is the optimal configuration for two of the three parts. The optimal configuration for one of the three parts is a mold variant with two gates with a runner diameter of 5 mm.

Keywords: Injection Molding, Moldflow Simulation, Runner System

[140] Faisal Arif Nurgesang (Universitas Islam Indonesia) and Muhammad Alif Satrio (Universitas Islam Indonesia). *The Effect of Curing Temperature on Bending Strength of Sandwich Composite With 3D Printed PLA Core* .

Abstract. Sandwich composite is a composite that has a characteristic stiff yet light. It is composed of a core and skin where the stiffness is obtained from material of the core. In this study, the core was made using Polylactic Acid (PLA) through 3D printing technology and the skin used was woven type carbon fiber. By using the advantage of 3D printing, sandwich composite product can be made easily because of its design flexibility. In the process of making sandwich composites, a curing process is required to bond between the core and the skin. However, the curing process at room temperature is not enough to provide a strong bond between the core and skin. Therefore, in this study, the curing temperature was varied at room temperature, 60, and 70 °C for 5 minutes after the composite sandwich was opened from the mould. The test specimens were made using the vacuum infusion method with dimensions referring to the ASTM C-393 standard. Bending tests were carried out using the Universal Testing Machine with the three point bending method. Based on the test results, it was found that the bending strength of the sandwich composite at room temperature was 20.90 MPa. After curing at 60 °C, there was an increase in bending strength of 4.5% to 21.89 MPa. The increase in bending strength was still obtained by 11.7% when the specimen was cured at 70 °C to 23.67 MPa. From SEM observations, it was found that when the specimens were cured only at room temperature, voids were still visible, whereas when the specimens were cured at 70 °C, voids were no longer visible. Thus, curing temperature plays important role in strengthening the bending strength of sandwich composite.

Keywords: Sandwich composite, curing temperature, bending strength

[141] Muftil Badri (Jurusan Teknik Mesin, Fakultas Teknik Universitas Riau), Dodi Sofyan Arief (Jurusan Teknik Mesin, Fakultas Teknik Universitas Riau) and Amri Pahlevi (Jurusan Teknik Mesin, Fakultas Teknik Universitas Riau). *Pengaruh Kedalaman Pin terhadap Sambungan Friction Stir Welding Pelat HDPE*.

Abstract. FSW, or friction stir welding, is a relatively new solid-state joining method. This method is energy efficient and environmentally friendly. FSW was first typically applied to metallic materials such as titanium and aluminum that are difficult to join by fusion welding. Research on FSW is currently being developed for the joining of non-metallic materials such as polymers. Polymers are widely used in the food, automotive, transportation and textile industries. Polymers are lighter and more corrosion resistant than metals. HDPE polymer is used as a material that is joined by the FSW method in this study. Spinning tool speed, welding speed, and depth of feed are the three variables used in this FSW welding. The pin depths varied were 5.65 mm, 5.7 mm and 5.75 mm. The welding speed was 7.3 mm/min, the welding angle was 2° and the tool rotation speed was 630 rpm. The pin material used is steel, pin diameter 6 mm and shoulder diameter 16 mm. It was found that the pin depth affects the temperature distribution, where the increasing pin depth increases the maximum temperature. The maximum tensile strength in FSW welding is obtained at a pin depth variation of 5.7 mm, which is 23.79 MPa. The tensile strength obtained at 5.7 mm pin depth FSW welding increased by 13.3%.

Keywords: FSW, depth of pin, HDPE

[142] Khusnul Khotimah (Politeknik Manufaktur Bandung) and Aida Mahmudah (Politeknik Manufaktur Bandung). *Peningkatan Efisiensi Proses Produksi melalui Pengembangan Progressive Hybrid Tool pada Pembentukan Komponen Otomotif Bracket Parking Brake Cable Guide Material SCGA270C-45.*

Abstract. The automotive industry is currently experiencing development. In response to these developments, car manufacturers made changes to the features or components of one type and another. Of the many components contained in the car, one of them is the parking brake cable guide bracket which is one of the fastening components in the parking brake of the car, with the material type SCGA270C-45. The previous production process used several single and group types of stamping tools, which means that it takes several machines and several operators to produce the bracket components. To speed up production, an improvement stamping tool is carried out to obtain a more optimal and efficient process. Several tools used will be condensed into one progressive hybrid tool. In order that obtains the design of a progressive hybrid tool, that complies with the technical requirement of production constraints, it is used the VDI 2222 (Verien Deutsche Ingenieur) as a design method. The design results in the progressive hybrid tool with 10 stamping stations, and the dimensions of the tool are 800mm in length, 450mm in width, and 365mm in height. The force required for a whole process is 24.5 tonnes. By using this tool, only one machine and one operator are needed in the bracket component production process.

Keywords: bracket, progressive hybrid tool, SCGA270C-45

[143] Purtojo Purtojo (Universitas Islam Indonesia), Nur Amiral Mahdi (Universitas Islam Indonesia), Donny Suryawan (Universitas Islam Indonesia) and Agung Nugroho Adi (Universitas Islam Indonesia). *Perancangan Sistem Kendali Rotary-Crane Skala Laboratorium menggunakan Model State Space .*

Abstract. A crane transports heavy goods using a tall structure to move from one point to another within a certain distance. On an experimental scale, the rotary crane can be modeled in the form of a simple rotary pendulum. The model as a controlled object is used to simulate the control performances that is appropriate for used on cranes. The angular position of the pendulum arm and pendulum link are the main object to be controlled. Less pendulum link swing and fast pendulum arm reach final position without or with small overshoot are desired. The space space model of the rotary pendulum is derived since it represent multi-input-multi-output system. The state feedback control was then developed in order to design the control system. Performance index of integral time absolute error was set as desired performance within the operation range. The controller gain K was obtained based on the performance index and characteristic equation of the system. Simulation was then conducted in computer model using Xcos model provided by Scilab software in order to iterate the best value of controller gain K. The simulation result was implemented in the real rotary pendulum as a controlled object. The rotary pendulum is driven by using a dc motor with rotary encoder attached to it to track it position. The angular swing pendulum is tracked using a rotary encoder as well. Hardware in the loop configuration was build to conduct the experiment.

Keywords: crane, rotary pendulum, state space, state feedback, angular position

[144] Yudan Whulanza (Mechanical Engineering Department) and Deni Haryadi (Department of Mechanical Engineering Universitas Indonesia). *Optimizing Hot Embossing of Poly(methyl methacrylate) Microfluidic Chip.*

Abstract. Microfluidic research become a more important research field in mechanical and bioengineering fields. The application of microfluidic has a positive relation to the micro or precision manufacturing ability. Nowadays, the manufacturing in this area is aimed at around 100-500 μm . Here, a hot embossing method is reported to realize microchannel with dimensions of height and width of 150-300 μm and 600-800 μm , respectively. This study also shows that the margin factor between the mold/dies to the realized dimension is 50-70% and 5-7% for height and width, respectively.

Keywords: microfluidic, micromanufacturing, microchannel, hot embossing

[145] Yudan Whulanza (Department of Mechanical Engineering Faculty of Engineering, Universitas Indonesia) and Yunus Bakhtiar Arafat (Department of Mechanical Engineering Universitas Indonesia). *The Effect of Snap-off Distance and Screen Variation on the Screen Printed Electrodes Fabrication Process*

Abstract. Screen Printing Electrode (SPE) has advantages in production efficiency and cost open up wider application opportunities in a wide range of industries, including medical, environmental, and sensor technology. In addition, the potential of SPE in detecting analytes with high sensitivity and selectivity can have a positive impact on the development of more sophisticated and accurate detection and monitoring systems. For this research is carried out mechanically with a screen printing machine, so it is expected to get electrodes from screen printing that have better repitability and sensitivity while the parameters used in the screen printing process are variations in setting the distance between the stencil and the substrate (snap-off) by 0.5mm; 1mm; and 1.5mm. Although made at low cost, electrodes for electrochemical biosensors have a fairly high repeatability percentage of 1.5-4.3%, so there is uniformity in prints using this machine.

Keywords: 3D Electrodes, Textured Electrodes, Screen Printing Method, High Sensitivity, Capacitive Sensing

[147] Warjito Warjito (Universitas Indonesia), Budiarmo Budiarmo (Universitas Indonesia), Dendy Adanta (Universitas Indonesia) and Muhammad Mizan (Universitas Indonesia). *Kajian Pemodelan Turbulen Turbin Piko Hidro Jenis Propeller.*

Abstract. Aliran turbulen merupakan aliran yang tidak beraturan sehingga aliran ini sangat sulit untuk dianalisis, baik itu property aliran yaitu kecepatan yang di dekat dinding maupun di tengah terjadi tingkat fluktuasi aliran yang sangat tinggi dan memiliki bilangan Reynolds yang cukup tinggi (>2000).

Kajian ini bertujuan untuk mempertimbangkan jenis pemodelan turbulen yang cocok diaplikasikan pada simulasi CFD untuk tubin pikohidro tipe propeller. Model pemodelan turbulen yang cocok dikaji dengan membandingkan hasil simulasi CFD dengan data hasil eksperimen.

Hasil kajian menunjukkan bahwa pemodelan turbulen yang sesuai untuk turbin air pikohidro adalah pemodelan Reynolds Stress Model (RSM) k- ϵ .

Keywords: aliran turbulen, pemodelan, pikohidro, propeller, RSM k- ϵ

[148] Muhammad Faisal Abror (Universitas Gadjah Mada), Eko Pujiyulianto (Institut Teknologi Sumatra), Muslim Mahardika (Universitas Gadjah Mada), Suyitno (Universitas Tidar), Urip Agus Salim (Universitas Gadjah Mada) and Budi Arifvianto (Universitas Gadjah Mada). *Simulasi Aliran Fluida Elektrolit dalam Proses Poles Elektrokimiawi Produk Stent Kardiovaskular.*

Abstract. Stents are devices that are often used as an alternative for treating stroke. Some methods of making stents still require final treatment to reduce surface roughness. One method to reduce surface roughness is electropolishing. However, this method still leaves problems related to flow turbulence. Flow turbulence will reduce the effectiveness of chemical polishing. Therefore, a final post-production process is required to obtain a stent surface that meets standards. In this research, electropolishing is carried out as a finishing technique in the form of an Ansys simulation. Next, the velocity contour, velocity flow direction, and velocity on each stent surface are studied. The results showed that polishing perforated stents using electrodes in making electrolyte flow has the potential to cause turbulence. Turbulent flow also forms at the outer and combined electrodes, only they are located outside the stent. Meanwhile, the area under the stent (BO) has the highest flow compared to other areas. An alternative is when the outer surface wants to be polished, use a speed that is not too high so that the bottom of the stent is not polished quickly. Furthermore when the inside of the stent wants to be polished too, prefer to use high speed. Although this surface finishing technique is promising for stent processing, duration and other factors also need to be considered in its application because it will affect the result.

Keywords: Poles Elektrokimiawi, Stent Kardiovaskular, Simulasi, Ansys, Permukaan, Aliran

[149] Muhammad Marsudi (Islamic University of Kalimantan - Muhammad Arsyad Al Banjari) and Firda Herlina (Islamic University of Kalimantan - Muhammad Arsyad Al Banjari). *Peningkatan Mutu Produk Dengan Metode Statistical Process Control Di Industri Elektronik.*

Abstract. Statistical Process Control (SPC) is a technique to increase the quality and to ensure the needs or requirements of customers are achieved. SPC is a set of tools for managing processes and determining and monitoring the quality of the output of an organization, and it provides an objective means of controlling quality in any transformation process. Besides, SPC is also a strategy for reducing variation in products, deliveries, processes, materials properties and equipment which are the cause of most quality problems. This study is conducted in an electronic industry - Toshiba Electronics, which manufactures transistors and other electronics parts, where its objective is to observe the implementation of quality management and its performance in the industry. To achieve the objective, the Statistical Process Control technique was applied for the analysis. The SPC tools used in this study are only Pareto analysis, and Cause and Effect analysis. Besides that, the use of questioners is also used to collect the data. Based on the results, although the quality production processes in the company are in control, some problems related to the quality have been identified. At the end of the study, some action plans and suggestions were recommended to improve the quality, especially on the quality management aspect.

Keywords: electronic industry, production process, quality management, SPC

[150] Stenly Tangkuman (Program Studi Teknik Mesin, Universitas Sam Ratulangi, Manado) and Tritiya A.R. Arungpadang (Program Studi Teknik Mesin, Universitas Sam Ratulangi, Manado). *Pengembangan Grey Model untuk Prognosis Kesehatan Komponen Mesin.*

Abstract. This paper presents a prediction model to predict future conditions based on grey models and one-step-ahead forecasting techniques. In particular, the suitability of the grey model as a predictor in component health prognosis systems has been investigated. To validate the proposed method, three experimental data have been used, namely low methane compressor bearing data, Li-ion battery voltage data, and crack propagation test data. The results show that the grey model and one-step-ahead technique were reliable predictors in the three cases tested. Specifically, a modified model of the basic grey model has been created to increase prediction accuracy. This model can work well even though it only uses a small amount of input data.

Keywords: grey model, prognostics, health of components



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[1] Lovely Son ([Universitas Andalas](#)), Mulyadi Bur ([Universitas Andalas](#)), Eka Satria ([Universitas Andalas](#)) and Wahyu Wafid ([Universitas Andalas](#)). *Reduction of UAV Vibration Response by Addition of T Spar in Wing Structure*.

Abstract. This study is performed to evaluate the vibration response of UAVs during flight tests. The UAV's vibration response is measured using the existing accelerometer installed on the UAV flight controller. An additional accelerometer is placed inside the UAV fuselage near the flight controller board for high-frequency vibration measurement. The vibration response analysis shows that the maximum acceleration response occurs when a UAV flight is in turning mode. An additional T spar is added between two existing tubular spars in the UAV wing to increase the wing stiffness. It was shown from the flight test that the acceleration response amplitude reduces by 26,84% when using T spar on the wing structure.

Keywords: UAV, Vibration, Response, Spar, Structure

[2] Wahyono Suprpto ([Brawijaya University](#)), Erwin Erwin ([Brawijaya University](#)), Sudjito Suparman ([Brawijaya University](#)), Yudy Surya ([Brawijaya University](#)), Asmadi Lubay ([IBA University](#)) and Rasta Satya ([Brawijaya University](#)). *Effect of Nickel Solubility in ADC12 Melt on Its characterization*.

Abstract. This paper describes the solubility of nickel alloys in molten Al-Si alloys at 900 °C to form Al-Si-Ni alloys. Which is nickel metal with a melting point of 1450 °C and aluminum alloy Silumin has a melting point of 600-760 °C. Solid phases: α -Al, Al-Si, Si, and Mn-Fe-Si intermetallic are microstructures in Silumin with different geometries, expansion coefficients, and mechanical properties. The uncontrolled ferro-manganese intermetallic phase in aluminum alloys triggers cracking and reduces manufacturing properties. The phenomenon of nickel solubility in a liquid silumin bath at 900 °C besides reducing the melting energy can also increase ductility through controlling metallographic characteristics. ADC12 smelting and nickel alloying are carried out in the R703 electric resistance furnace. Melting operation, ADC12 is inserted into the furnace at a temperature of 250 °C and melts at 600 °C at the same time as Nickel is added. After that the furnace temperature was increased to a temperature of 900 °C and held for 45 minutes then the molten ADC12+Ni alloy was stirred, the slag was removed from the ladle, the molten alloy was removed from the furnace and poured into the specimen permanent mold. The independent variable in this study was the weight of nickel in each smelter: 2, 4, 6, 8, and 10% by weight of the ADC12 ingot. As the dependent variable is the characterization of the ADC12+Ni alloy consisting of nickel solubility, type, shape and solid fraction. Testing of chemical elements was carried out by optical emission spectrometry, the metallography was carried out by optical microscopy, and the phase fractions were carried out using the imageJ software application. Melting point solid nickel of 1450 °C can dissolve in ADC12 melt on a temperature 600 to 900 °C at a holding time of 45 minutes. The amount of nickel dissolved in ADC12 continues to increase in line with the weight of the nickel melted. The weight percent of dissolved nickel and nickel with the intermetallic fraction Al-Ni in the Al-Si-Ni alloy immersion 2, 4, 6, 8, and 10 Ni respectively is 2.98-2, 5.04-3, 6.97-8, 8.13-10, and 10.02- 10 in [%].

Keywords: solubility, intermetallic, silumin, solid phase, ImageJ.

[3] Achmad Yahya Teguh Panuju (Universitas Lampung), Ganang Setya Wahyudi (Universitas Lampung), Muhammad Toby Al Ghazali (Universitas Lampung), Martinus Martinus (Universitas Lampung), Akhmad Rizal (Universitas Lampung), Arinal Hamni (Universitas Lampung) and Yanuar Burhanuddin (Universitas Lampung). *Design for sustainable behaviour effect: Identifying behaviour changes pattern through eco feedback strategy.*

Abstract. Research in the field of design for sustainable behavior (DfSB) has been conducted quite extensively, but studies that provide evidence of the effects of design strategies on measurable changes in consumer behavior are still scarce. Moreover, this study introduces a framework to comprehend the behaviour changes after interacting with DfSB. This research further investigates the relationship between behavioural changes and increased environmental awareness resulting from the implementation of one eco-design concept in a dual-tub washing machine, namely the addition of an eco-feedback component. Through a series of experiments, it was found that the difference in respondents' educational backgrounds did not have a significant influence, but increased awareness showed a positive correlation with eco behavioural changes among the respondents. Additionally, behavioural changes were also identified to be influenced by other factors that are difficult to quantify, such as past habits and respondents' perception of cleanliness. The results of this research are expected to contribute to the process of designing products that are more targeted and measurable in order to encourage consumer behaviour to be more environmentally friendly, especially in everyday household products.

Keywords: design for sustainable behaviour, eco feedback, environmental awareness, sustainable design

[4] A P Bayuseno (Diponegoro University), F Agung Wicaksono (Diponegoro University), A Prihanto (Diponegoro University), Vivi A Fardilah (Diponegoro University), Y. M Pusparizkita (Diponegoro University), R Ismail (Diponegoro University) and J Jamari (Diponegoro University). *Assisted hydrothermal synthesis of green mussel shell-derived hydroxyapatite for use in filler polymer-based composites.*

Abstract. Biodegradable bone implants based on biocomposite of polylactic acid and polycaprolactone biopolymers with hydroxyapatite are available and have significantly increased the usage of biomaterials in the medical industry. This study was to generate biodegradable biocomposites using polylactic acid (PLA), polycaprolactone (PCL), and hydroxyapatite. The biocomposite made from a blend of 60% PCL and 40% PLA was with various quantities of hydroxyapatite, ranging from 5%, 10%, 15%, and 20% by weight. During the chemical blending procedure, chloroform was a solvent. The following evaluating tests included SEM, XRD, FTIR, microhardness, tensile and density Tests, and Biodegradation Tests. The chemical blending procedure could convert PCL, PLA, and hydroxyapatite materials into biocomposite materials. The presence of hydroxyapatite increased both the hardness and density of the biocomposite. The three materials are mechanically linked to prevent any new phases from being revealed by SEM, XRD, or FTIR examination. Materials that contain more hydroxyapatite dissolve more quickly when submerged in NaCl solution.

Keywords: Polylacticacid matrix, Polycaprolactone polymer, Hydroxyapatite filler

[5] Muhammad Akif Miftahun Najakhi (Mechanical Engineering Study Program, Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung), Poetro Lebdo Sambegoro (Energy Conversion Research Group, Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung) and Firman Bagja Juangsa (Energy Conversion Research Group, Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung). *Numerical Simulation Analysis of Hydrogen Co-Firing Dual-Fueled Diesel-Gas Engine Power Plant.*

Abstract. In Indonesia, power plants contribute the most CO₂ emissions in the energy sector. To achieve the target of zero carbon emissions by 2060, PT PLN made a policy of converting gas diesel power plants to non-carbon fuel-based plants. One of the efforts that can be taken in this transition period is to conduct co-firing. Hydrogen has the potential as an alternative non-carbon fuel in co-firing with fossil fuels because of its characteristics as a carrier of large amounts of energy. The focus of the co-firing study in this research is Pesanggaran diesel gas power plant. Modeling and simulation of natural gas and hydrogen co-firing were done with Ansys Forte software. The hydrogen mole fraction in co-firing varies from 10% to 100% in 10% increments. The analysis showed that the average maximum cylinder pressure and temperature increased with the increase of hydrogen mole fraction. The duration of ignition delay continues to grow while the duration of combustion continues to decrease. Fluctuations occur in power per cylinder of the engine and thermal efficiency, but the specific fuel consumption (SFC) continues to fall. On the other hand, CO₂ and CO emissions can be reduced as the hydrogen mole fraction increases, with the most significant reduction of 95% and almost 100% occurring at 100% hydrogen mole fraction, respectively. NO_x emissions increased due to the average maximum cylinder temperature increase, exceeding the 350 mg/Nm³ threshold at 90% hydrogen mole fraction. Considering the engine's combustion characteristics, performance, and exhaust emissions, the maximum recommended hydrogen mole fraction in co-firing is 40%.

Keywords: hydrogen, diesel engine, gas engine, carbon emission, cofiring

[6] Gunawarman Gunawarman (Universitas Andalas), Jon Affi (Universitas Andalas) and Fakhar Zaky (Universitas Andalas). *Effect of Sintering Temperature on Adhesion Strength of Hydroxyapatite Coating Layer of Titanium TNTZ Pre-pared by Dip Coating Method.*

Abstract. This study investigates the effect of sintering temperatures on the adhesion strength of hydroxyapatite (HA)-coated Ti-29Nb-13Ta-4.6Zr (TNTZ) prepared using dip coating method. TNTZ samples were coin type specimens with diameter of 15 mm and a thickness of 4 mm, and polished surfaces. The sol-gel, which is used to help the hydroxyapatite adhere to the metal surface of the material, was prepared by mixing KH₂PO₄ liquid, Ca(NO₃)₂ liquid, and NH₄OH as a catalyst. The coating process uses the dip coating method with an immersion time of 30 s and a withdrawal speed of 4 mm/s. Sintering process was carried out at temperature of 700 °C, 800 °C, and 900 °C for 1 hour, respectively. The surface morphologies were then examined using optical and scanning electron microscopes, respectively. Coating layer thickness, covered surface and addition strength were then measured by using related equipment's. The results show that the measured surface properties depend significantly on the sintering temperatures. The addition strength decreases with increasing temperature although layer thickness increased. It seems that the higher sintering temperatures lead to more cracks and detachment of the hydroxyapatite layer, reducing the covered surface area and adhesion strength. The low sintering temperature of 700°C achieves better coating characteristics and adhesion strength of titanium TNTZ.

Keywords: Titanium, Hydroxyapatite, Dip Coating Method

[7] Muhammad Farid Abdillah (Mechanical Engineering Study Program, Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung), Azaria Haykal Ahmad (Mechanical Engineering Study Program, Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung), Firman Bagja Juangsa (Energy Conversion Research Group, Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung) and Prihadi Setyo Darmanto (Energy Conversion Research Group, Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung). *Analysis of Air Conditioning System Based on Computational Fluid Dynamics in Mini Plant Factory.*

Abstract. . The projected population of Indonesia to reach around 320 million people in 2045 is worried to threaten the growth of various plants. The threat occurs due to various human activities that result in reduced land for growing plants and climate change. Plants are needed by humans as a source of food, medicine, and other valuable products. Plant Factory (PF) is a place for indoor plant production with climatic conditions that can be adjusted according to needs and is used to increase plant production on limited land. The Mini Plant Factory (MPF) is a small-scale PF. This study concerns simulating the MPF model in order to understand better the distribution of air temperature and velocity in it. Computational Fluid Dynamics (CFD)-based simulations were carried out in the bright period (plants carry out photosynthesis) and dark period (plants carry out transpiration). Transient simulations were conducted to determine the duration of the AC compressor turning on and off in a daily operation. The duration is used to calculate the operating costs of the MPF. The investment costs and income are also calculated to estimate the payback period of MPF. The air temperature around the planting rack is kept close to 21°C in the bright and 19°C in the dark periods. Within 24 hours, the AC compressor is on for 9.2 hours and off for 14.8 hours. The investment cost incurred to make MPF on an existing building is IDR 22,961,471.00. MPF can generate an income of IDR 11,673,851.00 annually. The payback period of the MPF project in this study was around two years.

Keywords: CFD simulation, Plant Factory, Transient simulation, Economic analysis

[8] Dwi Priyo Prayitno (Universitas Gadjah Mada) and Prasetya Adi Nugraha (PT Industri Kereta Api (Persero)). *Wheel Profile Analysis of 50 Tons Capacity Coal Wagon on Driving Stability Due to Yaw Angle.*

Abstract. ABSTRACT.

Riding stability of a rail vehicle is determined by the lateral displacement and yaw angle on the kinematic oscillations of the moving rail vehicle. This will have an impact on the comfort and safety of rail vehicles, especially when passing the curve track. Derailment events can be caused by poor driving stability if it has a large enough lateral displacement and yaw angle, which can make the rail vehicle fail to pass the curve track.

This research focuses on the influence of the wheel profile on the yaw angle that arises in the 50 tons capacity wagon on the Babaranjang Train, a coal train in South Sumatra, by using the Universal Mechanism software which is simulated with a multibody system modeling. Simulations were carried out by comparing the use of wheel profiles 1:40, 1:20 and 1:10. Modeling a wagon is simulated running on a track with the conditions represented by the interference force obtained from the Track Inspection Car, the results of the recording on the South Sumatra route in the first semester of 2021. The results show that wagons with a wheel profile of 1:40 produce the largest yaw angle, namely 0.25 degrees and the yaw angle deviation is 40 degrees. The 1:20 wheel profile has the largest yaw angle of 0.21 degrees and a yaw angle deviation of 20 degrees. The 1:10 wheel profile has a maximum yaw angle of 0.07 degrees and a yaw angle deviation of 0.10 degrees. The simulation is carried out at a speed of 50 Km/hour on a curve track. The wheel profile used on the Babaranjang train is currently 1:40. From the results of this study it is suggested to use a large conicity wheel profile, such as 1:20 or 1:10 on a 50 tons capacity wagon on the Babaranjang Train to reduce the risk of derailment in South Sumatra which can result in cost losses for PT KAI as the Babaranjang Train operator.

Keywords: Babaranjang Train, Yaw angle, Wheel profile

[9] Jalaluddin Haddada (Department of Mechanical Engineering, Hasanuddin University), Rustan Tarakka (Department of Mechanical Engineering, Hasanuddin University), Syahid Arsyad (Department of Mechanical Engineering, Hasanuddin University) and Muhammad Anis Ilahi Ramadhani (Department of Mechanical Engineering, Hasanuddin University). *PERFORMANCE STUDY OF STORAGE THICKNES OF THE FLAT-PLATE SOLAR COLLECTOR.*

Abstract. A solar water heater (SWH) system is the most frequently used devices for utilization of solar energy. Thermal energy storage systems are needed to improve the performance of the SWH system. This work focuses on investigating the effect of storage thickness to the performance of the collector which is integrated phase change material (PCM) paraffin wax into an absorber plate collector at the bottom as thermal storage. The method used in this study is an experimental method, which is a method used with experiments to test the effect of storage thickness using Phase Change Material (Paraffin Wax) as Thermal Storage on the efficiency of solar water heater collectors. The experiments were conducted using variations in the thickness of the PCM, with a flowrate parameter of 10 liters/hour and a PCM volume of 4 mm, 7 mm, and 10 mm, taking into account the inlet temperature and outlet temperature. The results of the study show a comparison of efficiency between standard collector plates with variations in the thickness of the PCM. The efficiency of the standard flat collector plate is 79.84%, while for plate efficiency with variations in PCM thickness, the value of the 4 mm thickness variation is 83.93%, for the collector plate efficiency with 7 mm thickness variation is 81.29%, and for the collector plate efficiency value with thickness variations of 10 mm by 82.30%.

Keywords: Solar water heater system, phase change material (PCM), storage thickness, flat-plate collector

[10] Mohamad Zaenudin (Jakarta Global University), Yasya Khalif Perdana Saleh (Jakarta Global University), Nashrul Chanief Hidayat (Jakarta Global University), Adhes Gamayel (Jakarta Global University), Ade Sunardi (Jakarta Global University), M. N. Mohammed (Management & Science University) and Junaidi Syarif (University of Sharjah). *Molecular dynamics simulation of mechanical behavior of Fe-Ni-Cr-Co-Cu high-entropy alloy: compressive and creep properties.*

Abstract. This study utilizes molecular dynamics simulations to investigate the mechanical behavior of the Fe-Ni-Cr-Co-Cu high-entropy alloy, with a focus on its compressive and creep properties. Three distinct models (Model A, Model B, and Model C) are analyzed to understand their responses to external forces and sustained loads over time. The compressive test results reveal significant variations in compressive strength among the models, with Model A exhibiting the highest compressive strength (7.75 GPa), followed by Model B (6.75 GPa), and Model C (6.285 GPa). Moreover, in the creep tests, Model A exhibits the lowest creep rates at all time inter-vals, indicating superior creep resistance compared to Model B and Model C. These results underscore the importance of microstructural design and elemental composition in shaping the mechanical properties of high-entropy alloys, offering promising opportunities for engineering materials with exceptional mechanical strength and creep resistance in various technological applications. Experimental validation is essential to verify the accuracy of the simulations and to gain further insights into the alloy's real-world behavior. Ultimately, this study contributes valuable knowledge to the field of high-entropy alloys, laying the groundwork for future research and development efforts in designing advanced materials for diverse industries.

Keywords: High Entropy Alloy, Mechanical Behavior, Compressive Test, Creep Test, Fe-Ni-Cr-Co-Cu

[11] Rachmad Hartono (Universitas Pasundan), Widiyanti Kwintarini (Universitas Pasundan) and Muhammad Zulfahmi (Universitas Pasundan). *Development of an Operations Monitoring System in the Sand Mold Core Industry.*

Abstract. Abstract. Increasing effectiveness and efficiency is very important for industry to be able to compete with other factories. Monitoring combined with CPS is one application of information technology in the production process to increase effectiveness and efficiency. This research will discuss the development of a monitoring system based on the CPS concept with a case study of a company engaged in the shell core production industry for the automotive parts casting industry. This research was conducted in several stages: determining the criteria for the production virtual model, modeling the production virtual model, defining the user interface for management and operators, and verifying the system through testing using temporary data. The user interface for web-based applications has been made for the managerial team based on the production virtual model, and the user interface for Android-based applications has been made for the operator based on the production virtual model. The main key to the implementation of the system that has been created is implementing the identity of the product. The proposed virtual production model can save the production data and generate reports based on the production data and the reference data with the help of web-based and Android-based applications.

Keywords: Monitoring system, Cyber Physical System, shell core production industry

[12] Rustan Tarakka (Department of Mechanical Engineering, Hasanuddin University, Makassar), Nasaruddin Salam (Department of Mechanical Engineering, Hasanuddin University, Makassar), Jalaluddin Haddada (Department of Mechanical Engineering, Hasanuddin University, Makassar), Gerard Antonini Duma (Department of Mechanical Engineering, Hasanuddin University, Makassar), Ikhlas Kitta (Department of Electrical Engineering, Hasanuddin University, Makassar), Kasbawati Kasbawati (Department of Mathematic, Hasanuddin University, Makassar), Damora Rhakasywi (Department of Mechanical Engineering, UPN Veteran, Jakarta), Muhammad Ihsan Mukrim (Department of Civil Engineering, Sekolah Tinggi Teknik Baramuli, Pinrang), Nur Al Faqih Imam Jafar (Department of Mechanical Engineering, Hasanuddin University, Makassar) and M. Dzulfaqar Syaifullah (Department of Mechanical Engineering, Hasanuddin University, Makassar). *Analysis of the Application of Combined Flow Controls on Vehicle Models by a Computational Approach.*

Abstract. Aerodynamics on the vehicle body is among the most important aspects to optimize the use of vehicle fuel. In general, a vehicle moving in the air will undergo aerodynamic drag due to airflow in direct contact with the vehicle body. Two of the major contributors to excessive aerodynamic drag are the pressure drop and flow separation occurring at the rear of the vehicle. The use of combined flow control by dimple and suction gives a positive is expected to contribute to controlling the flow separation occurrence. This study analyzes the effect of a combination of active flow control by suction and passive flow control by dimples on the aerodynamic drag of the vehicle model. The vehicle model was the vehicle model with a suction speed of 0.5 m/s. The study was carried out by a computational approach with the k-epsilon turbulence model. The upstream velocities used are 16.7 m/s, 19.4 m/s, and 22.2 m/s, respectively. The study results which obtained show that the use of combined flow control suction and dimples in the model induces significant effects on aerodynamic drag, by reducing the drag coefficient up to 14.82%.

Keywords: CFD, dimple, drag coefficient, suction

[13] Ardiyansyah Yatim (University of Indonesia), Ridho Irwansyah (Universitas Indonesia), Aldi Pradana (University of Indonesia), Jassim Addi (Université de Rennes) and Aurelie Adam (Université de Rennes). *Design of Humidifier Control System for Psychrometric Chamber in University of Indonesia.*

Abstract. Currently, the Air Conditioner is one of the tools that has become a necessity for people all over the world. Most homes, office buildings to shopping centers use Air Conditioners to increase comfort. Therefore, the use of electricity due to air conditioning is quite large and always increases with the increase in population. This is the government's concern because the increase in energy required is increasing. The government wants to try to reduce the consumption of electrical energy due to the use of air conditioning without reducing the need for air conditioning for the community. One of the solutions of the Indonesian government, the Ministry of Energy and Mineral Resources, is to apply an energy label for the use of air conditioners by using the Energy Efficiency Ratio (EER) as a parameter to calculate how much EER is in air conditioners. To achieve this, a controlled room called the Psychrometric Chamber is needed where the temperature and humidity of the air can be adjusted as needed. This study aims to complete the humidifier system on the chamber room. The result of this research is the design of a humidifier system as a humidity control system in the Psychrometric Chamber.

Keywords: psychrometric chamber, control system, air conditioning, humidifier, dehumidifier

[14] Zuryati Djafar (Universitas Hasanuddin), Aswin Ashar Abdullah (Universitas Hasanuddin), Asriadi Sakka (Universitas Hasanuddin), Faisal Mahmuddin (Universitas Hasanuddin), Syerly Klara (Universitas Hasanuddin), Nurlaela Rauf (Universitas Hasanuddin), Mustofa Mustofa (Universitas Tadulako), Khairil Anwar (Universitas Tadulako) and Wahyu Haryadi Piarah (Universitas Hasanuddin). *Utilization of a Copper Heatsink as an Air Condenser in an Atmospheric Water Generator based on a Thermoelectric Cooler.*

Abstract. Clean water is vital for human needs for normal activities. Research is needed that can explore sources to obtain clean and healthy water, both on a small scale and on a large volume scale. This research is one of the efforts made to produce clean water by utilizing atmospheric air. The method that has been carried out is to make a prototype tool that is able to condense atmospheric air in the laboratory environment. The process of condensing atmospheric air utilizes thermoelectric technology based on the Peltier effect known as the Thermoelectric Cooler (TEC). In this study, the cold side of the TEC module was installed with a copper heatsink cooling system, while the hot side was installed with a heatsink-pipe-fan cooling system. The results of testing the prototype tool used showed that the volume in laboratory conditions, the prototype tool was able to produce 2 ml/hour of clean water with an efficiency of 3.873% with a Relative Humidity (RH) of around 69.153%. This indicates that the TEC module is a piece of technology that has the potential to produce clean water.

Keywords: Thermoelectric Cooler, Atmospheric Water Generator, Copper Heatsink

[15] Louis I Made Gunnardi Etsa ([Sanata Dharma University](#)) and I Gusti Ketut Puja ([Sanata Dharma University](#)). *EFFECT OF CURING TIME ON THE MECHANICAL PROPERTIES OF COMPOSITE WITH EPOXY MATRIX COCONUT SHELL CHARCOAL NANO CARBON REINFORCEMENT.*

Abstract. Developments in composite materials have resulted in many types of composites that utilize natural materials. One of the natural ingredients used is coconut shell. The result of processing coconut shells which are processed into charcoal can be used as reinforcement in composites. Research on composites with epoxy matrix reinforced with nano carbon from coconut shell charcoal was given curing and non-curing treatment. Variation of curing holding time is 0,5 hours; 1,5 hours; 2,5 hours; and 3,5 hours at 80 °C. Formation of nano-sized carbon using a high-energy milling process with a shaker mill machine. The composite is made from a mixture of epoxy resin, hardener, and coconut shell charcoal nanocarbon. The ratio between resin and hardener is 2:1. The composite that has been formed is then given curing variations and its mechanical properties are observed through tensile and impact testing. The epoxy matrix composite without filler has the highest tensile strength of around 57,9 MPa at a curing time of 2,5 hours and the highest impact toughness is around 5,82 kJ/m² at a curing time of 1,5 hours. Meanwhile, the nanocarbon-reinforced epoxy matrix composite has the highest tensile strength, which is around 59,3 MPa at a curing time of 2,5 hours and the highest impact toughness is around 9,31 kJ/m² at a curing time of 1,5 hours. Nanoparticles and the corresponding curing time greatly affect the value of the impact toughness more significantly than the resulting tensile strength.

Keywords: Composites, Coconut Shell Charcoal, Nano Carbon, Curing, Mechanical Properties

[16] Wawan Trisnadi Putra ([Universitas Muhammadiyah Ponorogo](#)), Fadelan Fadelan ([Universitas Muhammadiyah Ponorogo](#)) and Yoyok Winardi ([Universitas Muhammadiyah Ponorogo](#)). *Analysis Of Wood Plastic Composites Between Sea Sen-gon Wood And Hdpe Plastic For Tensile Tests And Micro Structure Tests.*

Abstract. The purpose of research was to determine the value of the tensile strength of the influence of the percentage of sea sengon sawdust with a mixture of HDPE (High Density Polyethylene) plastic and observed by microstructure test. The main research materials are HDPE plastic and sea sengon wood powder, Xylene, and M.A. Composites are made with a hot plate stirrer and a plastic injection machine. The tests carried out were tensile tests with reference to the ASTM D-638 Type II standard and microstructure tests. The results of this study indicate the tensile strength of the first percentage of the mixture, namely HDPE 60%, with an average stress value of 7.86 N/m², an average strain value of 0.42%, and an elastic modulus value of 13, 52 N/m². Then the second mixture is HDPE 65% with an average stress value of 8.99 N/m², an average strain value of 0.98%, and an elastic modulus value of 10.28 N/m². The third mixture is HDPE 70% with an average stress value of 11.84 N/m², an average strain value of 1.31%, and a modulus of elasticity of 11.08 N/m². The fourth mixture is HDPE 80% with an average stress value of 14.57 N/m², an average strain value of 1.93%, and a modulus of elasticity of 8.51 N/m². The microstructure test on specimen mixture 4, which is 80% HDPE, shows that HDPE plastic dominates most of the specimens; therefore, this fourth mixed specimen is the best specimen and has the greatest tensile strength of the previous specimen.

Keywords: Wood Plastic Composite, Stress, Strain, Modulus of Elasticity, Microstructure Test

[17] Tono Sukarnoto (Universitas Trisakti), Muhammad Ihram Maulana (Universitas Trisakti), Muhammad Fadhlán (Universitas Trisakti) and Wahyu Yulia Defi (Universitas Trisakti). *Thin-walled Tube Load Cell for Bolt Torsion Test.*

Abstract. The purpose of this research is to know that thin-walled load cell can be used properly to measure the torque for high quality bolt torsion testing. The load cell made from SUS 304 tube completed with four holes was designed. It was developed from the previous one that using intact tube. For strain sensing in orientation at +45 degree and -45 degree, two rosette strain gages were used in the opposite position. The strain gages connected in full Wheatstone bridge configuration to a Computing Data Logger. Set up calibration equipment for torsion load only was built for this load cell and the result is constant 12.85 for Data Logger setting. A torque wrench was used for setting maximum load applied and load cell with Data Logger measure and counting the actual torque. For the experiment two size hexagonal zinc coated steel bolt M8 and M10 were used for testing sample. Test result shows that all samples can reach minimum torque load that mentioned in specification.

Keywords: thin-walled load cell, Strain gage, torsion, bolt

[18] Adjar Pratoto (Mechanical Engineering Department, Andalas University), Fajar Putra Harapan Limbong (PT. Fajar Anugerah Dinamika) and Endri Yani (Mechanical Engineering Department, Andalas University). *Drying Characteristics of Roselle (Hibiscus Sabdariffa) Calyces Under Low-Temperature and -Relative Humidity Atmosphere.*

Abstract. Roselle (*Hibiscus sabdariffa*) offers nutritional and medicinal benefits for human life. To preserve its quality and shelf life, the post-harvest measures should be taken appropriately. Drying is the common method to preserve its shelf life and occasionally its quality. The current study is concerned with the experimental investigation of the drying characteristics of roselle calyces at low temperature and low relative humidity conditions. A household refrigerator was utilized to produce low temperature and low humidity environment. The experiment included two different drying loadings; the first used 550 g of fresh calyces, while the second used 275 g. During drying, the temperature and the relative humidity fluctuated in a saw-like manner and their profile mirrored each other; whenever the temperature increased, then the relative humidity decreased, excepting that after the first point of inflection both temperature and relative humidity decreased. The air temperature ran between 10 C to 40 C. At the first stage, the relative humidity dropped to 30%, then increased, and fluctuated between 50% and 60%. The drying loading did not affect the air temperature and relative humidity profile, excepting the extent to which the curve ceased. The moisture loss took place fairly slow at first and faster afterwards. The drying rates did not reveal a constant-rate period. Both drying loadings showed similar drying rate profile. However, the drying rate profile with respect to the moisture content for the higher drying loading fairly shifted to the lower moisture contents.

Keywords: Drying Characteristics, Roselle, Calyx, Low Temperature, Low Relative Humidity

[19] Pryawrata Putera Moniaga (Universitas Indonesia), Imansyah Ibnu Hakim (Universitas Indonesia), Mulya Juarsa (Research Organization for Nuclear Energy (ORTN), National Research and Innovation Agency (BRIN)) and Putut Hery Setiawan (Research Organization for Nuclear Energy (ORTN), National Research and Innovation Agency (BRIN)). *Reynolds and Grashof Numbers Analysis on Steady State Natural Circulation Flow using FASSIP-02 Large Scale Test Loop.*

Abstract. The Station Blackout incident at the Fukushima Daiichi Nuclear Power Plant, which caused the failure of the active cooling system (with a pump) has made research on passive safety systems (without a pump) in nuclear safety technology increasingly developing and becoming an important issue. The use of natural circulation phenomena in passive cooling systems has become the concern of researchers worldwide by modifying the geometry and the working fluid used as a coolant. The focus of the research that researchers will characterize the natural circulation flow based on correlation of non-dimensional number like Reynolds Number, Grashof Number and geometrical ratio for large scale facilities. In addition, other parameters are boundary conditions, such as the difference in the total pipe length, pipe diameter, and the height difference between the heating outlet and the cooling inlet being the determining parameters. The correlation results between Re versus Gr/NG with fixed numbers were a is 2.89 and b is 0.38, similar to other researchers' data. These results will be compared with the correlation of non-dimensional numbers Vijayan et.al., the comparison results show that the correlation of non-dimensional numbers in the FASSIP 02 large-scale loop is in the turbulent regime. The results of the Reynolds number calculation are 5233.77 - 13676.45

Keywords: Natural Circulation, Reynolds Number, Grashof Number, Flow Regime

[20] Andi Amijoyo Mochtar (Teknik Mesin Hasanuddin University), Andi Hasizah (Fakultas Pertanian Universitas Hasanuddin), Rahimuddin Rahimuddin (Teknik Sistem Perkapalan Universitas Hasanuddin), Rustan Tarakka (Teknik Mesin Universitas Hasanuddin), Ilyas Renreng (Teknik Mesin Universitas Hasanuddin), Salengke Salengke (Fakultas Pertanian Universitas Hasanuddin), Lukman Kasim (Teknik Mesin Universitas Hasanuddin), Irwan Irwan (Teknik Mesin Universitas Hasanuddin) and Hadi Ikram Ismail (Teknik Mesin Universitas Hasanuddin). *Application Hexa-Drone Rice Seed Transporters and Sowers Using System Autonomous.*

Abstract. Abstract. The use of Hexa-drones has grown rapidly, especially in the field of agricultural drones. In this study, hexa-drones are used to transport and sow rice seeds in wetlands to improve farmer performance and efficiency. The hexa-drone consists of six arms equipped with a motor with a global positioning system (GPS) using an Autonomous mechanism that can be controlled using a remote control at a certain distance in both manual and automatic modes. The design of a seed hopper integrated with a hexa-drone framework is carried out to spread rice seeds. Simulation of seed stocking using Ansys software with several variations of sowing machine motor speed. The seeding mechanism uses Spreading which is equipped with a Y-shaped forked nozzle to adjust the volume of seeds sown. The results of seed seeding modeling show that with motor speeds between 100-170 rpm it is more efficient than other speed variations. This is due to the higher speed compared to other variations of the occurrence of blockage between the slit space and the mouth of the Y-shaped nozzle.

Keywords: Hexa-drone, rice, transport, GPS, autonomous

[21] Rikko Putra Youlia (Northwestern Polytechnical University), Wang Lei (Shenyang Aerospace University), Zhao Xinhua (Shenyang Aerospace University) and Diah Utami (Universitas Mercu Buana). *Study of Microstructure and Mechanical Property of Mismatched 2A12 Friction Stir Weld.*

Abstract. A study was conducted on homogenous FSW joints of twin Aluminum alloy plates 2A12-T4 and 2A12-O respectively, using a sequence of microscopic and mechanical tests. The results of sustained properties testing revealed that both joints exhibit two distinct material behaviors with respect to the FSW joining technique, as well as tangential properties. The Vickers Hardness distribution graph was plotted by means of a Vickers hardness indenter, using HV values obtained individually from both joints throughout the cross-sectional area. The graph showed different fluctuations, with the T4-joints experiencing a rough 20% base property derivation in mechanical testing, while the O-joints underwent a significant enhancement of over 50%. These initial findings suggest that each mechanical property experiment may potentially reveal an equivalency in properties mismatch from base to joints on each joint. In addition to the mechanical tests, OM and metallographic analysis showed that FSW leads to recrystallization and refinement of grain morphology. Both joints exhibited fine recrystallized equiaxed grains, which were deformed into much smaller sizes, particularly in the nugget zone. Notably, the O-joints showed an onion-ring pattern that was clearly observed. Overall, this study provides valuable insights into the behavior of FSW joints in aluminum alloy plates, highlighting the impact of FSW on mechanical properties and grain morphology. The findings may have significant implications for the development of more efficient and effective welding techniques in the future.

Keywords: friction stir welding, 2XXX series aluminum alloy, microstructure, mechanical properties, properties mismatch.

[22] Harinaldi (Universitas Indonesia) and Hana Nabila (Universitas Indonesia). *Numerical Analysis of Horizontal Axis Tidal Turbine with Diffuser and Brim using NACA Airfoil 4418.*

Abstract. Tidal energy is one of the prominent options to be implemented in Indonesia, as the largest archipelago in the world, which offers tidal energy potential. Tidal energy is generated from the movement of the ocean tides due to the gravitational pull of the moon. This becomes advantageous because tidal movements are predictable and reliable. Research has shown that the power coefficient increases when a diffuser and brim are added to the turbine. Blade design is another factor that can enhance the performance of tidal turbines. Considering the high fabrication and operational costs of tidal turbines, it is necessary to conduct studies to obtain the most optimal turbine design. Blades with NACA 4418 airfoil profiles offer several advantages for tidal turbine design, including higher resistance to roughness and a larger stall delay. This paper will simulate NACA 4418 blades using diffuser and brim, where the variations consist of diffuser angle (10,43, 15,34, 35,97), brim height (0,1D, 0,3D, 0,5D), and TSR value. Based on the simulation result, the highest power coefficient obtained for all variations with NACA 4418 was 97.8% whereas the previous study using NACA 4616 blades resulted in 93,416%, and the power coefficient in all variations for NACA 4418 reached its maximum at TSR 3,5, whereas in NACA 4616 at TSR 2,5. Blades with the NACA 4418 profile can be considered as one of the choices for direct implementation, considering their resistance to roughness, which occurs due to the environmental conditions for tidal turbines.

Keywords: tidal turbine, CFD, power coefficient, NACA 4418 airfoil, diffuser, brim

[23] Irwansyah Irwansyah (Universitas Syiah Kuala), Hamdani Hamdani (Universitas Syiah Kuala), Teuku Nanta Aulia (Universitas Syiah Kuala) and Irwansyah Irwansyah (Universitas Syiah Kuala). *Integrating digital twin approach for the additive manufacturing of medical implants.*

Abstract. Additive manufacturing (AM) is included for medical implants in their process, and a company level of complexity rises. As increasingly complex technologies are employed, the process expands in complexity, necessitating the employment of additional personnel and supervision, as well the smooth operation as an entire of these factors. Time becomes a crucial factor that must be efficiently utilized when business operations increase. A company may consider the appropriate decision by locating a tool to assist with the optimization of resources. Digital twins (DT) are virtual versions of businesses, processes, or systems. The steps needed to develop a digital twin were researched. The simple digital twin examples for medical implants were created to demonstrate how the user may change the data and the procedure to address issues.

Keywords: Additive manufacturing, medical implants, digital twin, optimization

[24] Shaffira Adelina Aristiana (Heat Transfer Lab, University of Indonesia), Ibnu Roihan (Heat Transfer Lab, University of Indonesia) and Raldi Artono Koestoer (Heat Transfer Lab, University of Indonesia). *Development of a New Model "MAGIC BOILER" for Faster Steam Production: Second-Phase Progress.*

Abstract. Boilers, essential vessels for applications like water heating and steam generation, hold significant roles in various sectors, from industry to households. Indonesian home industries, primarily focused on food and fashion, rely on boilers. However, high energy consumption, coupled with escalating energy prices, poses profitability and sustainability challenges. To tackle this, we propose the "MAGIC BOILER," an innovative, energy-efficient electric water boiler. Its unique design, featuring an enhanced heating surface, maximizes heat output and optimizes electrical input. Comparative tests demonstrate the "MAGIC BOILER" achieving an 8.74% faster heat transfer rate with an additional 0.01 m² surface while operating at 150 W power input. This advancement proves crucial in effectively addressing industry challenges.

Keywords: Boiler, heating element, low-cost, faster heating rate

[25] Indah Ayu Pertiwi (Magister Program in Renewable Energy Engineering, Faculty of Engineering, Universitas Malikussaleh), Muhammad Muhammad (2Chemical Engineering Department, Faculty of Engineering, Universitas Malikus-saleh), Adi Setiawan (Mechanical Engineering Department, Universitas Malikussaleh) and Rizky Iskandar (Mechanical Engineering Department, Universitas Malikussaleh). *Combustion Profile of Bio-pellet Produced from Sawdust Using Wet Torrefaction Method with Various Concentrations of Acetic Acid.*

Abstract. Sawdust is one of the industrial wastes which naturally contains low energy density. An effective method is needed to utilize this biomass as a solid fuel product. This work aimed to investigate the physical and combustion properties of bio-pellet produced from sawdust under the wet torrefaction method. To prepare sawdust bio-pellet a number of steps were carried out including the wet torrefaction process, dough preparation, pelletizing, and drying. Wet torrefaction was performed by hydrothermally treating the sample in an autoclave at a temperature of 130°C and pressure of 2 atm (g) for 80 minutes. For the hydrothermal process, the used acetic acid solution was varied with variations of 1.3 M, 1.8 M, and 2.3 M. Properties of the product were analyzed under proximate and bomb calorimetry analyses. To evaluate the combustion properties a purposely built test apparatus was developed equipped with a data logger system. Based on the results it can be observed that increases in torrefaction temperature and acetic acid concentration resulted in an increase in the calorific value as well as decreases in the ash content. It was found that the highest calorific value was 4745 kcal/kg obtained from sawdust torrefied in acetic acid with a concentration of 2.3 M at a temperature of 130°C. This sample also exhibits the lowest ash content which is only 1.97%. The combustion test suggested that the highest temperature observed was 589.2 °C with a burning rate of 0.711 g/min. It can be concluded that wet torrefaction of sawdust using acetic acid is an effective method to enhance the properties of bio-pellet products.

Keywords: Sawdust, Wood pellets, Acetic Acid, Hydrothermal, Rate of Combustion

[26] Sabarullah Sabarullah (Magister Program in Renewable Energy Engineering, Faculty of Engineering, Universitas Malikussaleh), Muhammad Daud (Electrical Engineering Department, Faculty of Engineering, Universitas Malikussaleh), Adi Setiawan (Mechanical Engineering Department, Universitas Malikussaleh), Siti Nurjannah (Magister Program in Renewable Energy Engineering, Faculty of Engineering, Universitas Malikussaleh), Arnawan Hasibuan (Electrical Engineering Department, Faculty of Engineering, Universitas Malikussaleh), Faisal Faisal (Mechanical Engineering Department, Universitas Malikussaleh) and Edy Yusuf (Mechanical Engineering Department, Faculty of Engineering, Universitas Malikussaleh). *Design of Monitoring and Control Device for Biogas Production in a Pilot Scale Anaerobic Digester* .

Abstract. Monitoring and control in the biogas production process play important role to optimize the processes occurred inside the digester and help to achieve a stable and safe process. Anaerobic digestion is a complex process involving several groups of microorganisms that are sensitive to many operating factors. Therefore, it is important to monitor and detect the process imbalances at an early stage, thus action can be taken in time to prevent the failure. The purpose of this study is to design an appropriate bio-digester to produce biogas from culinary food waste and a smart-based design device which can help in monitoring and controlling the process to enhance the biogas yields and control the process of purifying biogas into bi-methane. The research method in this study consists of several stages including de-signing the reactors and instrumentation, fabrication and installation, testing and calibration of the sensors. Performance of bio-digester plants was evaluated based on data gained from the sensors. The efficiency of digesters equipped with control and monitoring instruments is better than ordinary manual digesters. Smart-based digesters can increase the rate of gas production more measurably and be recorded systematically and in real time. It can be concluded that a smart bio-digester equipped with a microcontroller and monitoring with Web Application can save the time and improve biogas production and safety.

Keywords: Smart biodigester, Control, Monitoring, Biogas, Anaerobic digestion

[27] Sofyan Andika (Institut Teknologi Bandung), Ditho Pulungan (Institut Teknologi Bandung), Satrio Wicaksono (Institut Teknologi Bandung), Hermawan Judawisastra (Institut Teknologi Bandung) and Tatacipta Dirgantara (Institut Teknologi Bandung). *Unraveling Toughening Mechanisms in Adhesively Bonded CFRP with Thermoplastic Inserts through Numerical Micromechanics*.

Abstract. Adhesive bonding is widely used in the joining of composite structures for structural applications in aerospace and automotive industries. Secondary adhesive bonding of carbon fiber reinforced polymer (CFRP) composites are susceptible to brittle delamination, leading to catastrophic failures. The toughening response can be achieved by introducing inserts into the adhesive layer, promoting the development of bridging bundles as crack arrest features. In this study, the mode I interlaminar fracture behavior of CFRP laminates was modelled using a numerical micromechanics approach. The micromechanics model represents the double cantilever beam (DCB) specimens discretized as linear-elastic continuum shells, beam elements for the bridging bundles, and connector elements for the adhesive. The crack propagation is sequentially governed by adhesive decohesion and the failure of the bridging bundles. The numerical simulations effectively captured the global response and the mechanism of crack deceleration by comparing them with the baseline condition and observing the underlying physical phenomena at various loading stages. Effect of various patterns of polymer mesh inserts was also studied.

Keywords: adhesive bonding, delamination, bridging, micromechanics, thermoplastics

[28] Sally Cahyati ([Universitas Trisakti](#)), Rosyida Permatasari ([Universitas Trisakti](#)), Martinus Bambang Susetyarto ([Universitas Trisakti](#)) and Muhammad Alwan Ridhoarto ([Universitas Trisakti](#)). *Energy Audit and Management System for Smart Classroom of Green Design Building*.

Abstract. The design of an energy audit is the first step in the energy management process as an effort to support the 12th SDGs program on responsible consumption and production in achieving energy sustainability. The energy audit plan is applied to the smart classroom equipped with SPEM (Smart Plug Energy Monitoring) by considering thermal comfort based on the results of the CFD simulation using the CLTD calculation approach by finding the proper number and position of air conditioning location. To maintain the comfortable condition of a smart class-room that has 9.3 m in length, 8.3 m in width, and 3 m in height, and 21 person capacity plus various types of equipment inside with a cooling load of 11364,169 Watt or equivalent to 38776,159 Btu/hour, 2 units of 2 HP air conditioning with a capacity of 19000 Btu/hour per unit are required. EMAS (Energy Audit and Management System) is a program designed by combining the results from CFD calculation concepts with conventional energy audit concepts to calculate Energy Using Intensity (EUI) and find the potential for energy savings while maintaining the thermal comfort of the room continuously in real-time

Keywords: energy audit, SDGs, CFD, CLTD, Smart Classroom

[29] Agung Setyo Darmawan ([Universitas Muhammadiyah Surakarta](#)), Agus Yulianto ([Universitas Muhammadiyah Surakarta](#)), Bambang Waluyo Febriantoko ([Universitas Muhammadiyah Surakarta](#)), Masyrukan Masyrukan ([Universitas Muhammadiyah Surakarta](#)), Turnad Lenggo Ginta ([National Research and Innovation Agency](#)) and Abdul Hamid ([Universiti Tun Hussein Onn Malaysia](#)). *Engineering hardness and toughness of gray cast iron with the addition of silicon elements*.

Abstract. Gray cast iron has high strength, hard and brittle properties. In applications that allow sudden loads, it is necessary to increase the toughness of cast iron. This study aims to investigate the effect of silicon addition on the microstructure, hardness, and toughness of gray cast iron. In this study, the silicon composition was varied in 2.466, 2.981, 3.304, and 3.363 wt% Si. The microstructure was investigated using a Scanning Electron Microscope (SEM). Hardness was tested using the Brinell technique with a load of 187.5 kgf and an indenter diameter of 2.5 mm. Meanwhile, toughness was tested by the Charpy impact technique. In this technique, toughness is represented by the Charpy impact value parameter. The test results show that gray cast iron has a flake-shaped graphite phase with a pearlite-shaped matrix. The higher the silicon composition, the greater the graphite phase. Increasing the size of this graphite resulted in decreased hardness and increased toughness.

Keywords: Gray Cast Iron, Hardness, Toughness

[30] Muhammad Husni Husni ([Universitas Trisakti](#)), Sally Cahyati ([universitas trisakti](#)) and Emelia Sari ([Universitas Trisakti](#)). *IMPROVING THE PRODUCTIVITY OF HYDRAULIC BODY LINE THROUGH ROOT CAUSE ANALYSIS APPROACH WITH ELIMINATION COMBINE REARRANGE SIMPLIFY METHOD.*

Abstract. M. Husni Usman¹, Sally Cahyati², Emilia Sari²

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Abstract

Sustainability in manufacturing requires a holistic view that includes design products, manufacturing processes, manufacturing systems, and the entire supply chain. Problems at Company X on lines 1-17 in the hydraulic line were in the form of long change over time, bottlenecks or work in process. This causes loss time which results to waste. It has an impact on decreasing the level of company productivity. Therefore, improvements are made with using root cause analysis approach with the Eliminate-Combine-Rearrange-Simplify (ECRS) method. The root cause analysis method is expected to be able to provide a clear picture of the company's performance from an economic, environmental and social perspective. ECRS is a repair method by eliminating work that is considered unimportant, merge jobs, reset job, and simplify jobs. It is a simple approach to implement and use and is good when applied in the company's improvement process. Improvements made are expected to minimize and reduce problems that arise during production on lines 1-17, streamlining change over time, reducing bottleneck so it could reduce waste. Eventually, company targets could be achieved, production could be increased. By implementing the ECRS method and root cause analysis, it is expected that the output value produced by each operator per hour (PMH) value would increase by 8% compared to the previous year.

Keywords: Productivity, repairs, change overtime, loss time, bottleneck, waste root, cause analysis, ECRS

[31] Asep Indra Komara ([Institut Teknologi Bandung](#)), Rachman Setiawan ([Institut Teknologi Bandung](#)) and Bagus Budiwanto ([Institut Teknologi Bandung](#)). *Manufacturing Process Design for Cellular Structure Used as Impact Energy Absorbers.*

Abstract. The application of passive safety technology in vehicles is generally through impact-absorbing structures. This technology has been widely applied to trains, planes, and cars to protect passengers from fatal accidents. Cellular structures are defined by a unit cell that is some combination of material, space, and unit cell repetition to obtain a large structure. It is selected as the base structure of the impact energy absorber for its potentially high specific energy absorption (SEA). Such a structure poses a challenge in its manufacturing method. This study examines alternatives of manufacturing process for cellular structures designed as impact-absorbers, select and develop an effective and efficient manufacturing method to produce such structures. From a number of alternatives of manufacturing methods, it was selected to exercise the use of a combined plaster molding technology and additive manufacturing for prototyping. Manufacturing process simulation study uses hyper work software to determine the success rate of the casting process to be carried out. The final stage is to carry out the process of making cell structures and evaluating the results. The result of this work is an effective manufacturing process design to be implemented throughout the stage of production. Furthermore, for mass production, mold patterns may be replaced by using injection molding.

Keywords: Cellular Structures, Process Design, Impact Absorber

[33] Nasril Nasril (National Research and Innovation Agency). *Development of Quality Measurement Tool for Complex Surface Machining Process* .

Abstract. Sensors and measurement systems have a key position in the production process in Industry 4.0. To optimize the production quality of workpieces that have complex surfaces, such as mold, dies, turbine blades, etc., it is necessary to develop sensors and metrology. So far, the trajectory error has not been considered important, because it is still considered to be related to the appearance of the workpiece contour. In this study, it is proposed to develop a quality measuring instrument for complex surface production processes using a high-accuracy laser displacement sensor. The laser displacement sensor is installed on the machine tool spindle to measure the difference in the G-Code trajectory of the scanning movement of the laser displacement sensor with the same G-Code for the machining process. Laser displacement sensors can perform complex surface contour scanning of machined workpieces with accuracy below 30 μm . The sensor and measurement system that has been developed shortens the time for measuring the accuracy of complex surface production processes with high accuracy.

Keywords: Trajectory error, Complex surfaces, Laser displacement sensor, Non-contact measurement system.

[34] Hendri Nurdin (Universitas Negeri Padang), Waskito Waskito (Universitas Negeri Padang) and Anna Niska Fauza (Universitas Negeri Padang). *Analysis of Physical and Mechanical Properties of Particle Board Made from Areca Fibre Using Gambier Adhesive*.

Abstract. The development of technology in the field of engineering materials that continues to increase demands that people must be innovative to find alternative raw materials that can be used. One engineered material being developed is the utilization of areca fibre waste which has potential as a raw material for particle board manufacturing. The experimental method carried out in this study was manufacturing particleboard made from areca fibre particles mixed with gambier adhesive. The process of making particle board is done by varying the areca fibre particles and gambier adhesive, based on the weight fraction ratio of 90%:10%, 80%:20%, 70%:30% and 60%:40%. Testing of physical and mechanical properties of particle board produced guided and compared with quality standards JIS A5908 and SNI 03-2105. This study's results obtained physical and mechanical properties in the form of a density value of 0.57 gr/cm^3 , water content of 5.48%, and 2.29% thick development at a variation ratio of 60%:40%. Evaluation of test physical and mechanical properties of particle board produced is thus in recommended as a raw material fatherly manufacture of furniture interior whose use is not exposed to water and low humidity

Keywords: Areca fibre, Particle board, Physical and Mechanical Properties, Gambier

[35] M Sabri (Universitas Sumatera Utara), Ms Fajar (Universitas Syiah Kuala), Faris Am Sabri (Universitas Sumatera Utara) and Geubrina Hs (Universitas Sumatera Utara). *Interface Design with Load Testing on the Mitsubishi Movemaster RV-M1 Using Bluetooth.*

Abstract. The Mitsubishi Movemaster RV-M1 is a robotic arm with 5 degrees of freedom and an additional gripper that functions to clamp objects which uses a DC motor as the main mover. The Mitsubishi Movemaster RV-M1 arm robot is not just often be used in large-scale industry, but also used for education. In addition, this arm robot uses several dividing wheels and belting to increase the robot's torque. However, this arm robot is considered outdated as technology develops. It causes the function reduction of the arm robot which caused by their interface that cannot keep up with technological developments. The interface of this arm robot still uses computer commands and basic programming in order to move it, hence the movement becomes limited. Therefore, we need to design a new interface, so that the robot can be used in the latest technological era. In this research, a new interface that have been designed using the Arduino mega microcontroller and Bluetooth module for sending commands to move the Mitsubishi Movemaster RV-M1 arm robot will be tested. The method used to test the interface is by performing load and no-load testing so that the effect of the load on the interface can be known. From the experiment, the data shows that the arm robot's movement in the interface that has been designed will be slower as the load increases.

Keywords: Arm Robot, Mitshubishi Movemaster RV-M1, Load Testing

[36] Rosyida Permatasari (Universitas Trisakti) and Mochamad Ghani Hanif Suryaningrat (Universitas Trisakti). *Optimization Of Angle Deflection on Pelton Turbine Bucket Using CFD .*

Abstract. The Pelton turbine is a type of water turbine that is often used in hydroelectric power plants. This Pelton turbine is generally used for locations with a head height of more than 30 meters. The water in the Pelton turbine moves fast and the turbine extracts energy from the water by slowing down the water, which makes it an impulse turbine. This study aimed to determine the optimal efficiency of the Pelton turbine by analyzing the blade design using variations in the deflection angle. The velocity of the fluid flow out of the bucket with variable deflection angles of 15°, 17°, and 19° using the Computational Fluid Dynamics (CFD) method with SolidWorks simulation software. The simulation data were then analyzed and described using the triangle method. speed. From the simulation, the largest value of turbine power is 329,54kW and efficiency is 95.98% at an angle of 15° with a discharge of 0.35 m³/s.

Keywords: Pelton Turbine, Deflection Angle, CFD

[38] Pricylia Valentina (National Research and Innovation Agency and Department of Mechanical Engineering Universitas Indonesia), Agus Sunjarianto Pamitran (Department of Mechanical Engineering Universitas Indonesia), Mulya Juarsa (National Research and Innovation Agency) and Adhika Enggar Pamungkas (National Research and Innovation Agency). *Design of Heating Power Control System for Passive Cooling System Simulation Facility using PID Control based LabView.*

Abstract. The on-off control system implemented for regulating the power of the heating element in the passive cooling system simulation facility produces a high overshoot in the experimental results. A LabView-based PID control system for heating power regulation can be achieved by setting a desired setpoint and then maintaining the actual water temperature with minimal error. The temperature difference between the setpoint and the actual temperature serves as the input data for the PID system, allowing it to calculate and analyze the required heating power to keep the water temperature in the heating tank at the setpoint value. The output of the PID control system can be in the form of a duty cycle switch controller or an analog signal fed into a single-phase SCR power controller, thus providing the heating element with power as determined by the PID system's calculations. By evolving the heating power control system into a PID control system, it is expected to reduce overshoot without increasing the experimental rise time

Keywords: PID, LabView, Overshoot, Heater, Passive Cooling System

[39] Sunandi Kharisma (Heat Pipe and Nanotechnology Laboratory, Faculty of Engineering, Udayana University, Indonesia.), Dwi Yuliaji (Department of Mechanical Engineering, Ibn Khaldun Bogor University, Indonesia / Gadjah Mada University), Adhika Enggar Pamungkas (National Research and Innovation Agency of Indonesia (BRIN)), Arif Adtyas Budiman (National Research and Innovation Agency of Indonesia (BRIN)), Putut Hery Setiwan (National Research and Innovation Agency of Indonesia (BRIN)), Muhammad Rafel (Department of Mechanical Engineering, bn Khaldun Bogor University), Shendy Akbar Maryadi (Department of Mechanical Engineering, Ibn Khaldun Bogor University), Ryan Oktaviandi (Gadjah Mada University), Nur Rochman Budiyanto (Gadjah Mada University), Wayan Nata Septiadi (Udayana University) and Mulya Juarsa (National Research and Innovation Agency of Indonesia (BRIN)). *Natural Circulation Flow Boiling Phenomenon Based on Cooler Temperature Variation Using FASSIP-04 Rectangular-TP Ver.2 Loop.*

Abstract. Passive cooling systems based on the principle of natural circulation, usually called passive residual heat removal, can be used to cool the decay heat of nuclear reactors. The most efficient is the direct passive residual heat removal system. So passive cooling research using Loop Rectangular-TP FASSIP-4 Ver.2, which works based on a direct heating model, was carried out to investigate the phenomenon of two-phase natural circulation flow. This research aims to obtain data on temperature, flow rate, and flow regime characteristics observed during natural circulation. The experimental method was carried out by varying the cooling water temperature to 10°C, 15°C, and 20°C by setting the heating power at 5600 watts until it reached a steady-state condition. The research results show that increasing the cooling water causes steady-state conditions to be called more quickly and decreases the average steady-state temperature, changing from 97.77°C, 97.75°C, and 97.71°C, respectively. In addition, the average Reynolds number increases as the cooling water temperature rises from 5770 to 7027, which enters the turbulent flow regime.

Keywords: passive cooling system, natural circulation, boiling, oscillation, FASSIP-04 Ver.2, Reynold number

[43] Yohanes Satria Jatinendra (Institut Teknologi Bandung), I Gede Sattvika Satya Dharma (Institut Teknologi Bandung), Rachman Setiawan (Institut Teknologi Bandung) and I Wayan Suweca (Institut Teknologi Bandung). *Double arrowhead auxetic structure behavior as battery protection under localized impact loading.*

Abstract. In the contemporary era of transportation, the accelerated adoption of electric vehicles (EVs) underscores the imperative of fortifying their battery systems' safety. A salient concern centers on safeguarding these batteries from detrimental consequences of mechanical impacts, which could precipitate incidents like fires or explosions. This study rigorously investigates the efficacy of auxetic structures for bolstering battery protection in EVs. Distinctively characterized by a negative Poisson's ratio, auxetic materials exhibit superior energy absorption attributes relative to their traditional counterparts. Through meticulous design and modeling, this research harnesses finite element analysis methodologies to ascertain the performance metrics of these auxetic configurations. Preliminary findings corroborate that under the duress of side pole impacts—a prevalent vehicular collision paradigm—auxetic structures afford augmented protection to EV batteries. Moreover, comparative analyses pinpoint the Double Arrowhead auxetic configuration as the most efficacious relative to other foundational auxetic geometries. By harnessing the inherent attributes of auxetic materials and integrating the study with surrogate modeling of various unit configurations, this research endeavors to spearhead the next wave of battery protection systems. The overarching objective is to substantially reduce the risks associated with EV battery impacts, thereby contributing to a safer and more sustainable future for electric transportation.

Keywords: Crashworthiness, Electric vehicles (EVs), Auxetic Structure, Finite element, Battery protection, Surrogate Model, Neural Network, Machine Learning

[44] Almira Citra Amelia (National Research and Innovation Agency (BRIN)), Ronald Akbar (Universitas Indonesia), Putut Hery Setiawan (National Research and Innovation Agency (BRIN)), Iwan Roswandi (National Research and Innovation Agency (BRIN)), Agus S Pamitran (Universitas Indonesia) and Mulya Juarsa (National Research and Innovation Agency (BRIN)). *Experimental Study of Counter Current Flow Limitation for Water and Air Injection in Cold Conditions Inside a Semi-Spherical Narrow Channel.*

Abstract. INES determined that Three Mile Island Accident (TMI) Unit 2 in fifth level. The damage caused the core reactor have melted (debris). The boiling heat transfer has different characteristics based on the gap size. At gap sizes below 2 mm, the heat transfer is influenced by Counter Current Flow Limitation (CCFL). this study aims to observe the phenomenon of CCFL in a semi-spherical test section to illustrate the lower plenum RPV. The results of research data in vapor superficial velocity will be processed and predicted by CCFL correlations from several researchers to obtain liquid superficial velocity in semi-spherical narrow gap 2.0 mm with air injected to water. The results of research data in vapor superficial velocity will be processed and predicted by CCFL correlations from several researchers to obtained liquid superficial velocity. Similarity of geometrical test section apparatus experimental, semi-spherical plenum. Based on experimental data, higher superficial velocity of liquid and vapor contributed to increase deviation.

Keywords: CCFL, semi-spherical, narrow gap, superficial velocity, melt-down

[45] Muhammad Dzulfikar (Wahid Hasyim University), Helmy Purwanto (Wahid Hasyim University) and Muhammad Abdul Wahid (Wahid Hasyim University). *CFD Study of an Electric Ducted Fan Thrust System on Fibonacci Blade*.

Abstract. Electric ducted fans can be used to generate the necessary force and moment for propulsion in many applications. It powered by an electric motor that rotates a multi-bladed propeller. EDF has different specifications for each size, in this study the focus is on knowing the thrust generated by the EDF using the computational fluid dynamics (CFD) method. Fibonacci number of blade is used 5, 8, and 13 blades with a diameter of 80 mm, with a duct housing size of 81 mm in diameter. The geometry model used refers to the 80 mm FMS brand EDF. The thrust value for each variation in the number of blades continues to increase as the rotational speed increases.

Keywords: Ducted Fans, Rotational Speed, Fibonacci Blade

[46] Harsa Dhani (Widya Karya Catholic University) and Kukuk Yudiono (Widya Karya Catholic University). *An Omni Wheel Robot Platform Prototype for Batch Soybean Handling in A Tempeh Industry 4.0*.

Abstract. In tempeh production, the availability of nutrition and bioactive compounds greatly depends on production process, equipment, and sanitation. However, conventional tempeh production suffers some disadvantages of: possibility of product failure due to weather or process failure is high, tempeh quality is not stable, tempeh maker needs long experience, and hygienic cannot be assured. The batch soybean handling by human worker prone to failure of contamination and inconstant processing time. Thus, the purpose of this paper is to develop a mobile robot platform suitable for soybean handling in a tempeh production facility. The robot prototype was designed with Omni Wheel capable of moving in all direction in a constraint space. The robot was equipped with a RFID sensor and two Time of Flight distance sensors for recognizing the correct production station and positioning itself for picking or dropping the soybean basket. The utilization of an Omni Wheel Robot for soybean handling in tempeh production will stabilize the tempeh quality.

Keywords: Omni Wheel Robot, Tempeh Industry 4.0, Robot for Batch Soybean Handling

[47] Agus Yulianto (Universitas Muhammadiyah Surakarta), Agung Setyo Darmawan (Universitas Muhammadiyah Surakarta), Agus Dwi Anggono (Universitas Muhammadiyah Surakarta) and Bibit Sugito (Universitas Muhammadiyah Surakarta). *Effect of Preheating 300 °C Metal Mold with Material Nodular Cast Iron Against Hardness Distribution of Castings Gray Cast Iron.*

Abstract. This study aims to analyze the effect of preheating metal molds using nodular cast iron material on the hardness distribution of gray cast iron castings. Nodular cast iron has superior mechanical properties compared to conventional gray cast iron, but proper processing is required to achieve optimum mechanical properties. Mold pre-heating is a key factor in the casting process, where mold preheating before casting aims to reduce thermal contraction which can affect the quality of the castings. In this study, the preheating temperature of the mold was carried out on nodular cast iron material at 300 °C to observe changes in the distribution of hardness in the results of gray cast iron castings. The results of the specimen hardness test can be concluded that each part has a varying degree of hardness because each point tested has a different carbon content. The higher the carbon content, the higher the level of hardness. The results of this study are expected to provide better insight into the relationship between mold preheating temperature and the mechanical properties of the castings, thus providing a guide for industrial practitioners in optimizing the casting process to achieve castings with the desired quality.

Keywords: Preheating, Nodular Cast Iron, Gray Cast Iron, Hardness

[48] Shirley Savetlana (Universitas Lampung), Harnowo Supriadi (Universitas Lampung), Zulhanif Zuhani (Universitas Lampung) and Muhammad Iqbal Adi Nugraha (Universitas Lampung). *The cellulose effect on the tensile properties of pineapple leaf, coconut coir, and banana stem fibers reinforced natural rubber composites.*

Abstract. A highly demand for green, non-toxic, renewable, and environmental friendly material that mainly needed for bio application. In the bio application, the material can be subject to high strain and stress. Natural fiber composite reinforced natural rubber composite is a biomaterial that potential for such application. In this study, the materials used were natural rubber and natural fibers. The natural fibers were pineapples leaf, coconut coir and banana stem. The cellulose content of pineapple leaf fiber, coconut coir fiber, and banana stem fiber were 50.98%, 33.10%, 33.00% cellulose content. The preparation of composite was as follow: firstly, preparation of the fiber and natural rubber form the latex. Secondly, arrange the fiber in the mold and then the latex was pour into the mold. Left it drying overnight. Then, the specimen was pressed with a load of 8 tons for 30 minutes. Finally, the specimens were dried in an oven at 150°C. The pineapple fiber reinforced natural rubber has the highest tensile strength follow by coconut fiber reinforced rubber composite and the lowest one was banana fiber reinforced rubber composites. The SEM observation show a higher compatibility between pineapple fiber and the natural rubber matrix as compare with coconut and banana fiber.

Keywords: Natural Rubber, Pineapple Fiber, Coconut Fiber, Banana Fiber, Natural fiber Composite.

[49] Rico Aditia Prahmana (Institut Teknologi Bandung), Prihadi Setyo Darmanto (Institut Teknologi Bandung), Iman Kartolaksano Reksowardojo (Institut Teknologi Bandung and Universitas Pertamina), Firman Bagja Juangsa (Institut Teknologi Bandung) and Tirto Prakoso (Institut Teknologi Bandung). *The Influence of Silicon Dioxide as a Fuel Additive in a Diesel Engine Fueled by Pure Palm Oil.*

Abstract. In the last decade, the Indonesian government has implemented a program to use biodiesel as a substitute for fossil diesel to reduce dependence on fossil fuels. On the other hand, the development of biodiesel as an alternative fuel to replace fossil diesel has several challenges, one of which is the production of biodiesel, which is more complicated and requires a long process. However, the direct use of crude palm oil (CPO) in diesel engines is not recommended because it has many drawbacks. Re-research recently shows that fuel additives in diesel engines have promising prospects. Therefore, to improve the problem, this study used pure palm oil (PPaO) as the primary fuel with the addition of silicon oxide (SiO₂) as fuel additives in diesel engines. The results showed that using SiO₂ additive in PPaO can increase thermal efficiency by 18.8% at 60% load compared to diesel fuel (DF). Nevertheless, using this fuel increased specific fuel consumption (SFC) by 3.9% on average and increased the opacity by 153% compared to diesel fuel. These results indicate that SiO₂ has the potential to be developed as an effective additive to PPaO fuel that can improve the efficiency and performance of diesel engines.

Keywords: Pure Palm Oil, Silicon Oxide, Diesel Engine Performance

[50] Witono Hardi (Mechanical Engineering, University of Khairun), Kifli Umar (Mechanical Engineering, University of Khairun) and Mohammad Shalahuddin Abdul Aziz (Mechatronic Engineering Department, Electronic Engineering Polytechnic Institute of Surabaya). *The Behavior of Thin-walled Aluminum Circular Tube Due to Changes in Ratio of Diameter to Thickness (D/t) Subjected to High-velocity Impact.*

Abstract. Thin wall structures in various geometrical shapes are widely used in many applications of energy absorbers. A steel impactor collides with the thin-walled aluminum alloy tube in an axial direction with a 40 m/s high velocity. The cylinder tube responds well when subjected to dynamic axial loads due to its ability to absorb impact energy by converting kinetic energy to plastic strain energy. In this study, we changed the ratio of diameter to thickness (D/t) by a fixed cross-sectional area of 317 mm². The research results modeled by finite element analysis (FEA) show that the larger the D/t ratio, the larger the maximum deformation. The reaction forces obtained by specimens are relatively constant. The maximum energy absorbed by the models are same as the absorbed kinetic energy, but the higher the D/t ratio, the longer the time required for the energy absorption process. The collapse mode indicates that with the increasing D/t ratio, the collapse mode was changed from axisymmetric to non-axisymmetric. The energy absorption response of cylinder tubes is highly affected by the D/t ratio. This study's results will be considered when constructing a high-velocity impact energy absorption system.

Keywords: Thin-walled, Energy Absorber, FEA, Deformation Mode, Cylinder tube

[51] Wayan Nata Septiadi (Udayana University), Ketut Astawa (Udayana University), Rolland Pierce Eleazar (Udayana University), Dandi Ramadhani (Udayana University), Kadek Dananta Jayendra (Udayana University) and Nabel Rafa Angel Bhaswara (Udayana University). *L-Heat Pipe Simulation for Lithium-Ion Electric Vehicle Battery Cooling Systems*.

Abstract. The Li-ion battery is electrical storage in the form of chemical energy and is considered the strongest candidate for electrical-based automotive applications. The performance of the battery greatly affects the performance of electric vehicles. There is a need for effective thermal management to control battery temperature below a defined temperature such as 50°C. The thermal management system in the battery can be done by passively cooling it using heat pipes and heat sinks. This research was conducted by simulating the Makara Electric Vehicle's electric scooter battery module which was applied with a heat pipe-based cooling system. The simulated module focuses on heat pipes and 18650 lithium-ion batteries with discharge rate variations of 1C, 2C, and 3C. The method used is literature study and CFD simulations. The results show that the heat pipe cooling system can reduce battery temperature at each discharge rate variation of 12,85%, 16,23%, and 23,74%. Heat Pipe can absorb the highest heat of 68,1178 kW when the module uses a 3C battery.

Keywords: Battery Thermal Management, Electric Vehicles, Heat Pipe, CFD

[52] Amrizal Amrizal (Mechanical Engineering Department, Universitas Lampung, Indonesia), Calvin Andyansa F (Mechanical Engineering Department, Universitas Lampung, Indonesia), Amrul Amrul (Mechanical Engineering Department, Universitas Lampung, Indonesia), Muhammad Irsyad (Mechanical Engineering Department, Universitas Lampung, Indonesia), Harmen Harmen (Mechanical Engineering Department, Universitas Lampung, Indonesia) and Ahmad Yonanda (Mechanical Engineering Department, Universitas Lampung, Indonesia). *Performance study of Photovoltaic/Thermal (PV/T) collector with cross-cut fins*.

Abstract. The performance of a Photovoltaic (PV) panel increases as the operating temperature decreases. To deal with this, cross-cut fins could be proposed to absorb the waste heat of the PV panel. These fins are advantageous because they increase effective surface area to dissipate more residual heat. Therefore, this study aims to analyze the thermal and electrical performance of Photovoltaic/Thermal (PV/T) with cross-cut fins compared to the no-fins case (conventional one). Furthermore, the cross-cut fins were then attached underneath the surface of the PV and were designed in inline and staggered arrangements. In this study, the performance of the Photovoltaic/Thermal (PV/T) was characterized indoors using a solar simulator with 12 halogen lamps of 300 W each. Several variables were varied according to the air mass flow rate of 0.0085-0.256 kg/s and radiation levels of the solar simulator of 500 - 1000 W/m², respectively. The results indicate that the PV/T collector with cross-cut fins significantly improves thermal and electrical performance. Based on data obtained from this work, in which an air mass flow rate of 0.0256 kg/s and radiation of 1000 W/m² remains constant, the performances of the PV/T collector with cross-cut fins reach the highest thermal efficiency and electrical efficiency of about 75.77% and 6.93%, respectively. In terms of the maximum temperature difference, it is found to be 11.15°C compared to the conventional one. However, the comparison between the two arrangements provides a slight difference in the performance results.

Keywords: Photovoltaic, performance, cross-cut fins, staggered, inline

[53] Eko Prasetyo (Universitas Indonesia), Ario Sunar Baskoro (Universitas Indonesia) and Agus Widiyanto (Universitas Negeri Yogyakarta). *Effect of Weaving Speed on Tensile Strength and Micro Hardness of Stainless Steel 316L Pipe in Orbital Gas Tungsten Arc Welding (GTAW)*.

Abstract. This research applies the 5G welding method by welding Gas Tungsten Arc Welding (GTAW) orbital pipes without metal filler (autogenous) on SS316L-type stainless steel pipes. The test specimen has a thickness of 3 mm and an exterior diameter of 114 mm. The test begins with the preparation of welding specimens. Orbital pipe welding is carried out counterclockwise using the parameters of welding current 100A, welding speed 1.4 mm/s, and variations of three weaving speeds, namely 0.150 mm/s, 0.154 mm/s, and 0.161 mm/s. Tensile tests were performed at angular orientations of 0°, 90°, 180°, and 270° with tensile testing machines of tension-type A&D RTF-2350 and microhardness tests were performed only at angular orientations of 180° with Vickers test equipment. The tensile test data shows that all fractures occur in the weld area, with the maximum tensile strength of all occurring at an angular orientation of 180° where the highest maximum tensile strength occurs at a weaving speed of 0.150 mm/s of 571.07 MPa. Microhardness was tested on weld metal (WM), heat-affected zone (HAZ), and base metal (BM) areas. The WM area received the highest average value of 148.47 HV at a weaving speed of 0.161 mm/s, while the HAZ received an average of 147.06 HV at a weaving speed of 0.161 mm/s. In the BM area, the microhardness value is relatively stable at all three weaving speeds ranging from 164.98 HV-169.36 HV. The highest microhardness value was achieved at a weaving speed of 0.150 mm/s, amounting to 169.36 HV. This study shows that the higher the weaving speed, the tighter the weld pool produced so that the tensile strength value is more excellent, and for microhardness, the higher the weaving speed in the WM and HAZ areas, the higher the microhardness value, while in the BM area, the higher the weaving speed shows the lower the microhardness value.

Keywords: Gas Tungsten Arc Welding (GTAW), Orbital pipe welding, SS316L, weaving speed, tensile test, microhardness test

[54] M. Sultana Aliefiansyah (Universitas Indonesia), Andhy Muhammad Fathoni (Universitas Indonesia), Gerardo Janitra Puriadi Putra (Universitas Indonesia), Nyoman Ari Bhaskara (Universitas Indonesia) and Nandy Putra (Universitas Indonesia). *An Experimental Study on the Thermal Performance of Electronic Cooling using BatiX Heatsink-PCM*.

Abstract. Increasing computational capabilities and the miniaturization of computer devices have led to an increase in heat flux, which can result in a decrease in the lifespan of CPUs. In fact, 55% of CPU failures are caused by excessive heat. This has driven research in CPU heat dissipation. This experimental study utilizes a Parangkusumo batik-inspired heatsink design, with copper as the material, manufactured using 3D Printing metal. Additionally, the experiment combines the BatiX heatsink with PCM RT 35, injected into the heatsink to enhance heat dissipation. The experiment involves varying the heat load, air temperature, and airflow velocity to assess the heat dissipation performance at higher temperatures and determine the Nusselt correlation on the BatiX heatsink fins. The findings demonstrate that the addition of PCM can reduce CPU surface temperature by up to 8% and increase the setpoint time within the range of 5-10%.

Keywords: Electronic cooling, heatsink, phase change material

[55] Mohammad Azwar Amat (Universitas Indonesia), Gandjar Kiswanto (Universitas Indonesia), Agung Shamsuddin Saragih (Universitas Indonesia), Sugeng Supriadi (Universitas Indonesia) and Ario Sunar Baskoro (Universitas Indonesia). *Solid state welding in light structure materials aluminium alloys: A parameter review.*

Abstract. Friction stir welding (FSW) and friction stir spot welding (FSSW) are relatively newer method in weld joint to compete other techniques especially in joining aluminum alloys. Early days, FSW was meant to be joining aluminum alloys, but nowadays researcher trials to joining magnesium, copper, stainless steel, and even polymers. When the other technology constantly has problematic result in joining aluminum alloys in late 80's, example of this, a fusion weld such as metal inert gas (MIG) and tungsten inert gas (TIG). In 1991, The Welding Institute (TWI) found a new method that was promising to join aluminum alloys which was FSW and later in early 2000's a new method called FSSW was introduced to compete against resistance spot welding (RSW). This article mainly focuses on introducing statistically and infographic way of a review, in such that readers can easily mapping what major topics, materials, parameters, and tools used by the researchers and what is the possibly minor to covered or might be has not been covered by anyone. Ideally, more than 500 articles across different journals needs to be covered from early days until now using statistics sampling method. For early step, this article only covered 109 major articles FSW and FSSW. Therefore, the stats cannot be concluded for the whole research in FSW and FSSW, that is because the comprehensive beyond the ideal.

Keywords: Review, FSW, FSSW, Infographic, classification

[56] Illa Rizianiza (Universitas Indonesia, Institut Teknologi Kalimantan), Ahmad Indra Siswantara (Universitas Indonesia), Tanwir Ahmad Farhan (Universitas Indonesia), Candra Damis Widiyawaty (Universitas Indonesia, Politeknik Negeri Jakarta), M. Hilman Gumelar Syafei (Universitas Indonesia, Universitas Negeri Semarang), Diyas Prawara Mahdi (Universitas Indonesia) and Adi Syuriadi (Universitas Indonesia, Politeknik Negeri Jakarta). *Investigation of temperature distribution in a novel pyrolysis reactor using Computational Fluid Dynamics.*

Abstract. Pyrolysis is one of the most complex energy conversion processes because it involves various physical and chemical phenomena that interact and occur simultaneously. One factor that influences both the quality and quantity of the pyrolysis product is the temperature distribution within the reactor. The reactor plays a crucial role in the pyrolysis process, facilitating the thermal degradation and decomposition of the feedstock. This paper presents the investigation of the temperature gradients within the pyrolysis reactor using CFD. The research employed a slow pyrolysis methodology, utilizing sheep manure as the feedstock. The heat required for the process was generated by an Internal Combustion Engine exhaust gas, which was directed through a helical pipe located within a fixed-bed reactor. The temperature range for pyrolysis is typically observed to be within the range of 523–673 K, while the reactor temperature in the CFD simulation varies between 400–730 K. To determine the accuracy of the prediction, a comparison is conducted between the predictions and the experiments, followed by an error assessment utilizing the Mean Absolute Error metric. The result of the calculation of the mean absolute error is 98.58 K or 22.53%. However, if observed overall still has the same temperature distribution trend between experiment and simulation.

Keywords: CFD, Pyrolysis, Reactor, Temperature

[57] Gerard Antonini Duma (Universitas Hasanuddin), Luther Sule (Universitas Hasanuddin) and Andi Besse Riyani Indah (Universitas Hasanuddin). *Performance Analysis of Vertical Shaft Savonius Water Wheel with Number of Blade and Discharge Variations.*

Abstract. Fluid is a substance that can flow and conform to its container. Any substance or material that experiences movement or moves from one place to another will produce energy and this energy is strongly influenced by the physical properties of the fluid which is the source of this energy. Because of the same fluid properties, Savonius can also be applied to water flows. The Savonius waterwheel is a simple water-wheel that works because of the different forces on each blade. The concave blade (concave) facing the direction of the water will catch the water and force the blade to rotate on its axis and the convex blade (convex) which is pushed by the fluid flow also causes the blade to rotate even though there is a load caused by the convex part when pushed by the flow. This study determines to analyze efficiency and power of vertical shaft savonius water wheel with four blades and six blades on discharge variations. The best performance of the vertical shaft savonius water wheel with four blades is on load of 1.5 kg, the highest efficiency 17.16% and the highest water wheel power 1.317 watts with a discharge of 0.629 m³/s. For the best performance of the vertical shaft savonius waterwheel with six blades on discharge 1 (0.629 m³/s) produced the highest power of 1.248 watt and the highest efficiency 15.92% at load of 1.5 kg.

Keywords: vertical shaft savonius waterwheel, energy, power, efficiency, blade

[58] Luther Sule (Universitas Hasanuddin), Gerard Antonini Duma (Universitas Hasanuddin) and Elieser Timbayo Sule (Universitas Hasanuddin). *Analysis of Performance of Overshot Water Wheel with Bowl-Shaped Blade.*

Abstract. Hydropower is one of renewable energy that many country uses to fulfill the need for their energy. One of the uses in the use of water energy is using a waterwheel or water turbine by utilizing the flow of a river or waterfall. Overshot turbine utilize high water pressure from nozzle to convert water energy to mechanical energy. The bowl-shaped blade (half ball) has one of the highest drag coefficient values. This test was carried out experimentally using the type of bowl-shaped blade with the number of blades are 8 blades and the type of water turbine was the overshoot where the fluid flows above the turbine. The results obtained indicate that the performance of overshoot water wheel with eight bowl-shaped blades at variations in loading and discharge produces the highest value at discharge is 0.00048 m³/s on load of 2 kg with maximum water turbine power of 8,6626 watts. and water turbine efficiency is 96.5396%.

Keywords: overshoot water wheel, energy, efficiency, power, bowl-shaped blade

[59] Farid Rizayana (Universitas Pasundan), Fandi Rahmad Ramadhan (Universitas Pasundan), Sugiharto Sugiharto (Universitas Pasundan), Dedi Lazuardi (Universitas Pasundan), Mohammad Reza Hermawan (Universitas Pasundan), J Jamari (Universitas Diponegoro) and Athanasius P. Bayuseno (Universitas Diponegoro). *Design and Stress Analysis of Type-Disk Rotary Blades for Portable Cultivator*.

Abstract. A disc-type rotary blade is a type of cultivator blade used for tillage on a small plot of land. Due to its small design, fast manufacturing process, and low production cost, the disk-type rotary blade was ideal for use in culti-vator packages. The design of disk-type rotary knives for cultivator packs is presented in this work, along with structural strength analysis. This re-search aimed to come up with a cultivator blade design that was lighter and cheaper to produce. The research method used is to use the finite element method to analyze the strength of the structure. This analysis yields a stress, deformation, and safety factor distribution assuming a load of 160 N calculated from the average soil-specific gravity and disc-type rotary blade volume. The safety factor reveals that this disc-type rotary bar is quite safe, with the lowest value in the notch region valued at 3. The val-ues of stress and deformation in this region of the disk are displacements of 6 MPa and 0, respectively. This is due to the box-shaped reinforcement designed to strengthen the rigidity of the disk, preventing it from being easily plastically deformed. The greatest pressure and deformation of the disk-type rotary blades when on the blades averages 87 MPa and the dis-placement is 2.4mm. As a result, the blade had to be strengthened so that there was no excessive deformation while the portable cultivator was be-ing operated.

Keywords: Disk-type rotary blade design, Portable cultivator, Stress analysis

[60] Muhammad Marsudi (Islamic University of Kalimantan - Muhammad Arsyad Al Banjari). *The application of mathematical model to analyze production system in a manufacturing industry*.

Abstract. Mathematical analysis can be very useful for investigating the performance of production systems. This study describes the production process based on a mathematical model of queuing theory in the manufacturing industry, named Company X. It aims to model the production process by appropriate queuing model and determine its performance measures. A field study was conducted and production data was collected through employee self-timing methods. This study then presents the selected production processes in the form of an independent queuing system and describes the various performance measures for each queuing system. The production process was simplified to four independent series workstations, Mixing, Length Cutting, Width Cutting and Packing. The arriving and leaving distribution were determined by the Chi-square goodness of fit test. The performance measures analysis later found that Length Cutting and Width cutting experienced blocking while packing experienced starving. Several suggestions were discussed to improve the queuing performance. Results show that the queuing theory is suitable for to study of production efficiency with some extent of limitations.

Keywords: Mathematical Analysis, Manufacturing System, Production Management

[61] Dedikarni Panuh (Universitas Islam Riau), Adhila Tamlihan (Universitas Islam Riau), Rieza Aldio (Universitas Islam Riau), Kurnia Hastuti (Universitas Islam Riau), Dody Yulianto (Universitas Islam Riau), Mohd Shahbudin Masdar (Universiti Kebangsaan Malaysia), Azran Zainoodin (Universiti Kebangsaan Malaysia) and Nik Norziehana Che Isa (Universiti Teknologi MARA). *Effect of Heat Treatment on Porosity, Microstructures, and Mechanical Properties of Silica Composite Pellets.*

Abstract. Silica composite pellets in the petroleum industry are often called proppants, which have resistance to high temperatures, chemicals, and mechanical strength. The effect of heat treatment on the porosity, microstructure, and mechanical properties of silica composite pellets is the aim of this research. In this study, the composition of silica and polyethylene glycol (PEG) with a value of 85%: 15%, compaction process with a pressure of 5 tons and provide different heat treatments ranging from 1100°C, 1200°C, and 1300°C. The lowest compressive strength test results were found in samples with a heat treatment of 1000°C, namely 1.8 MPa. The highest compressive strength value occurred in the sample with 1200°C heat treatment, which was 10.54 MPa due to the volume shrinkage, which increased the ceramics' adhesive power.

Keywords: Ceramic, Composite, Porosity, Silica

[62] Nur Rochman Budiyanto (Universitas Gadjah Mada), Ryan Oktaviandi (Universitas Gadjah Mada), Dwi Yulijaji (Universitas Ibn Khaldun, Universitas Gadjah Mada), Roy Waluyo (Universitas Ibn Khaldun, Universitas Gadjah Mada), Esa Putra Ariesta Raharjo (Universitas Gadjah Mada), Putut Hery Setyawan (National Research and Innovation Agency of Indonesia (BRIN)), Shendy Akbar Maryadi (Universitas Ibn Khaldun), Muhamad Rafel (Universitas Ibn Khaldun), Deendarlianto Deendarlianto (Universitas Gadjah Mada) and Mulya Juarsa (National Research and Innovation Agency of Indonesia (BRIN)). *Thermal Effect on Natural Circulation Flow using Water and Al₂O₃-Nanofluids Inside Rectangular Loop in Vertical Position.*

Abstract. Passive cooling technology in closed circuits without the use of pumps works based on the principle of natural circulation, where the variable geometry and working fluid used will affect the amount of flow rate that occurs. Variations of the working fluid and thermal effects need to be investigated regarding their effectiveness on the natural circulation flow rate. This research aims to investigate the characterization of thermal effects on natural circulation flow using water fluid and Al₂O₃-Nanofluid in a rectangular loop in a vertical position. The re-search method was carried out experimentally by varying the heating water temperature from 50°C, 60°C, and 70°C with the cooling water temperature set at 10°C. The analysis was carried out for steady conditions. The experimental re-sults show that the highest temperature difference occurs in the heating water temperature variation of 70°C and 10°C cooling water with an average temperature difference of 6.5°C at steady state. In contrast, the lowest temperature difference occurs at 50°C heating water temperature of 4.8°C. So, the highest mass flow rate in water fluid is 0.01728 kg/s at a temperature of 70°C, and the lowest is 0.01167 kg/s at 50°C. As for the results of the correlation comparison between the mass flow rate of water fluid and nanofluids, the highest value was obtained for Al₂O₃ nanofluids of 0.01736 kg/s, and the lowest was 0.01173 kg/s.

Keywords: natural circulation, mass flow rate, water and Al₂O₃, thermal, nanofluids

[63] Ryan Oktaviandi (Gadjah Mada University), Muhamad Rafel (Ibn Khaldun Bogor University), Dwi Yuliaji (Gadjah Mada University, Ibn Khaldun Bogor University), Roy Waluyo (Gadjah Mada University, Ibn Khaldun Bogor University), Sunandi Kharisma (Udayana University), Putut Hery Setiawan (National Research and Innovation Agency (BRIN)), Deendarlianto Deendarlianto (Gadjah Mada University) and Mulya Juarsa (National Research and Innovation Agency (BRIN)). *Natural Circulation Flow Rate Comparison using Water and Al₂O₃ as Working Fluids Based on Power Control in Medium-scale Passive Cooling Experimental Facility.*

Abstract. The use of natural circulation as a passive cooling safety system in reactors has been applied by nuclear power plants around the world, including the AP1000 reactor from Westinghouse and SMART from KAERI with a passive cooling system, namely, Passive Residual Heat Removal System (PRHRS) to prevent overpressure from overheating in the reactor cooling system during an accident. The type of working fluid used affects the natural circulation flow rate. This research compared the mass flow rate of natural circulation based on water and Al₂O₃-nanofluid working fluids to changes in heater power used for steady-state conditions. The experiment was conducted by varying heater power in the heating tank from 1400 W, 2800 W, and 4200 W. Data collection was carried out experimentally and analyzed calculations to obtain the mass flow rate value in water and nanofluids as working fluids that will be used. The results indicate that using nanofluids can increase the value of the mass flow rate compared to ordinary water because there is a difference in density values that affect the mass flow rate. Where the high mass flow rate value is at 4200 powers with a value of Al₂O₃-nanofluids mass flow rate is 0.0456 kg/s and water mass flow rate is 0.0454 kg/s.

Keywords: natural circulation, mass flow rate, nanofluids, power, Al₂O₃, passive cooling

[64] Muhammad Rizky Ananda (Department of Mechanical Engineering, Faculty of Engineering, Universitas Sumatera Utara), Basuki Wirjosentono (Department of Mechanical Engineering, Faculty of Engineering, Universitas Sumatera Utara) and Indra Nasution (Department of Mechanical Engineering, Faculty of Engineering, Universitas Sumatera Utara). *Aerodynamics characteristic for drive rib on airplane wing components based on CFD tests.*

Abstract. This article presents a several step method to estimating aerodynamic parameters Ribs on aircraft wing components. Ribs function to hold and distribute the force received by the aircraft wing evenly. When assembling aircraft wing components, the drive rib will be fixed-supported on the spar, so the drive rib will experience a force (load) from its own weight. This study aims to analyze the aerodynamic characteristics of the drive rib to be able to determine the model of lift and angle of at-tack on the components of the aircraft wing. The design used in this study is to de-termined the angles of attack (α) = 0°, 5°, 8°, 10°, 12°, 15°, 16°, 17°, 20° to the optimal limit angle at flight speed conditions $v=250$ m/s respectively for altitude $H=9,000$ m, 11,000 m, 13,000 m, 14,000 m, 15,000 m, 16,000 m, 17,000 m, 18,000 m, atmospheric pressure $P_a=16,000$ Pa, atmospheric temperature $T_a=217$ K, and the density of air $\rho=0.2556$ kg/m³. The simulation is carried out by computational fluid dynamic method for successive angles of attack from which the lift value decreases rapidly. The results of the flight altitude test estimate the maximum wing flight altitude of the aircraft, namely $H_{max} = 16,625.77$ m. This test method can be used to analyze any aircraft construction.

Keywords: Drive rib, Aerodynamic characteristics, Aircraft wing

[65] Reza Setiawan (Universitas Singaperbangsa Karawang), Aripin Aripin (Universitas Singaperbangsa Karawang), Agustian Suseno (Universitas Singaperbangsa Karawang), Vera Pangni Fahriani (Universitas Singaperbangsa Karawang), Iwan Nugraha Gusniar (Universitas Singaperbangsa Karawang) and Rizal Hanifi (Universitas Singaperbangsa Karawang). *Study Utilization of Circulated Al₂O₃-Water Nanofluid in Engine Cooling Process.*

Abstract. Researchers and industry are competing to increase engine efficiency to reduce global warming and other toxic gases, especially Karawang Regency as the center of the largest automotive industry in Southeast Asia. The engine cooling system needs to be saved because it consumes one-third of the input energy. The main factor that plays a key role is the type of coolant used. Water, glycerol and ethylene glycol are still the most widely used coolants but their performance is still unsatisfactory in the ever-growing industrial era. So that it is necessary to type and test new coolant fluids that have the potential to be in the future. Nanofluid of Aluminum Oxide (Al₂O₃)-water has the potential to become a new liquid to be developed. The high thermal conductivity of Al₂O₃ nanoparticle can increase the heat absorption capability of the base fluid. The research method to be carried out is an experiment. The stages of research activities were preliminary studies, preparation of nanoparticle, manufacture of nanofluid, set up of research tools, testing, analysis and conclusions. The research variables used were the type of nanoparticle material Al₂O₃, the concentration of nanofluid 0.1% and 0.3%, and the circulation flow rate of the nanofluid 0.24 kg/s and 0.32 kg/s. The results obtained showed that the highest increase in heat transfer occurred in Al₂O₃-water nanofluid with a concentration of 0.3%, followed by Al₂O₃-water nanofluid with a concentration of 0.1% when compared to water base fluids.

Keywords: Nanofluid, Nano particle Al₂O₃, Concentration, Circulation, Engine cooling

[66] Adi Syuriadi (Politeknik Negeri Jakarta), Ahmad Siswantara (Universitas Indonesia), Ridho Irwansyah (Universitas Indonesia) and Supriyadi Supriyadi (Politeknik Negeri Jakarta). *Analysis of the Effect of Inlet velocity on Pressure drop on Cyclone Separator to be used in Pyrolysis System.*

Abstract. Pyrolysis is a process of chemical decomposition of biomass through heating at high temperatures (above 300°C), with no or little oxygen, which produces green fuels such as: syngas, bio-oil and bio-char. The most important component of a pyrolysis system is the cyclone separator. The function of the cyclone separator is to remove solid particles from the syngas formed, so that the syngas becomes cleaner. Therefore, to improve the performance of the cyclone separator, it is necessary to test it experimentally. Pressure drop is an important variable in determining the performance level of the cyclone separator in the pyrolysis system. The cyclone types tested are Stairmand and Lapple types. Based on the experimental results, inlet velocity is very influential on the pressure drop of the cyclone separator. The greater the inlet velocity value, the higher the pressure drop value. The highest pressure drop is in the Lapple type of 16.2649 mbar compared to the Stairmand type of 12.1644 mbar with each inlet velocity of 13 m/s.

Keywords: Pyrolysis, Cyclone Separator, inlet velocity, pressure drop

[67] Khamdi Mubarak (University of Trunojoyo Madura), Nadhir Maulidi (Universitas Trunojoyo Madura) and Mahrus Khoirul Umami (Universitas Trunojoyo Madura). *Optimization of 3D Printing Process Parameters to Maximize the Mechanical Properties of 3D Printing Products using Taguchi Method.*

Abstract. Three-dimensional (3D) printing or additive manufacturing has gained more popularity over the past few years for rapid prototyping. The quality of 3D printed products depends on the setting of printing parameters. In this research, we studied the effect of printing process parameters and material filament selection on the mechanical properties of 3D printed parts. The main objective of this research is to determine the optimal composition of input parameters to maximize tensile strength and compression strength. For this purpose, Taguchi design of experiments and ANOVA were applied on the optimization of three independent parameters (infill density, nozzle temperature and types of filament material) with three levels. A total of 54 specimens were produced following the ASTM standard test specimens for tensile strength test and compression strength test. The results show that the optimum tensile strength and compression strength were both obtained at the infill density factor of 100%, the nozzle temperature at 230°C and the type of filament material of ABS. However, tensile strength is significantly influenced by type of filament material with the contribution factor of 88.72%, whereas infill density contributes as the most influenced factor on compression strength (77.28%)

Keywords: 3D printing, filament material, tensile strength, compression strength, Taguchi method

[68] Imam Basori (UNJ), Mahardika Sandy Ponco (Department of Metallurgy and Materials, Faculty of Engineering, Universitas Indonesia), Lukman Fauzi (Department of Mechanical Engineering, Faculty of Engineering, Universitas Negeri Jakarta) and Yunita Sari (Department of Mechanical Engineering, Faculty of Engineering, Universitas Negeri Jakarta). *Effect of Cold Rolling and Annealing on Microstructures and Hardness of Cu-32Zn-0.5Al-0.15Mn Alloy.*

Abstract. The Brass commonly used in pipe industry, radiator, screw, and firearm's cartridge case because their mechanical properties combination such as strength, ductility, corrosion resistance and good at drawability. Deep drawing process are used to make cartridge case. In deep drawing process, deformation are happened, high drawability materials are needed. Cartridge brass drawability can increased with adding other compound, cold working, and heat treatment. In this research, will showing influ-ence of addition 0.5 %Al and 0,15 %Mn on microstructure and hardness of Cu – 32Zn alloy. The sample were then cold rolled with 20%, 40% and 70% thickness reduction. After then, sample are annealed at 300 °C, 400°C, 500°C dan 600°C tem-perature variation with 30 minutes holding time. The result showing that Cu – 32Zn – 0.5Al – 0,15Mn have 72.4 VHN on hardness. After homogenization process, hard-ness are decreased until 70.66 VHN. At 70% cold rolled without annealing, are showed the highest hardness number at 236.6 VHN and lowest hardness number at 20% thickness reduction and 600°C annealing temperature at 135.94 VHN. The optimum hardness are reached with 70% thickness reduction and 300°C annealing temperature. From this research, we can conclude that as high deformation can in-creasing hardness of materials. After then, low anneal temperature are needed to form recrystallization on high deformation materials.

Keywords: Brass, Cartridge brass, Manganese, Cold rolling, annealing Introduction

[69] E. Irianto Bhifttime (Department of Military Mechanical Engineering, Indonesia Defence University, Sentul Bogor - West Java, Indonesia), Annisa Ariesta (Department of Military Mechanical Engineering, Indonesia Defence University, Sentul Bogor - West Java, Indonesia) and Muammar Pierre A. Ferriyana (Department of Military Mechanical Engineering, Indonesia Defence University, Sentul Bogor - West Java, Indonesia). *Investigation of Gnetum Gnemon and Ramie Natural Fiber on the Mechanical Properties of Composites with the Combination of Aramid and Carbon Fiber as Reinforcement for Military Personnel Applications.*

Abstract. Every equipment infrastructure in a TNI unit will be needed to support an operation in the defense system in order to maintain the integrity of the Unitary State of the Republic of Indonesia. As for personal protective equipment that is really needed for the safety or continuity of a war operation. Protective components made from composite fibers have the advantage of being resistant to corrosion caused by the environment. The natural fibers and carbon fibers will be mixed/reinforced with epoxy resin so that they will become composite materials. The purpose of this study is to identify Gnetum Gnemon fiber composites with carbon fiber and aramid fiber to determine the mechanical properties of the composite material resulting from a collision. Natural fiber Gnetum gnemon has not been widely studied as a reinforcing material for polymer composites. Gnetum gnemon fiber chemical composition is hemicellulose approx. 25%, 40% alpha cellulose, 10% lignin and 3-5% benzene extractive. Its density is quite light, namely, 1.2087 g/cm^3 - 1.8069 g/cm^3 . Because this fiber has a continuous fiber structure and a strong natural weave, its use is still very limited. Special treatment such as alkali treatment on Gnetum gnemon can increase the strength of natural fibers. Kevlar or aramid fiber due to its exceptional mechanical properties, are extensively used in industrial and military applications. The aramid fiber exhibited the transversely anisotropic nature in a small strain range, with its stress-strain behavior as linear and elastic. The anisotropic nature of the aramid fiber was due to its high ratio of tensile to shear modulus. The high strength and modulus were also found to be scattered due to the larger distribution of defects in the longer fiber. The epoxy resin is a type of polymer characterized often with one or more epoxide functional group with at least one of the epoxide functional group acting as a monomer and terminal unit of the polymer within the structural chain. Epoxy resins are extensively used in the production of lightweight carbon fiber reinforced composites (CRFC) to deliver desired engineering properties such as high modulus and strength, low creep, superb chemical and thermal stability.

Keywords: Aramid, Carbon, Composite, Epoxy, Gnetum gnemon, Natural fiber

[70] Stenly Tangkuman (Mechanical Engineering Department of Sam Ratulangi University), Tritiya Arungpadang (Mechanical Engineering Department of Sam Ratulangi University), Benny Maluegha (Mechanical Engineering Department of Sam Ratulangi University) and Allendro Pompana (Mechanical Engineering Department of Sam Ratulangi University). *Design of a heating tank for distilling traditional drink of North Sulawesi.*

Abstract. The aim of this research is to design a heating tank with an electric heating element for a palm sap distillator that produces traditional drink in North Sulawesi. The design procedure carried out includes determining the capacity of the tank, calculating the power requirement of the heating element, modeling and simulating the von Mises stress in the tank. Through this research, the heating tank of distillator with a capacity of 20 liters was obtained, in which the heating tank diameter was 0.265 m, the heating tank height was 0.42 m, and the conical cap height was 0.195 m. Based on the software simulation results, it is known that the maximum von Mises stress of the tank is 40.07 MPa. The heating tank is made using Stainless Steel 304 plate. The beverage products obtained have an alcohol content of 35% and 55%.

Keywords: Heating Tank, Distillator, Traditional Drink

[71] Wahyono Suprpto (Brawijaya University), Erwin Erwin (brawijaya university), Yudy Surya Irawan (brawijaya university), Sudjito Suparman (Brawijaya university), Asmadi Lubay (IBA university) and Rasta Satya I (brawijaya university). *Effect of Nickel Solubility in ADC12 Melt on Its characteristic.*

Abstract. This paper describes the solubility of nickel alloys in molten Al-Si alloys at 900°C to form Al-Si-Ni alloys. Which is nickel metal with a melting point of 1450°C and aluminum alloy Silumin has a melting point of 600-760°C. Solid phases: α -Al, Al-Si, Si, and Mn-Fe-Si intermetallic are microstructures in Silumin with different geometries, expansion coefficients, and mechanical properties. The uncontrolled ferro-manganese intermetallic phase in aluminum alloys triggers cracking and reduces manufacturing properties. The phenomenon of nickel solubility in a liquid silumin bath at 900 °C besides reducing the melting energy can also increase ductility through controlling metallographic characteristics.

ADC12 smelting and nickel alloying are carried out in the R703 electric resistance furnace. Melting operation, ADC12 is inserted into the furnace at a temperature of 250°C and melts at 600°C at the same time as Nickel is added. After that the furnace temperature was increased to a temperature of 900°C and held for 45 minutes then the molten ADC12+Ni alloy was stirred, the slag was removed from the ladle, the molten alloy was removed from the furnace and poured into the specimen permanent mold. The independent variable in this study was the weight of nickel in each smelter: 2, 4, 6, 8, and 10% by weight of the ADC12 ingot. As the dependent variable is the characterization of the ADC12+Ni alloy consisting of nickel solubility, type, shape and solid fraction. Testing of chemical elements was carried out by optical emission spectrometry, the metallography was carried out by optical microscopy, and the phase fractions were carried out using the imageJ software application.

Melting point solid nickel of 1450°C can dissolve in ADC12 melt on a temperature 600 to 900°C at a holding time of 45 minutes. The amount of nickel dissolved in ADC12 continues to increase in line with the weight of the nickel melted. The weight percent of dissolved nickel and nickel with the intermetallic fraction Al-Ni in the Al-Si-Ni alloy immersion 2, 4, 6, 8, and 10 Ni respectively is 2.98-2, 5.04-3, 6.97-8, 8.13-10, and 10.02- 10 in [%].

Keywords: solubility, intermetallic, silumin, solid phase, ImageJ

[72] Ade Bagdja (Universitas Pasundan). *“One Stop Machining” Toward Integrated CNC Machine in Industry 5.0.*

Abstract. The Industrial Revolution continues to develop. No matter it said that Industry 4.0 has not finished yet, Industry 5.0 has already at the front door. In manufacturing processes at industries, the CNC machine is the heart of the production process. Various developments have been carried out: application of FMC / FMS, integration with the Handling System, even In-Process Measurement for monitoring the produced workpieces. In this research, a concept called “One Stop Machining” was developed where the Integrated process of handling - machining – measuring – data communication is carried out to completion. Robot is used to assist operators in operating the system, not only for loading – unloading but also for additional operations as required. The workpiece is directly measured during the process. After machining is completed, the geometry of the workpiece is measured with a probe to ensure compliance with the requirements. Finally, the CNC Machine communicates with the Server for the confirmation process into the Production Management System and downloading programming data. By this concept, the System is implemented comply with Industry 5.0.

Keywords: Machining, In-Process On-Machine Measurement, CNC, Robot / Cobot, Production Management System, Data Communication, Industry 5.0, Automation, Digitalitation

[73] Muhammad Arif Budiyanto (Naval Architecture and Marine Engineering, Departement of Mechanical Engineering, Universitas Indonesia) and Muhammad Hanafi Lubis (Universitas Indonesia). *Reviews of 8 Solar Radiation Models for Estimating Solar Intensity in Indonesia.*

Abstract. Indonesia is a tropical nation with an equator that experiences intense sunlight all year round. Even with the little measurement data, there hasn't been much map-ping of the prospective solar intensity. This paper's goal is to review 10 common-ly used models for calculating solar intensity. Out of the 10 models that offer various physical qualities, one is determined to be a good fit for the Indonesian region based on the physical characteristics. Mghouchi model are the best per-formance for the estimation of hourly solar radiation intensity because they pro-vide small errors than the other empirical model.

Keywords: Solar intensity, Solar radiation, Empirical model

[74] Hery Sonawan (Universitas Pasundan). *Study of Erosion Shield Failure in Powerplant Steam Generator.*

Abstract. This report gives a comprehensive investigation on the failure of Erosion Shields in the steam generator of a coal-fired power plant. The primary purpose of the Erosion Shield is to safeguard the superheater tube from potential erosion caused by the forceful discharge of soot blower and to mitigate the occurrence of slagging. In certain instances, it has been observed that Erosion Shield clamps may fracture and descend to the lower region of the steam generator, hence causing disruption to the operation of the bottom ash management system.

In order to safeguard the superheater tube, the Erosion Shield is affixed and secured by the use of clamps and welding. Based on the observed data, it can be concluded that instances of failure are observed in both the clamp and weld components. In order to conduct a more comprehensive analysis, metallographic specimens of the clamp are made and subjected to hardness testing.

The microstructure analysis of the Erosion Shield sample involves the study of certain test locations located in the base metal, heat affected zone (HAZ), fusion line, and weld metal. Sufficient characterization of the Erosion Shield material as austenitic stainless steel type can be achieved by analyzing the microstructure of both the base metal and the heat-affected zone (HAZ). The observed grain structure of both the base metal and heat-affected zone (HAZ) did not exhibit any discernible differences. This can be attributed to the prolonged exposure of the Erosion Shield in a high-temperature gas environment ranging from 1200°C to 1400°C. Furthermore, there is a lack of evidence suggesting the presence of intergranular corrosion at the grain boundary of both the base metal and heat-affected zone (HAZ). The hardness of the weld metal is greater in comparison to the hardness of both the heat-affected zone (HAZ) and the base metal. The disparity in hardness between the E308 filler metal and the AISI 304 base metal is quite substantial

Keywords: erosion shield, soot blowing, slagging, steam generator

[75] Toto Supriyono (Universitas Pasundan), Ghazali Omar (Universiti Teknikal Malaysia Melaka), Noreffendy Tamaldin (Universiti Teknikal Malaysia Melaka), Bambang Ariantara (Universitas Pasundan) and Toto Supriyono (Universiti Teknikal Malaysia Melaka). *The observation of a cooler operating temperature for cooling a photovoltaic module.*

Abstract. Studies conducted by researchers on the performance of photovoltaic module (PVM) show that the PVM temperature affects its performance. Therefore, to maintain performance, a thermal management system is required on the PVM. This observation is part of the thermal management research on the PVM to maintain power output when the PVM operating temperatures are high enough. The thermal management in the investigated uses heat pipes as a cooler. To determine the operating temperature of the cooler, it is necessary to know the operation temperature of the PVM from the beginning to the end of the operation. The observation objective is to determine the operating temperature range of the PVM cooler which required in designing the PVM cooler. The observation method that has been carried out is to measure the back surface temperature of the 120 Wp PVM using a thermocouple connected to a temperature data logger system. There are 9 (nine, 2020 and 2021) and 3 (three, 2023) thermocouples mounted on the PVM back surface. The observation done on Juni 2023 were taken for 16 days on June 12 – 30, 2023 throughout the day from 6:00 a.m. to 6:00 p.m. In addition, it was conducted at the parking area on the 2nd floor of the Faculty of Engineering Campus, Pasundan Bandung University. The measurement results show that the PVM back surface temperature varies from around 19°C in the morning, at 6:00 a.m. and at 22°C in the evening at 6:00 p.m. The maximum temperature was reached at 64.5°C at 0:15 p.m. with a solar irradiation of 535 W/m². The PVM back surface temperature gradually rises above 25°C from 7:45 a.m. Its temperature above 30°C is reached from 8:15 a.m. and gradually rises to a temperature of 64.5°C at 0:15 p.m. In addition, the back surface temperature gradually drops to 30°C round 5:00 p.m. and the final temperature is 24°C at sunset. The observation result shows that the PVM cooler would work at temperatures of 30 – 65°C. This information can be used to determine the operating temperature of the PVM coolers.

Keywords: Photovoltaic Module, Performance, Cooler, Operating temperature, Heat pipe

[76] Muaz Arrari (Institut Teknologi Kalimantan), Andi Idhil Ismail (Institut Teknologi Kalimantan) and Faisal Manta (Institut Teknologi Kalimantan). *The Effect of rake angle and feed rate on the machining process of Ti6Al4V, a study using Finite Element Method.*

Abstract. Ti6Al4V is a material often used in various engineering sectors, such as aerospace, automotive, and chemical, because of its strength ratio to weight advantage. Ti6Al4V requires relatively difficult processing because of the material's mechanical properties, so research related to the processing of Ti6Al4V is needed to create a reference in its processing. This research aims to simulate the machining process with a finite element method to achieve lower cost and efficient research time compared to direct experiments. Cutting simulation was conducted as orthogonal 2D with the Johnson-Cook material and Johnson-Cook damage models. Predicting variable final results simulated stress, temperature, chip formation, and cutting force was the purpose of this research. Simulated rake angle varied by 0°, 7°, 14° and feed rate 0.08, 0.1, 0.15 mm/rev with cutting speed 40 m/min and width of cut 2 mm. Maximum stress 1342 N was achieved at feed 0.08 with rake angle 7° and maximum temperature noted 534°C at feed 0.15 mm/rev with rake angle 0°, while maximum cutting force reached 700 N at feed 0.15 mm/rev with rake angle 0°. Chip formation formed in this simulation mainly serrated chip in variation above 0° rake angle and more segmented serrated chip formed when rake angle increase in positive.

Keywords: Titanium Alloy, Low Speed Machining, Chip Formation, Finite Element Method

[77] I Putra (Politeknik Negeri Bali), Wayan Nata Septiadi (Udayana University), Dewa Ngakan Ketut Putra Negara (Udayana University) and Tjokorda Gde Tirta Nindhia (Udayana University). *Performance Investigation of Water Purification System Assisted by Ultrasonic Vibrating Mesh Atomizer.*

Abstract. The growth of the metropolitan area has necessitated an increase in the demand for freshwater. One of the issues facing modern life is water treatment plant to supporting the communities. The approaches for treatment of the brackish water were carried out utilizing a wide range of technologies and technology. Many different technologies have been created recently to transform brackish water into freshwater using a variety of methods and equipment. One approach to produce extremely tiny water droplets is ultrasonic vibrating mesh. In this research, the performance of ultrasonic vibrating mesh has been investigated to purify the brackish water. This technique is similar to the distillation method in purification system of water traditionally. The performance had been indicated by the rate of pure water productivity and its Total Dissolve Solids (TDS).

Keywords: water, Ultrasonic, Mesh, Purification, brackish

[78] Meifal Rusli (Mechanical Engineering Department, Faculty of Engineering, Universitas Andalas), M Arsyad Prasetyo (Mechanical Engineering Department, Faculty of Engineering, Universitas Andalas) and Hendery Dahlan (Mechanical Engineering Department, Faculty of Engineering, Universitas Andalas). *Experimental Study of The Acoustic Properties of Waste Tire Rubber and Polyester Composite Panels.*

Abstract. One of the prevalent materials employed for sound-absorbing panel construction is a porous material, which is adaptable for production using diverse source materials, including natural, synthetic, and waste materials. This study focuses on conducting an experimental investigation into the acoustic properties of materials fabricated from wasted tire rubber. Initially, waste tire rubber was chopped to achieve a specific size, followed by combining it together with polyester. The acoustical characteristics were measured in a four-channel impedance tube in strict accordance with ASTM E 2611-19. Various shapes, including fiber, grain, and powder, are produced by carefully shaping composite waste rubber from tires combined with polyester. Notably, the 5 mm, 10 mm, and 15 mm thicknesses remain constant throughout these geometries. The experimental findings reveal that variations in the thickness and shape of the chopped rubber components significantly influence both the sound absorption coefficient and transmission loss. Rubber with granular form has a better sound absorption coefficient than the other two. Apart from that, the pore size of each sample produced varies with the grain shape and affects the sound absorption value. The larger the pore size, the better the sound absorption value. The sound absorption coefficient increases as the panel thickness increases.

Keywords: waste tire rubber, polyester, sound absorption, sound transmission loss

[79] I Kadek Ervan Hadi Wiryanta (Politeknik Negeri Bali), Tjokorda Gde Tirta Nindhia (Universitas Udayana) and Wayan Nata Septiadi (Universitas Udayana). *Review of Nano-Composite PCM AlN/EG and Heat Pipe as a Hybrid Battery Thermal Management System* .

Abstract. The battery thermal management system (BTMS) is essential for maintaining the battery's temperature and hence its performance. BTMS is classified into three types: active cooling, passive cooling, and hybrid approaches. Because of its simple design, lack of additional power, and even temperature distribution, PCM is extensively used as a BTMS as a passive cooling technique. PCM also has drawbacks like leak sensitivity and limited heat conductivity. This stimulates PCM performance enhancement attempts. Adding reinforcing material to PCM is a standard way to increase its performance. Aluminum nitride (AlN) and expanded graphite (EG) are commonly employed as fillers. The addition of EG and nano-AlN materials can improve the performance of PCM composites compared to pure PCM. Chemical interactions between these materials do not take place either. It is undeniably advantageous that these two materials may be combined into pure par-affin-based PCM for energy storage applications. The combined or hybrid system of BTMS is the optimum alternative for increasing heat transmission from the battery modules into the surrounding environment. The battery temperature will be well maintained with the combination of 2 (two) and 3 (three) passive cooling methods or even combined with active cooling methods such as air-forced convection. In BTMS, the heat pipe is widely employed as a heat transfer improvement.

Keywords: 'BTMS', 'AlN', 'Expanded graphite', 'PCM', 'Heat pipe'

[80] Oknovia Susanti (Universitas Andalas) and Hameri Annisa (universitas andalas). *Cytotoxicity Of Mg-1.6Gd Alloys After Hot Rolling At An 80% Reduction Level As Implant Material*.

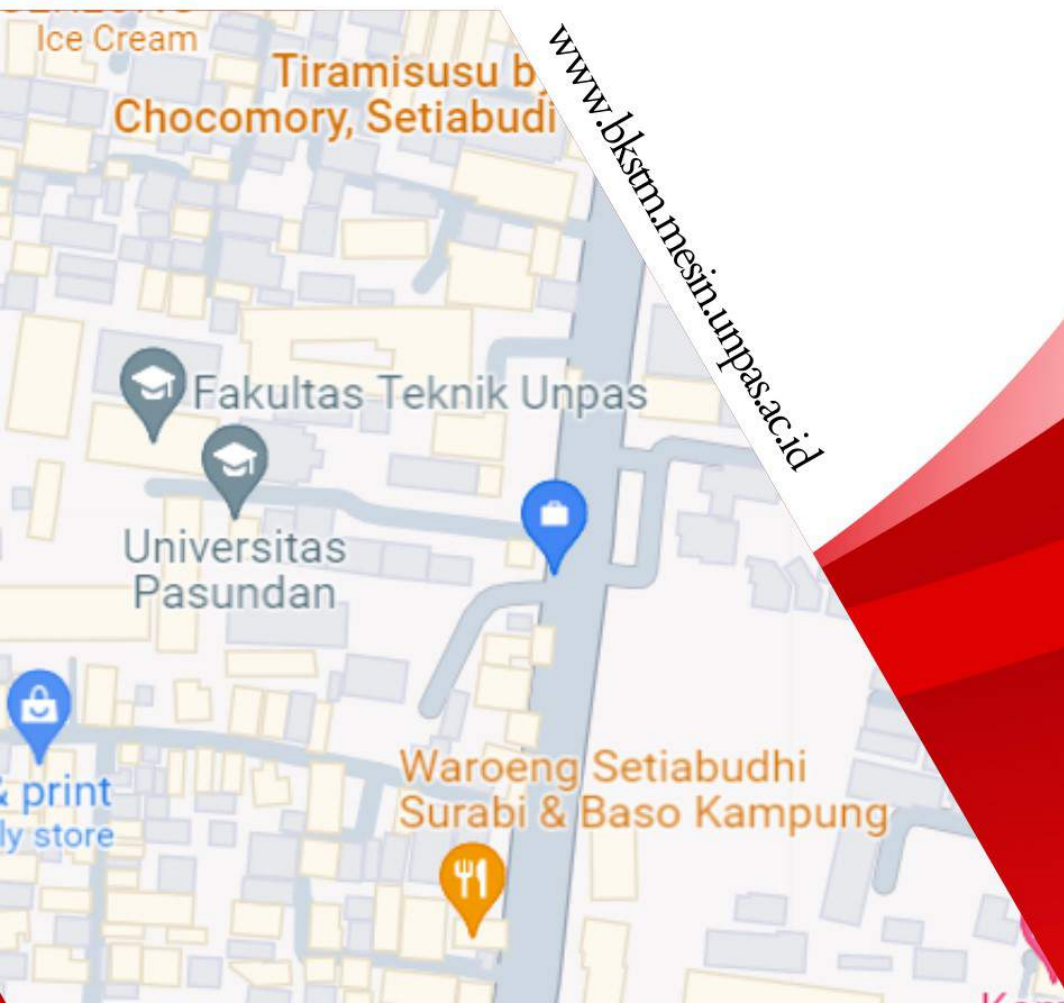
Abstract. The high number of traffic accidents in Indonesia causes many victims which suffer from broken bones. Treatment which can be conducted is bone implants installation. Furthermore, magnesium is an attractive material for biodegradable bone implants since its physical properties are almost similar to human bone, but in the human body, magnesium experiences rapid dissolution before new tissue grows. Therefore, it needs to be combined with gadolinium in order to delay the solubility of magnesium. Before the Mg-Gd alloy was used as implant material, it is important to conduct a cytotoxicity test by using osteoblast cells. In order to obtain cell viability after it was given treatment, this study used the MTT Assay method. Furthermore, Mg-1,6Gd samples which had rolled with 80% at various temperatures of 400°C, 450°C, 500°C, and 550°C were inserted into plates which contained osteoblast cells. After the samples were incubated for 3, 7, and 14 days, the MTT was dissolved into the plate and it was read with Elisa Plate Reader. The study shows that the sample which has rolled with 80% reduction is non-toxic since the average viability value is above 70%. In addition, samples which had rolled with 80% at a temperature of 400°C have stable viability value which is above 70%.

Keywords: Implant Bone, Magnesium, Gadolinium, Osteoblast Cells, Cytotoxicity



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