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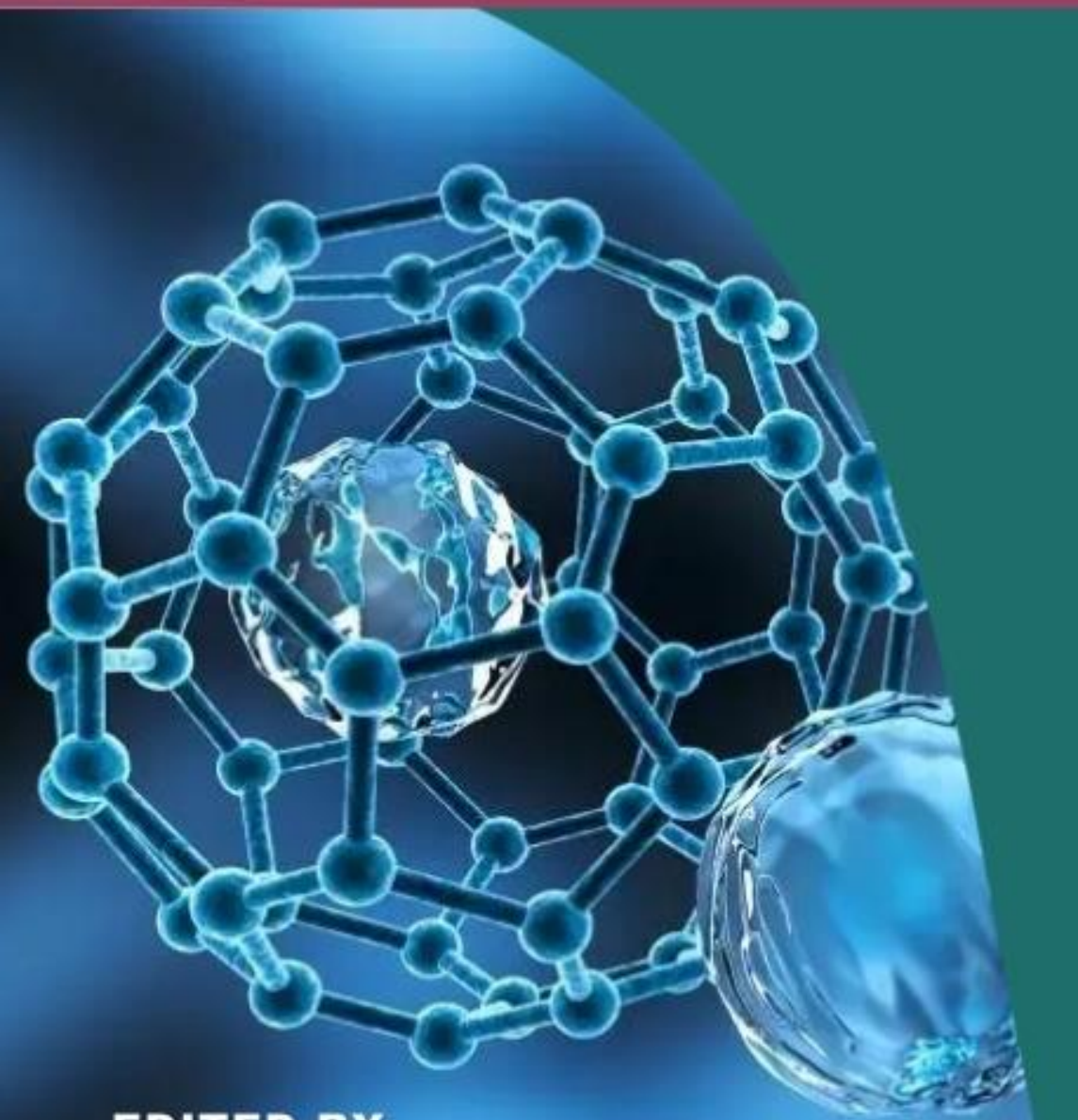
ICRAMEN 2021



EDITED BY
DR. MANOJ A. KUMBHALKAR

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Recent Advances in Mechanical Engineering and Nanomaterials

A

Souvenir of

International Conference on Recent Advances in Mechanical Engineering and Nanomaterials

(ICRAMEN 2021)

Volume 1

Editor

Dr. Manoj A. Kumbhalkar

BE, M.Tech., Ph.D. (Mechanical Engineering)

Guest Editors

Dr. Radheshyam H. Gajghat

Dr. Kishor S. Rambhad

RESEARCH ASSOCIATION OF MASTERS OF ENGINEERING

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In kind support and patience of my family

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Thermal Engineering and Fluid Science

Production and Industrial Engineering

PREFACE

Research Association of Masters of Engineering is committed to providing a peer reviewed platform to outstanding researchers to exhibit their findings for the furtherance of technology to provide a research forum. We are devoted to continual innovation to better support the wishes of our communities, making sure the integrity of the research we publish, and championing the importance of open research.

ICRAMEN 2021 was a two days event that aimed to showcase state-of-the-art methodologies and technologies in Mechanical Engineering and Nanomaterials. It focused on new ideas and paves the way to disseminate the latest innovations and practices. It facilitates opportunities to network, collaborates, and exchange ideas with renowned leaders, scientists, and researchers in Mechanical Engineering and Nanomaterials. It acts as a crucial platform for industry and academia to foster innovative ideas, theories, frameworks, and applications. ICRAMEN 2021 was encouraged recent and futuristic advancements, challenges, and new strategies in the frontiers of Mechanical Engineering and Nanomaterials.

Dr. C. C. Handa, Professor and Head, Department of Mechanical Engineering, KDK College of Engineering, Nagpur, Maharashra, India was the Chief Guest of the conference and delivered inaugural address. Dr. S. A. Khan, Professor, Department of Mechanical Engineering, International Islamic University Malaysia, Kuala Lumpur, Malaysia was the Guest of Honor and Keynote Speaker of the conference and delivered a key-note address on “Recent Advances in Aerospace Engineering”. Several students/research scholar and academicians have presented their research work at ICRAMEN 2021 in the areas of design engineering, thermal engineering and fluid science, material science and nanomaterials, production and industrial engineering. We believe that the knowledge exchanged at ICRAMEN 2021 immensely helps to the researchers working on relevant fields and contributes to the growth of science and technology.

As the coronavirus (COVID-19) spreads worldwide, taking into account the various circumstances of the participant, ICRAMEN was adopted all available social media methods, such as online presentation besides the regular

presentation styles (oral & poster). The online presentation session was arranged via. ZOOM platform. All authors were participated via in-person presentation at the time of their session on the online platform. Our sincere thanks to the keynote speakers, reviewers, technical and advisory committee members, organizing committee, and all authors for their contribution and making ICRAMEN 2021 a grand success.

About the Editor

Dr. Manoj A. Kumbhalkar received his Degree of Bachelor of Engineering in Mechanical Engineering, Degree of Master of Technology in CAD/CAM and Ph.D. in Mechanical Engineering from Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur, Maharashtra, India. He has awarded as a M. Tech. Topper by Rajiv Gandhi College of Engineering, Research & Technology, Chandrapur.

He is a President of Research Association of Masters of Engineering, India and a publisher of RAME Publishers, India. He is a life member of Indian Society for Technical Education (ISTE). He authored several peer-reviewed articles published in highly reputable outlets. He is worked as a Conference Chair of conferences, managing guest editor and chief editor of journals, and convener/coordinator for workshops/STTP. He reviewed many papers of peer reviewed journals of Springer, Elsevier, IOP Publishing, Taylor & Francis, etc. Also, he is appointed as a reviewer of the journals of Science and Education Publishing, Horizon Research Publishing Corporation, SCIREA. There is total 22 National/International conference papers and 22 journal papers (includes Elsevier, Springer, IoP, Inderscience), 3 books, 2 international book chapter and 2 patent on his name. His research interests include machine design, failure analysis, computer aided design, finite element analysis, vibration and biomechanics. He has total 13 years of teaching experience and currently working as a Head of Mechanical Engineering Department (Second Shift) in JSPM Narhe Technical Campus, Pune, Maharashtra, India.

About the Guest Editor

Dr. Radheshyam H. Gajghat has completed his Graduation (BE) in Production Engineering and Diploma in Business Management (DBM) from Nagpur University, Nagpur, Post-Graduation (MTech) in Production Engineering from Motilal Nehru National Institute of Technology (Deemed University), Allahabad (Prayagraj) and PhD degree from Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.

Presently, he is working as a Professor in Mechanical Engineering Department, Christian College of Engineering and Technology, Bhilai. He has more than 27 years of experience in Teaching, Industry, Research and Academic Administration. His area of interest in research is Engineering Education, Conventional and Advanced Manufacturing Processes, Computer Integrated Manufacturing, Human Factor Engineering, and Composite Materials. He has published more than 10 research papers in International/National Journals and presented many more papers in International/National Conferences. He has the expertise in Design of Academic Monitoring System and Innovative Teaching-Learning Methodology.

He has also developed an online software, ESPT (Engineering Students Performance Test) based on his research work to help the engineering students to predict their probability of passing in University Examination and find out the preparation gap between their present status and expected (optimum) status with respect to some important influencing factors. It will help them to improve their technical knowledge and hence increase their Employability. This software is feely available on www.checkmyperformance.com.

Dr. Kishor S. Rambhad received his Degree of Bachelor of Engineering in Mechanical Engineering from Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur, Maharashtra, India, Degree of Master of Technology in Heat Power Engineering from Visvesvaraya National Institute of Technology, Nagpur, Maharashtra, India, and Ph.D. in Mechanical Engineeringin from Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur, Maharashtra, India.

He has reviewed research papers of the reputed journals such as Energy Storage (Willey), Applied Thermal Engineering (Elsevier), The Open Petroleum Engineering Journal (Bentham Open), International Journal of

Refrigeration (Elsevier), Environment, Development and Sustainability (Springer), ACS Sustainable Chemistry & Engineering (American Chemistry Society), and many more. He has been a resource person for the one-day workshop on research/review paper writing conducted at JSPM Narhe Technical Campus, Pune, Maharashtra India. So far, he has published 48 papers in reputed journals and conferences. He also contributes to patenting the research, so far, he has filed 3 patents that are under examination. His research interests include heat and mass transfer, refrigeration and air-conditioning, renewable energy, and sorption technology. He has14 years of experience including industry and academics, he is currently working as Assistant Professor-Sr. Grade and Head in Mechanical Engineering Department at St. John College of Engineering and Management, Palghar, Maharashtra, India.

Nand Jee K. is pursuing PhD in Mechanical Engineering. He has received his M.Tech degree in Mechanical Engineering with specialization in CAD/ CAM. There is total 10 National/International conference papers and 26 journal papers (includes Elsevier, Springer, IoP, Wiley, Taylor & Francis), 4 international book chapter and 1 patent on his name. His research interests include interdisciplinary field of materials science but not limited to smart materials such as the biomimetic 4D printed materials, the self-healing composites and the biofunctional nanofibers, as well as the structural health monitoring for damage detection and characterization strategy for engineering structures.

About Research Association of Masters of Engineering

Research Association of Masters of Engineering is committed to providing a peer reviewed platform to outstanding researchers to exhibit their findings for the furtherance of technology to provide a research forum. We are devoted to continual innovation to better support the wishes of our communities, making sure the integrity of the research we publish, and championing the importance of open research.

We invite young students, scientist, researchers, and academician to contribute your research and promote to convert their research work in technical papers. The publication would also help in enhancing awareness about the need to become innovative and research minded. All articles presented in the conference will published in renowned journals and available to scientific researchers and innovators all over the globe. We provide a forum to publish the complementary aspects in science and engineering using computational methods and experimental measurements, and to stress the importance of their harmonious development and integration. Our aim is to become an effective medium for inspiring the innovators and researchers to bring out their contributions in the form of research papers, articles, case studies, review articles and innovations in the fields of engineering, science and technology.

Mission

To providing a peer reviewed platform to outstanding researchers to exhibit their findings for the furtherance of technology.

ORGANIZED BY
RESEARCH ASSOCIATION OF MASTERS OF ENGINEERING

About the Conference ICRAMEN 2021

ICRAMEN 2021 was a two days event that aims to showcase state-of-the-art methodologies and technologies in Mechanical Engineering and Nanomaterials. It focused on new ideas and paves the way to disseminate the latest innovations and practices. It facilitates opportunities to network, collaborates, and exchange ideas with renowned leaders, scientists, and researchers in Mechanical Engineering and Nanomaterials. It acted as a crucial platform for industry and academia to foster innovative ideas, theories, frameworks, and applications. ICRAMEN 2021 was encouraged recent and futuristic advancements, challenges, and new strategies in the frontiers of Mechanical Engineering and Nanomaterials.

Notification about COVID-19

As the coronavirus (COVID-19) spreads worldwide, taking into account the various circumstances of the participant, ICRAMEN was adopted all available social media methods, such as online/video presentation, etc, besides the regular presentation styles (oral & poster). The online presentation session was arranged accordingly. Authors have participated through the online platform "ZOOM" and presented paper during the technical session in this e-Conference.

Conference Website - https://icramen.rame.org.in/wc/

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Message of Chief Guest

It gives me great pleasure to extend my greetings and warmest wishes to the Research Association of Masters of Engineering for organizing an International Conference on Recent Advances in Mechanical Engineering and Nanomaterials (ICRAMEN 2021) during October 16-17, 2021.

Advances in Mechanical Engineering and nanomaterials are the main area covered by the conference. The growth and transformations of colloidal nanocrystals are a major issue for the creation of functional nanomaterials. In practical terms, knowledge of how to selectively synthesis the required sizes and forms of nanocrystal that would benefit various applications. Interdisciplinary character of research enthuses the current activity in the field of nanomaterials. People from varied backgrounds combine hands to succeed in establishing a simple way of synthesizing and applying heterogeneous nanomaterials.

Despite extensive efforts and evidence that the tuning of various nanomaterials to specific applications may be extremely advantageous, many basic features of complex nanomaterial systems are still poorly understood and empiricism is still widespread.

I am quite sure that this conference will ignite the creative ideas and exchange of knowledge to fill up the gaps in ongoing research on multifunctional nanomaterials.

I once again commend the core organizing team and wish the conference a resounding success.

Dr. C. C. Handa
Professor & Head,
Department of Mechanical Engineering,
KDK College of Engineering, Nagpur, Maharashtra, India.

Message of Guest of Honor

I feel truly delighted to learn that the Research Association of Masters of Engineering e- platform for the scientific community to share their ideas and research by organizing an International Conference on Recent Advances in Mechanical Engineering and Nanomaterials (ICRAMEN 2021) during October 16-17, 2021.

Its subject is fascinating since it focuses on the latest developments in mechanical and nanomaterial engineering. Through the range of discoveries and technologies produced using nanomaterials, we see a silent revolution. Now, nanomaterials and products, including paints, filters, insulation, and lubricant additives, are utilized in several manufacturing processes and medical treatments. There can be no exaggeration that multidisciplinary research now constitutes the foundation of any country's economic success and that humankind directly benefits. The finest examples of multidisciplinary research are nanotechnology and nanoscience.

It is also vital to grasp the underlying fundamental concepts of science, apart from developing applicable technology. ICRAMEN 2021, therefore, takes on particular relevance. I think the attendees will profit immensely.

My congratulations to the organizing team, and I extend my best wishes for its successful completion.

Dr. S. A. Khan
Professor,
Department of Mechanical Engineering,
International Islamic University Malaysia, Kuala Lumpur, Malaysia

Message of Conference Chair

I am very happy to share that Research Association of Masters of Engineering is organizing an International Conference on Recent Advances in Mechanical Engineering and Nanomaterials (ICRAMEN 2021) during October 16-17, 2021.

The fast advancements in technology make the promotion of technical competence in the workforce highly essential nowadays. One of the main problems for scientists is the implementation of their highly specialized research in many domains of human knowledge and interdisciplinary study. This problem must be seen as an opportunity for human resources development in a variety of areas. The other significant problem is to discover how these material advancements may be utilized to better the everyday job and the common person's surroundings. In these recent years there has been a lot of focus to promoting cross-disciplinary research with specific issues in nanoscience and nanotechnology.

I'm confident there will be many intellectually engaging contacts and the presentation of constructive ideas which would benefit a broad spectrum of participants in the conference on current achievements in mechanical engineering and nanomaterials.

I congratulate the team of RAME and extend my best wishes for its success.

Dr. M. A. Kumbhalkar
President,
Research Association of Masters of Engineering,
India.

Message of Convener

I am pleased to know that the Research Association of Masters of Engineering is organizing an International Conference on Recent Advances in Mechanical Engineering and Nanomaterials (ICRAMEN 2021) during October 16-17, 2021.

The present requirement of our society is to develop the abilities to address different challenges of individuals with a scientific temperament. Research in nanotechnology covers several fields, which get different information from multidisciplinary sources. Nano research is getting more and more inclusive. I'm delighted that the invited speakers for the event are well-known speakers from around the world.

I am convinced that at this magnificent conference on knowledge the mainstay of nanoscience and nanotechnology will put together the insight and wisdom appropriate to human growth.

I congratulate the Research Association of Masters of Engineering for organizing such event and convey my best wishes for all success.

Dr. R. H. Gajghat
Member,
Research Association of Masters of Engineering,
India

Message of Convener

It gives me immense pleasure to know that Research Association of Masters of Engineering is organising an International Conference on Recent Advances in Mechanical Engineering and Nanomaterials (ICRAMEN 2021) during October 16-17, 2021.

The subject of the conference is intriguing since it includes a wide variety of mechanical and nanomaterial characteristics. The emergence of huge potential uses of nanomaterials constantly leads to major societal transformations. The wall of traditional subjects collapses in the modern world and we see the spread of one domain's ideas into the next. The coagulation of thoughts can lead us all to the crossroads when the unity of knowledge from many fields can be noticed.

I am confident that debates and conversations at this e-conference will encourage the younger brains to understand the science and technology of nanomaterials.

My congratulations to the whole organizing team and best wishes for the grand success of the event.

Dr. Kishor S. Rambhad
Member,
Research Association of Masters of Engineering,
India

Message of Co-Convener

As a co-convener of the conference, I take great pride in welcoming the great scientists, academicians, young researchers, and students from all over the world to attend the International Conference on Recent Advances in Mechanical Engineering and Nanomaterials (ICRAMEN 2021) during October 16-17, 2021.

In ICRAMEN 2021 you may obtain insights into the latest technology and research that attracts great interest via the gigantic and enthusiastic presence of experts, young, brilliant researchers and outstanding student populations.

ICRAMEN 2021 aims to bring together a multidisciplinary group of scientists and engineers from across the world to present and exchange insights on the conference's primary subject. It encourages top-tier study and globalizes research on quality in general, thereby increasing the worldwide competition for debates, presentations and attention to recent excellent accomplishments in the field of scientific materials.

We are looking forward to an excellent meeting with great scientists from different countries around the world and sharing new and exciting results. I express pleasure to complement my team of RAME for their sincere hard work in formulating an excellent program.

Nand Jee K.
Member,
Research Association of Masters of Engineering,
India

ICRAMEN-2021 Program Schedule

DAY – 1 (16/09/2021)	
Time	Activity
9.45 AM - 10.15 AM	Online Registration Confirmation
10.30 AM - 11.00 AM	Inaugural Ceremony of ICRAMEN-2021
11.00 AM - 11.30 AM	Keynote Session DR. S. A. KHAN International Islamic University, Malaysia
11.30.00 AM - 12:00AM	Tea Break
12.00 AM – 1.30 PM	Technical Session I (Thermal & Fluid Science)
1.30 PM - 2.00 PM	Lunch Break
2.00 PM - 4.00 PM	Technical Session II (Material Science)
4.00 PM	Tea Break and End of Session

DAY – 2 (17/09/2021)	
10.15 AM - 10.45 AM	Keynote Session Dr. Gyanedra Kumar Singh Adama Science and Technology University, Adama, Ethiopia
10.45 AM - 11.00 AM	Tea Break
11.00 AM – 1.00 PM	Technical Session IV (Design Engineering)
1.00 PM - 2.00 PM	Lunch
2.00 PM - 4.30 PM	Technical Session III (Manufacturing/ Production)
4.30 PM - 5.00 PM	Conference Valedictory
5.00 PM	Tea Break
End of Conference	

TRACK 1

Design Engineering

RIDGE GAP WAVEGUIDE BASED BAND PASS FILTER FOR KU-BAND APPLICATION

ICRAMEN_PAPER_35

Neetirajsinh Chhasatia*, Jitendra Chaudhari and Amit Patel

V.T. Patel Dept. of E & C, Chandubhai S Patel Institute of Technology, Charotar University of Science and Technology, Changa, Gujarat, India

Abstract: This paper describes a simple, low loss, compact tuneable band pass filter based on ridge gap waveguide (RGW) technology for the Ku-band applications. This is achieved by keeping the height of the air gap in the gap guide structure equal to the thickness of the substrate or base of the structure. The resonant frequency and electromagnetic (EM) field distribution of the structure is investigated. This filter is designed by inserting the proposed ridge in the cut-off region of the gap waveguide. The frequency of tuning has been carried out using the slot created on ridge, which generates capacitive effect. Experimental results of the manufactured structure show an insertion loss of approximately 0.15 dB and a return loss of 16.38 dB over 4.5% relative bandwidth in Ku-band. The structure, put forwarded here, has been designed and optimized in the CST microwave studio environment and simulated results are validated by experimental results. The size of the structure is 64.65 mm x 64.65 mm x 7 mm.

Keywords: Dispersion Diagram, Insertion Loss, Kurtz band application, Return Loss, Ridge Gap Waveguide Technology

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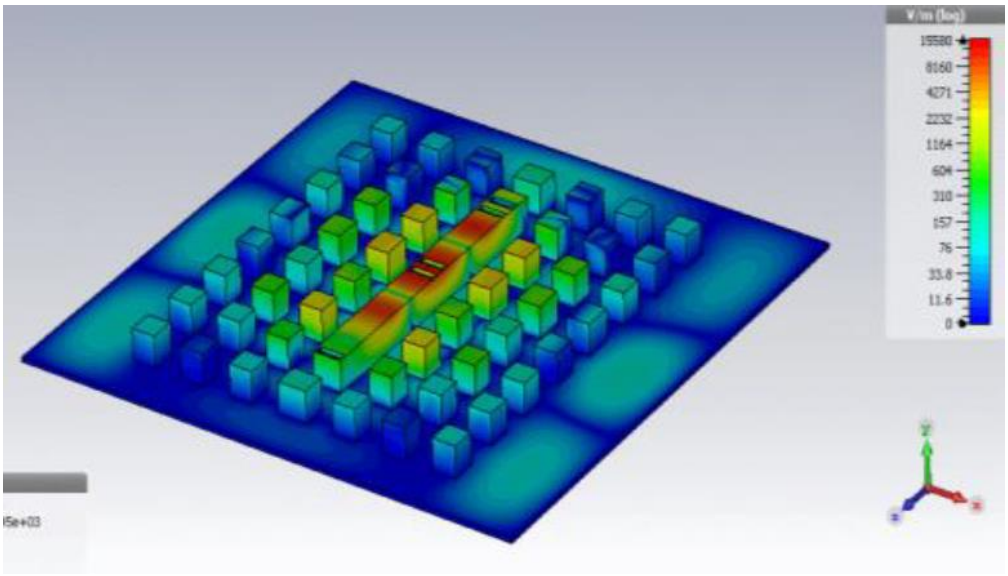
Neetirajsinh Chhasatia, Jitendra Chaudhari and Amit Patel

The E-field distribution in ridge gap waveguide filter



Reference: *Neetirajsinh J Chhasatia et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012011 https://doi.org/10.1088/1757-899X/1206/1/012011*

DESIGN AND ANALYSIS OF RELEASE MECHANISM USING SHAPE MEMORY ALLOY FOR SPACECRAFT

ICRAMEN_PAPER_36

Shrutika Dahake[1,*], Nilesh Awate[2], Rupesh Shelke[2]

[1]PG Scholar, Department of Mechanical engineering, G H Raisoni Collage of Engineering Nagpur, India

[2]Professor, Department of Mechanical Engineering, G H Raisoni Collage of Engineering Nagpur, India

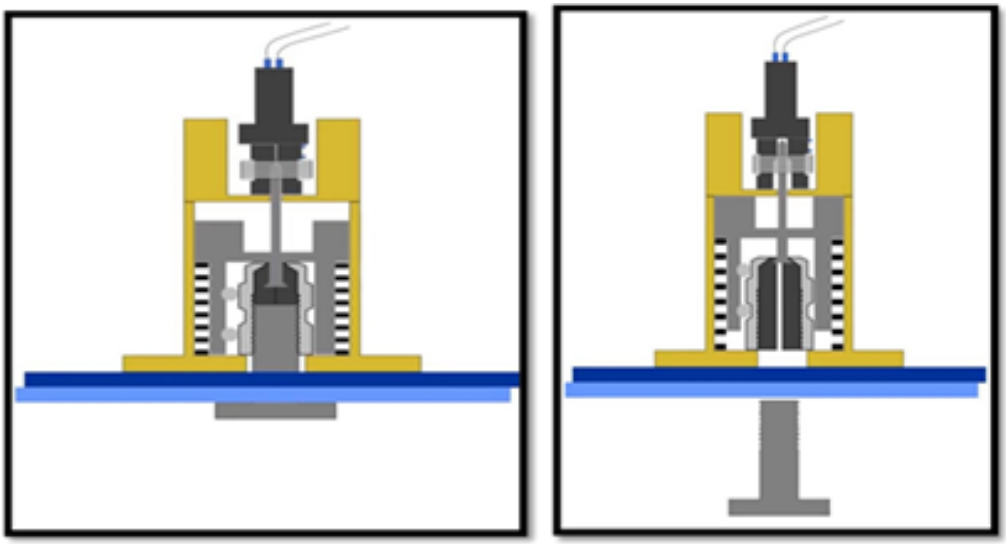
Abstract: Shape memory alloy (SMA) is used as a smart material. It is also called as Nitinol and intelligent material because it regains their original shape after deformation. It works on the principle of shape memory effect which regain their original shape after passing through different temperature phases. SMA get some more attention in incoming years due to their superior and unique properties. This paper presents design and maximum stress analysis of release mechanism using SMA. It also covers the capability and efficiency of notch bolt of Frangibolt mechanism. Its design, calculation and analysis has done in CAD software and simulation software.

Keywords: Shape Memory Alloys, Nitinol, Frangibolt, Release Mechanism

[*] *Corresponding Author Email: shrutikadahake6@gmail.com*

Shrutika Dahake, Nilesh Awate, Rupesh Shelke

Non- Pyrotechnic HDRM Before and After Actuation



Reference: *Shrutika Dahake et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012012. https://doi.org/10.1088/1757-899X/1206/1/012012*

AERODYNAMIC ANALYSIS OF AIRCRAFT MODEL USING INDIGENOUSLY DEVELOPED WIND TUNNEL FACILITY

ICRAMEN_PAPER_37

Deepesh Makhija, Sanjay Jain*, Madhusudan Achari and Kunal Ghosh

Mechanical Engineering Department, Institute of Technology, Nirma University, Ahmedabad, India

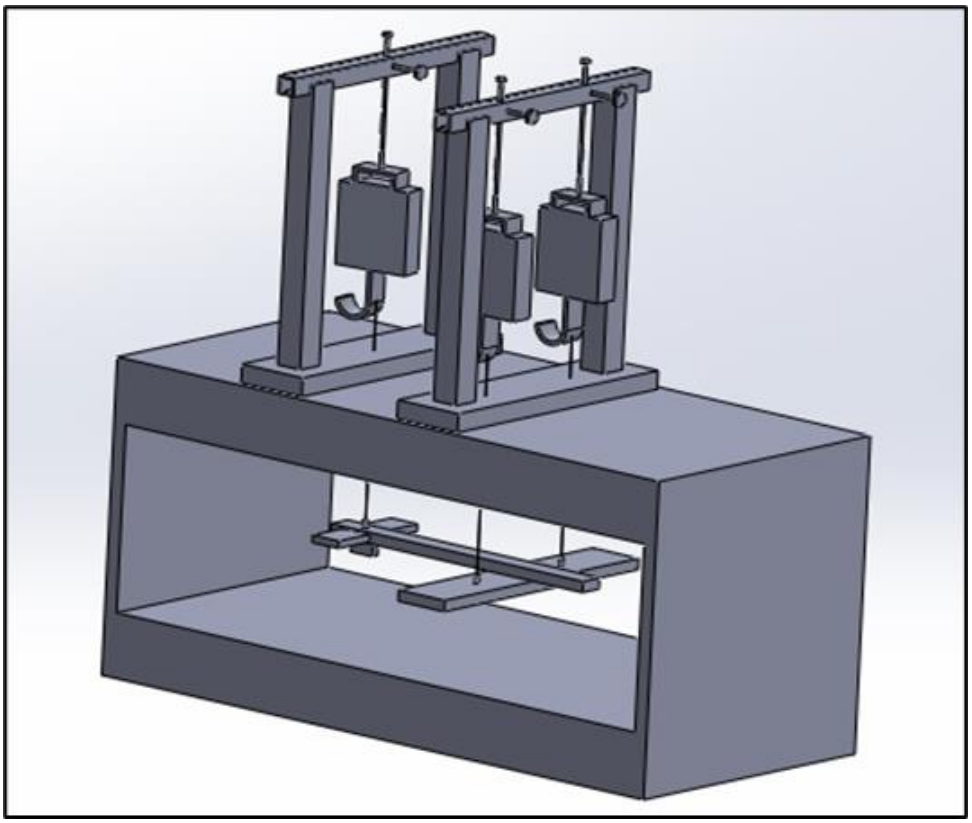
Abstract: This paper presents a design of force balance setup that can measure lift force acting on the aircraft model. The setup was developed indigenously and installed in an open circuit low-speed wind tunnel. It mainly consists of two components viz. a traverse mechanism that can hold the model in the test section at different angles of attack and air speeds and a supporting frame to hold the traverse mechanism over it. The spring balances are used to obtain lift force readings at different angles and air speeds. The experimental and numerical investigations were done in the wide range of Reynolds number (range: 0.55 to 1.12 lacks) and angle of attack (range: -6º to 20º). The results are presented in terms of pressure contours, velocity contours, pressure coefficient and lift coefficient. From the experiments it was found that value of lift coefficient increases with angle of attack and stalling occurs at 18º for all the air speeds. However, in the numerical results the stalling was observed little earlier than 18º angle of attack. The experimental results were compared with CFD results ware and an average relative error of 18% was observed which may be due to assumption of 2-D airfoil in CFD analysis.

Keywords: Aerodynamics, Aircraft, Wind tunnel

* *Corresponding Author Email: sanjay.jain@nirmauni.ac.in*

Deepesh Makhija, Sanjay Jain , Madhusudan Achari and Kunal Ghosh

3-D CAD model of the experimental setup



Reference: *D Makhija et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012013.* https://doi.org/10.1088/1757-899X/1206/1/012013

DESIGN AND ANALYSIS OF SMOKE FLOW VISUALIZATION APPARATUS FOR WIND TUNNEL

ICRAMEN_PAPER_38

Dhairya Raval, Sanjay Jain*, Madhusudan Achari and Kunal Ghosh

Mechanical Engineering Department, Institute of Technology, Nirma University, Ahmedabad, India

Abstract: In the present study, the design and analysis of smoke generator are done for the low-speed wind tunnel. The wind tunnel fan is fitted with the Variable Frequency Drive to produce the wind speed in the range of 3 to 32 m/s with fan speed of 150 to 1500 rpm. The design of smoke generator was done according to Preston Sweeting mist generator principle corresponding to the free stream velocity of 3 m/s. A controlled smoke generator consisting of kerosene reservoir, controlled heater, blower, liquid column height adjustment mechanism, valves etc. was designed and fabricated. The smoke generator produced the smoke at the rate of 154 cm^3/s which was close to the design flow rate of 149 cm^3/s. To supply the required quantity of smoke in the wind tunnel, the smoke rake of NACA 0010 profile was developed and installed in the rapid contraction section of the wind tunnel to achieve the streamlined flow. The parametric studies were done on the smoke generator at different power inputs and its effects were studied on smoke temperature, smoke discharge and boiling time of the kerosene. The flow visualization was carried out on NACA 0015 airfoil model and the images were captured to examine the flow physics around them under different operating conditions.

Keywords: NACA, Smoke flow visualization, Wind tunnel

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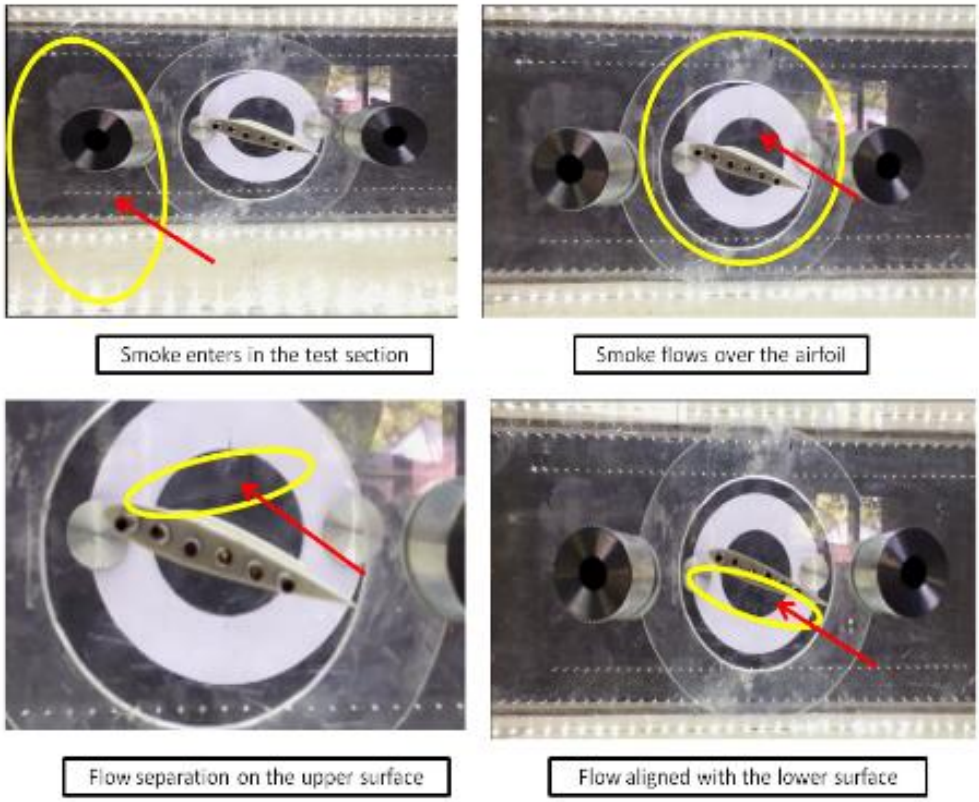
Dhairya Raval, Sanjay Jain , Madhusudan Achari and Kunal Ghosh

Flow visualization near airfoil at different time



Reference: *D Raval et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012014.* https://doi.org/10.1088/1757-899X/1206/1/012014

FREE VIBRATION ANALYSIS ON AXIALLY GRADED BEAM RESTING ON VARIABLE PASTERNAK FOUNDATION

ICRAMEN_PAPER_40

Saurabh Kumar*

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Abstract: Free vibration analysis is conducted on axially functionally graded Euler-Bernoulli beam resting on variable Pasternak foundation. The material properties of the beam and the stiffness of the foundation are considered to be varying linearly along the axial direction. Two types of boundary conditions namely; clamped and simply supported are used in the analysis. The problem is formulated using Rayleigh-Ritz method and governing equations are derived with the help of Hamilton's principle. The numerical results are generated for different material gradation parameter, foundation parameter and boundary conditions and the effect of these parameters on the free vibration behaviour of the beam is discussed.

Keywords: Functionally graded material, elastic foundation, free vibration, natural frequency

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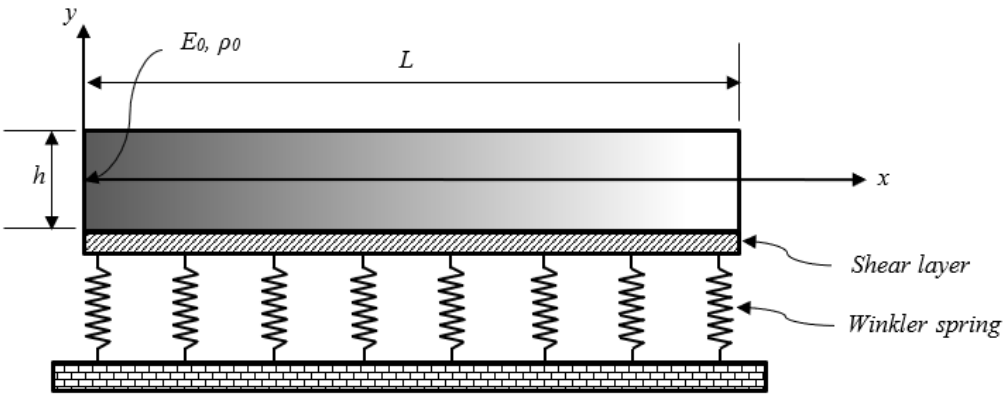
Saurabh Kumar

An axially functionally graded beam resting on two parameter elastic foundation



Reference: *Saurabh Kumar 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012016.* https://doi.org/10.1088/1757-899X/1206/1/012016

APPLICATION OF JAW TYPE FLEXIBLE CLUTCHES IN HUMAN POWERED MACHINES: A LITERATURE REVIEW

ICRAMEN_PAPER_44

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[4]Department of Mechanical Engineering, Yeshwantrao Chavan College of Engineering, Nagpur

Abstract: This article presents the topical signs of progress in the arena of an approach to articulate an experimental data-based model for jaw type flexible clutches. The developing countries are facing very acute problems of the energy crisis. It has become essential to use human energy for energizing the manufacturing process machine. This kind of machine necessitates a flexible clutch for torque transmission. Due to the intricate impact phenomenon, flexible clutches cannot be deliberate without experimental data. Therefore, the experimentation methodology and experimental setup to evaluate the performance of torque transmitted by the clutch have been augmented. It is obliging for the selection of the optimum clutch type for various applications in low powered processing machines. This proposed model can be useful for the comparative study of Jaw type flexible clutches and their transmission ability. Mathematical model and Artificial Neural Network (ANN) development are essential, to evaluate the belongings of altered components and to make forecasts about behaviour.

Keywords: Jaw Type Flexible Clutches Torque, Human Energy, and Artificial Neural Network.

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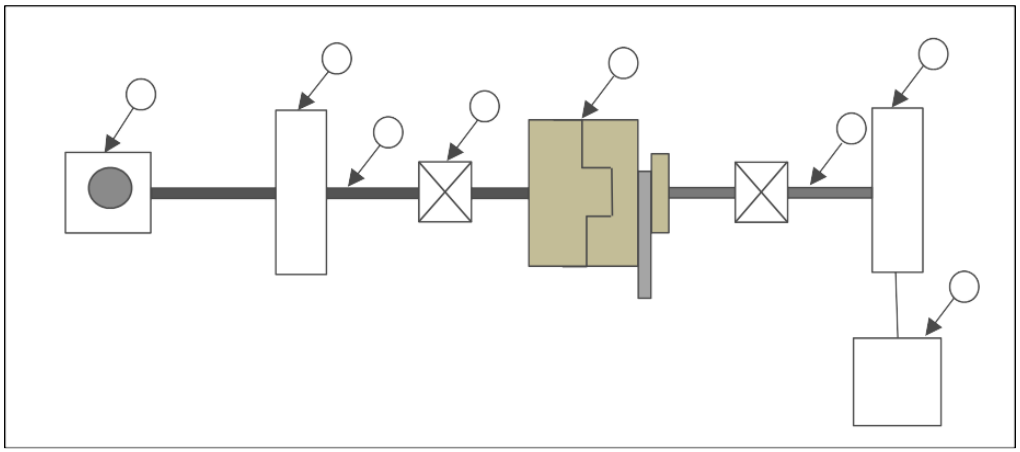
Nitin Sawarkar, K S Zakiuddin, Roshan Umate, Rajkumar Chagde

Schematic Representation of Experimental Setup



Reference: *Nitin Sawarkar et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012017. https://doi.org/10.1088/1757-899X/1206/1/012017*

FINITE ELEMENT MODEL FOR FREE VIBRATION ANALYSES OF FG-CNT REINFORCED COMPOSITE BEAMS USING REFINED SHEAR DEFORMATION THEORIES

ICRAMEN_PAPER_46

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Abstract: The present article deals with the free vibration of functionally graded carbon nanotube reinforced composite (FG-CNTRC) beams employing various refined deformation theories and validates the accuracy and feasibility of these proposed theories. The theories involved are the first order shear deformation theory (FSDT) and other refined theories involving additional higher order terms. Carbon nanotubes (CNTs) are assumed to be oriented along the axis of the beam. Uniform and three types of different functionally graded (FG) distributions of CNTs through the thickness of the beam are considered. The rule of mixture is used to describe the effective material properties of the beams. The governing equations are derived using Hamilton's principle and solved using the finite element method (FEM). A FEM code is compiled in MATLAB considering a C0 finite element. The influences of different key parameters such as CNT volume fraction, distribution type of CNTs, boundary conditions and slenderness ratio on the natural frequencies of FG-CNTRC beams are investigated. It can be concluded that the above-mentioned parameters have significant influence on the free vibration of the beam and the accuracy of the proposed refined theories is good.

Keywords: carbon nanotube, finite element method, functionally graded carbon nanotube reinforced composite, shear deformation theories

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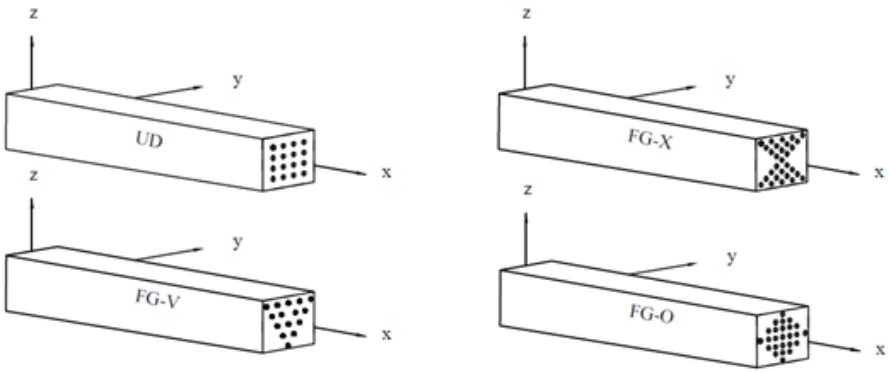
Surojit Biswas and Priyankar Datta

Configurations of the FG-CNTRC beams



Reference: *Surojit Biswas and Priyankar Datta 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012019*. https://doi.org/10.1088/1757-899X/1206/1/012019

STRESS-STRAIN DISTRIBUTION IN INTACT L4-L5 VERTEBRAE UNDER THE INFLUENCE OF PHYSIOLOGICAL MOVEMENTS: A FINITE ELEMENT (FE) INVESTIGATION

ICRAMEN_PAPER_51

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Abstract: This study is aimed at finding the stress and strain distribution in functional spinal unit of L4-L5 occurring due to physiological movements under five loading conditions, namely compression, flexion, extension, lateral bending and torsion. To this purpose, 3D finite element (FE) model has been generated using 4-noded unstructured tetrahedral elements considered both for bones and intervertebral disc, and 1D tension-only spring elements for ligaments. The analyses were performed for a compression load of 500 N and for other load cases, a moment of 10 Nm along with a preload of 500 N was applied. The model was validated against in-vitro experimental data obtained from literature and FE analysis data for a range of motion (RoM) corresponding to various loading conditions. The highest stress was predicted in the case of torsion though the angular deformation was highest in case of flexion.

Keywords: Lumbar spine, finite element analysis, ligaments, stress development, strain, range of motion, functional spinal unit

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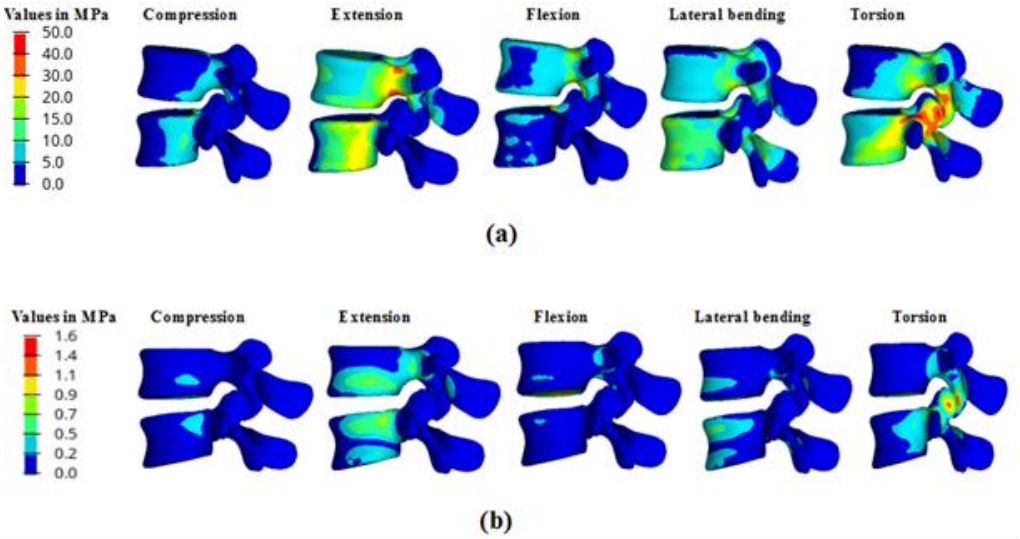
Devismita Sanjay, Neeraj Kumar and Souptick Chanda

Von Mises stress contours: (a) cortical bone and (b) cancellous bone



Reference: *Devismita Sanjay et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012024. https://doi.org/10.1088/1757-899X/1206/1/012024*

NUMERICAL SIMULATION AND PARAMETRIC ANALYSIS OF FATIGUE CRACK IN UIC60 RAIL THERMITE WELDED JOINT

ICRAMEN_PAPER_54

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[2]Professor, Mechanical Engineering Department, O.P. Jindal University Raigarh, India

[3]Department of Mechanical & Industrial Engineering, IIT Roorkee, India

Abstract: The mechanism of rail-wheel contact is the most essential field of study in railway engineering since it requires extensive application expertise, diagnostic skills, and a trustworthy analysis technique. In this research the fatigue life of a UIC60 rail AT weld under vertical load and its parametric effect has been studied, and for that a three-dimensional elastic-plastic finite element model is created using ANSYS space-claim software, and then finite element method is employed to analyse the full-scale model of wheel-track and weld system with realistic three-dimensional solution. Model assembly components include axle, wheel, and thermite-welded rail. Simulation of contact between wheel and UIC60 rail weld with crack on weld at angles of 30 and 60 degrees with different coefficients of friction between the weld wheel contact and between crack surfaces was carried out under vertical loadings. In general, the Hertz contact theory assumptions are taken into consideration throughout the analysis, and the impacts on fatigue life are given by using damage mechanics method. The results of the wheel/weld fatigue crack analysis have been displayed to demonstrate the influence of different parameters on the fatigue life of cracks. The purpose of this study is to identify and safeguard the rail against failure, as well as to ensure the safety of passengers and to reduce the cost of maintaining the rail system.

Keywords: Railway, fatigue, crack, FEM, ANSYS

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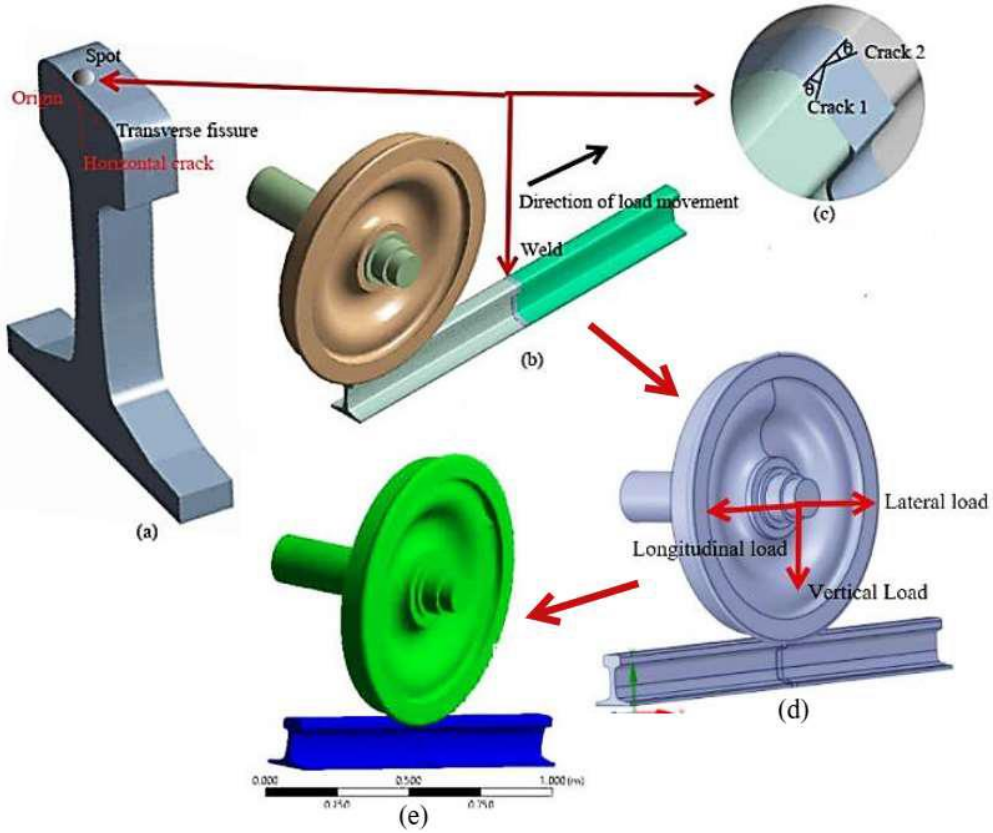
Prakash Kumar Sen, Mahesh Bhiwapurkar and S P Harsha

(a) AT weldment crack position (b) Rail weld with wheel assembly (c) weld part having crack positions (d) Loading conditions (f) simulation view of wheel contact on weldment



Reference: *Prakash Kumar Sen et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012027*. https://doi.org/10.1088/1757-899X/1206/1/012027

TRACK 2

Material Science and Nanomaterials

STUDY OF EFFECTS OF WEATHERING ON NATURAL FIBRE COMPOSITES

ICRAMEN_PAPER_12

Satadru Kashyap* **, Debanil Das**

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Abstract: Composite materials are known to have many advantages and they can be used in the manufacture of a wide variety of products which make them commercially valuable. However, they may come into contact with various conditions that might lead to weathering. Weathering might lead to discoloration, decrease in durability, decline in mechanical properties and decrease in mass in composites. Hence, it is paramount to study the effects of weathering on composites before they are used in service. For this study, wood polyester composite (WPC), jute polyester composite (JPC) and coir polyester composite (CPC) were fabricated and subjected to four weathering tests - water ageing test at room temperature, water immersion test at 100°C, exposure to external environment and exposure to UV rays. It was seen that CPC samples subjected to water ageing at room temperature and immersion at 100°C showed comparatively higher water absorption rate than the WPC and JPC samples as coir fibres in CPC are hollow at the centremost region. JPC and CPC also turned whitish after 24 hours of water ageing. However, exposing the samples to the environment for a period of 144 hours did not show any significant change in the sample. It was also found that the tensile strength of all the composites decreased after being exposed to UV rays in a QUV spray weathering tester. Additionally, the mechanical properties of the composites were also modelled with analytical techniques (Halphin Tsai method) and FEM analysis and the results were found to be analogous.

Keywords: Natural fibre, Composites, Polyester Resin, Weathering, Mechanical Properties

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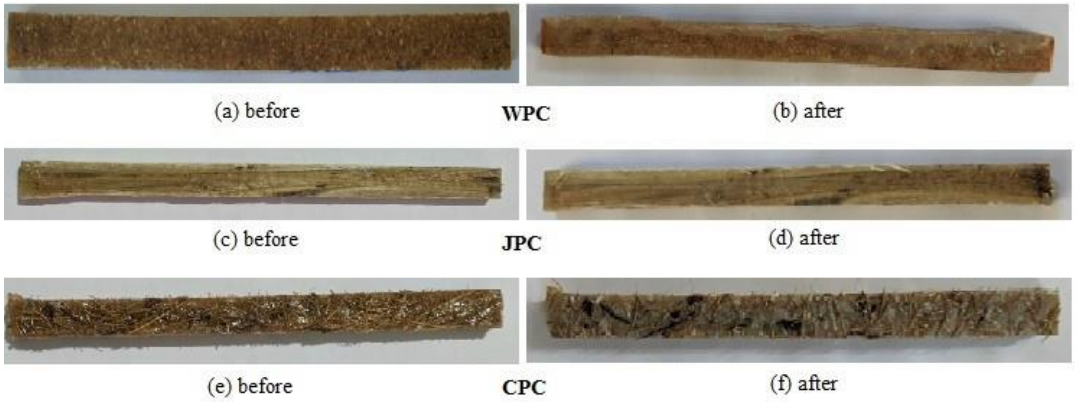
Satadru Kashyap, Debanil Das

Before boiling water ageing and after boiling water ageing images of (a-b) WPC, (c-d) JPC, (e-f) CPC samples



Reference: *Satadru Kashyap and Debanil Das 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012002*. https://doi.org/10.1088/1757-899X/1206/1/012002

MECHANICAL CHARACTERIZATION OF TIO2 NANOPARTICLES BASED ON GLASS FIBRE REINFORCED POLYMER COMPOSITE

ICRAMEN_PAPER_28

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Madan Mohan Malaviya University of Technology, Gorakhpur, Uttar Pradesh, India

Abstract: Nanotechnology has become the best truly developing innovation in the field of engineering science. Numerous examinations have been completed by different exploration researchers in the prior many years. In my examination work research, the impact of cross breed E-glass built up fibre with epoxy nanocomposite. The nanocomposite covers overlays were set up by hand layup procedures by shifting layers of Titanium Dioxide (TiO2) nanoparticles of 6% individually. The nano added substances are utilized to improve the strength from destroy opposition, hardness of the polymer composite and high strength to weight ratio. The nanocomposite laminates this prepared are characterized by the compression and flexural test. The flexural properties of the glass fiber built up plastic improved with expansion of nanoTiO2 filler particles. At 6wt% of TiO2 and having 12 layers the force at yield is 327.99N and bending stiffness 63.11 N/mm and in 9 layers force at yield is 149.06 and bending stiffness 36.22 N/mm. True interfacial bonding b/w the fiber and epoxy turned into the primary motive for reaching higher flexural properties.

Keywords: Nanoparticles, flexural strength, compression test, E-glass fiber, hand lay-up

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Abhishek Singh and S.C Jayswal

Compression and Flexural Sample

Fig- Compression sample A

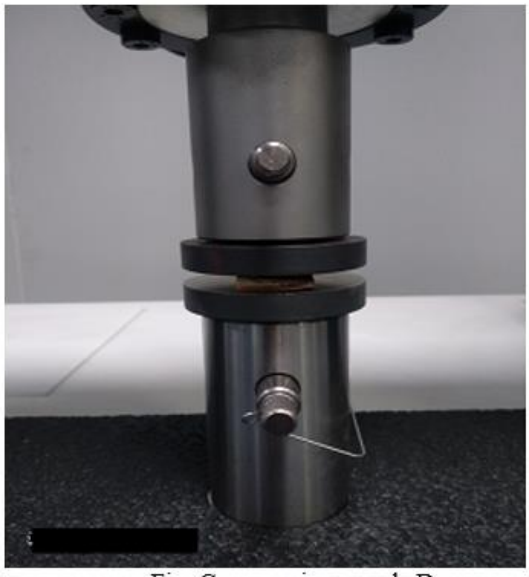

Fig- Compression sample D

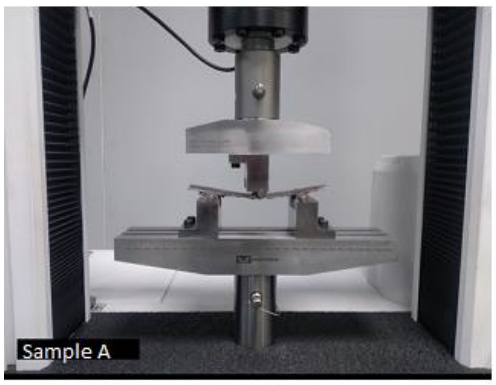

Fig- flexural sample A

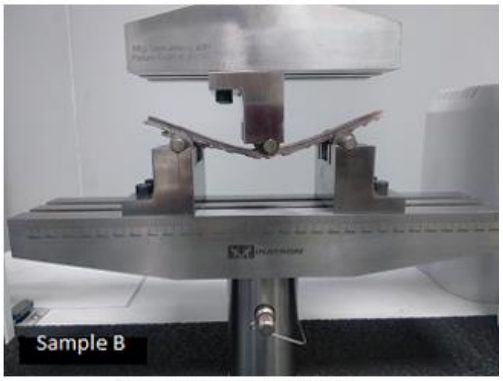

Fig- flexural sample B

Reference: *Abhishek Singh and S. C. Jayswal 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012006. https://doi.org/10.1088/1757-899X/1206/1/012011*

ENHANCING ELECTRICAL PROPERTIES OF CARBON NANOTUBES THIN FILMS BY SILICON INCORPORATION

ICRAMEN_PAPER_30

Sk Faruque Ahmed[1,*], Mohibul Khan[1] and Nillohit Mukherjee[2]

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[2]Centre of Excellence for Green Energy and Sensor Systems, Indian Institute of Engineering Science and Technology, Howrah 711103, India

Abstract: Silicon incorporated carbon nanotube (Si-CNTs) thin films was prepared by radio frequency plasma enhanced chemical vapor deposition technique. Tetraethyl orthosilicate solution was used for incorporation of silicon in CNTs thin films. Energy dispersive X-ray analysis shows that the silicon atomic percentage was varied from 0 % to 6.1 %. The chemical binding energies of carbon and silicon were analysed from X-ray photoelectron spectroscopy data. The various peaks at ~531 eV, ~ 285 eV, ~155 eV and ~104 eV was observed in the XPS spectra due to the oxygen, carbon and silicon respectively. Surface morphologies of Si-CNTs thin films have been analysed by field emission scanning electron microscopy, which revels that the length of the silicon incorporated carbon nanotubes ~500 nm and corresponding diameter ~80 nm. The room temperature electrical conductivity was increased whereas the activation energy was decreased with the increase of atomic percentage of silicon in Si-CNTs thin films. The room temperature electrical conductivity was increased from 4.3 x 103 to 7.1 x 104 S cm-1 as the silicon atomic percentage in Si-CNTs thin films increases from 0 to 6.1 % respectively.

Keywords: Carbon nanotubes, RF-PECVD Technique, Silicon incorporation, XPS, Electrical conductivity

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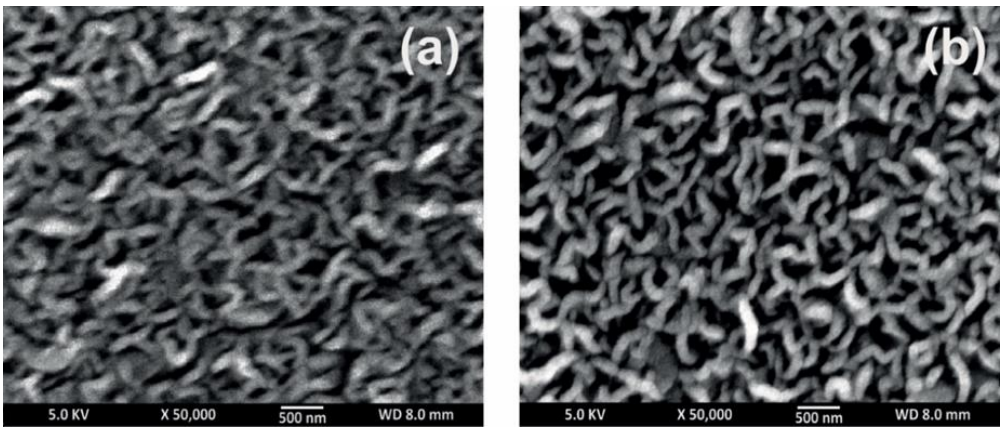
Sk Faruque Ahmed, Mohibul Khan and Nillohit Mukherjee

FESEM micrograph of (a) pure CNTs thin films and (b) 6.1 atomic percent silicon incorporated CNTs thin films.



Reference: *Sk Faruque Ahmed et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012028. https://doi.org/10.1088/1757-899X/1206/1/012028*

EXPERIMENTAL ANALYSIS USING AN INNOVATIVE CATALYTIC CONVERTER COATED WITH NANO-PARTICLES FOR POLLUTION CONTROL FROM AUTOMOBILES

ICRAMEN_PAPER_33

Dr. Mukesh Thakur[1,*], and Dr. Rohan Senanayake[2]

[1]Principal, NMDC DAV Polytechnic, Dantewada (C.G.), India.

[2]Associate Professor, Lincoln University, Malaysia

Abstract: Air pollution control has become the area of interest due to the ever-increasing air pollution problem from the automobiles. Several researchers have conducted several experiments to control the air pollution concentration from automobiles by using several techniques but this area has a wide scope for improvement. This research paper is based on an experiment conducted on a Four Stroke Spark Ignition engine test rig using an Innovative catalytic converter which was coated with nano-particles to estimate its effectiveness in air pollution control. The results of the experiment conducted clearly indicate that the Innovative design of catalytic converter is effective in air pollution control from automobiles.

Keywords: Automobiles, catalytic converter, nano-particles, pollution

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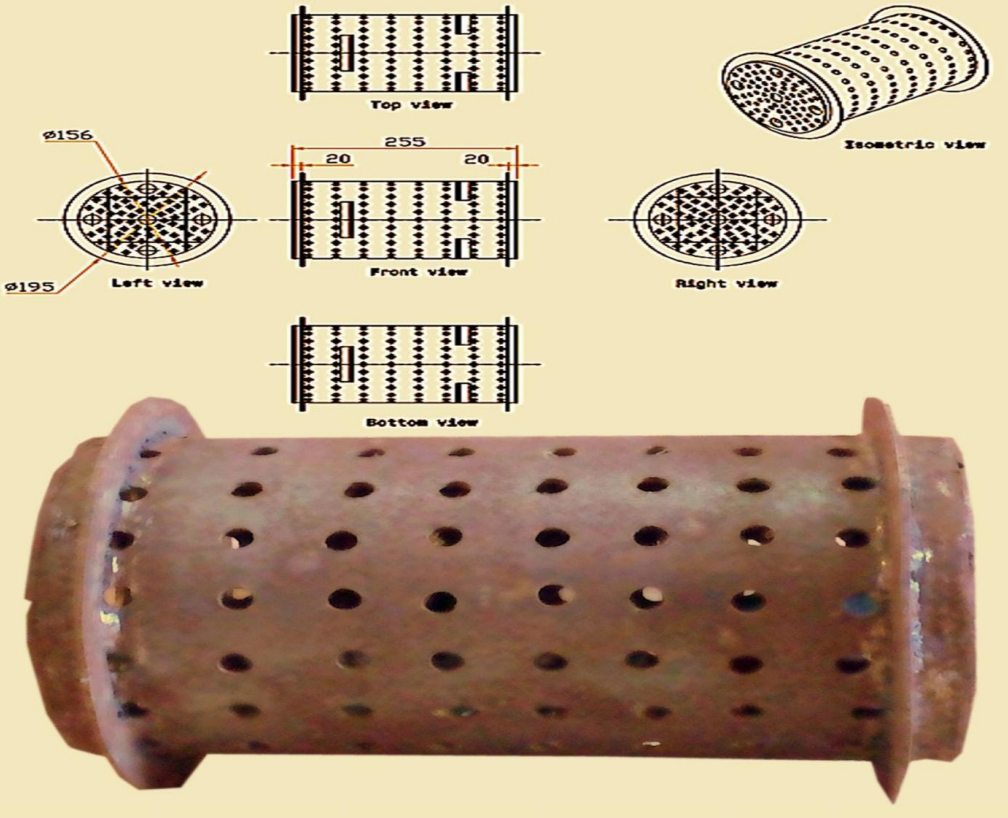
Dr. Mukesh Thakur, and Dr. Rohan Senanayake

Innovative Catalytic Converter



Reference: *Mukesh Thakur and Rohan Senanayake 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012009*. https://doi.org/10.1088/1757-899X/1206/1/012009

2-DIMENSIONAL INLINE SYSTEM FOR PEPPERMINT OIL EXTRACTION

ICRAMEN_PAPER_39

Mohd. Anas and Anurag Sharma*

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Abstract: Peppermint leaves have wide range of applications in medicines, toothpastes, soaps, mouth fresheners, chewing gums etc. However, in India, the traditional way of processing peppermint leaves for extraction of peppermint oil is slow, tedious, labour intensive, hazardous, and causes skin problem as well. This paper proposes a method of mechanizing the post harvesting process, with least modification in the current apparatus being used by the farmers in the Indian villages. It proposes a non-electric 2-dimensional Mechanized system for movement and compaction of the compact/ hay. The mechanism will help to reduce the number of labourers per unit hay volume and the risk associated with the contact of in-process hay with their skin. Also, a lot of time is wasted in putting the leaves/ hay in the boiler vessel, preparing the hay in a compact form and in removing the processed leaves. This paper is an attempt to get rid of most of the problems aforementioned and make the process safe, efficient, less labour intensive and more economical for farmers and workers. The mechanism proposed is sustainable and farmer friendly as it does not require any special training for its operation. It will increase the profit of small-scale industries with small capital investment for the setup.

Keywords: Extraction, Inline system, Manual, Mechanization, Menthol, Peppermint oil, Rural technology.

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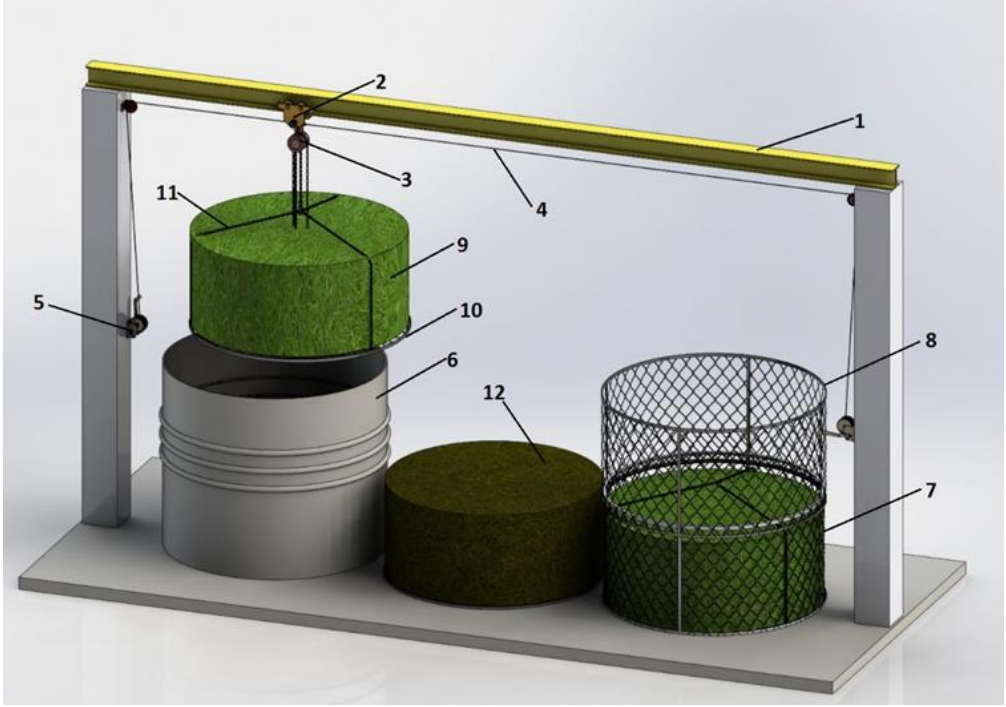
Mohd. Anas and Anurag Sharma

Details of proposed plant components



Reference: *M Anas and A Sharma 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012015. https://doi.org/10.1088/1757-899X/1206/1/012015*

INVESTIGATION OF SUBSTITUTE JAR MATERIALS FOR LABORATORY GRADE BALL MILLING MACHINE TO PROCESS ELECTRODE MATERIALS FOR ENERGY STORAGE DEVICES

ICRAMEN_PAPER_45

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[3]Dept. of Mechanical Engg., Northwestern University, IL, USA

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Abstract: Copious forms of energy are available in nature, but electrical energy is the convenient form of energy. As a result of this, it is expected that the need for electrical energy will increase considerably by the end of this decade. Thus, the storage of electrical energy is now becoming of paramount importance. Nevertheless, Ultra-capacitors are currently cardinal area of research for energy storage devices due to their high-power density rating, short charging time and long cycling time. The capacitance of Ultra-Capacitor is majorly result of processing of its electrode materials. Ball Milling is one of the most gainful and cost-effective process of electrode material processing. However, in most of the of ball milling researches focal point is on materials used for balls in ball milling it is also observed that the material used to produce ball mill jars is of equal momentousness. So, this research aims to examine various materials as jars for a ball milling machine.

Keywords: Ultra-Capacitors, Capacitance, Ball Milling, Power density, Energy, Jars.

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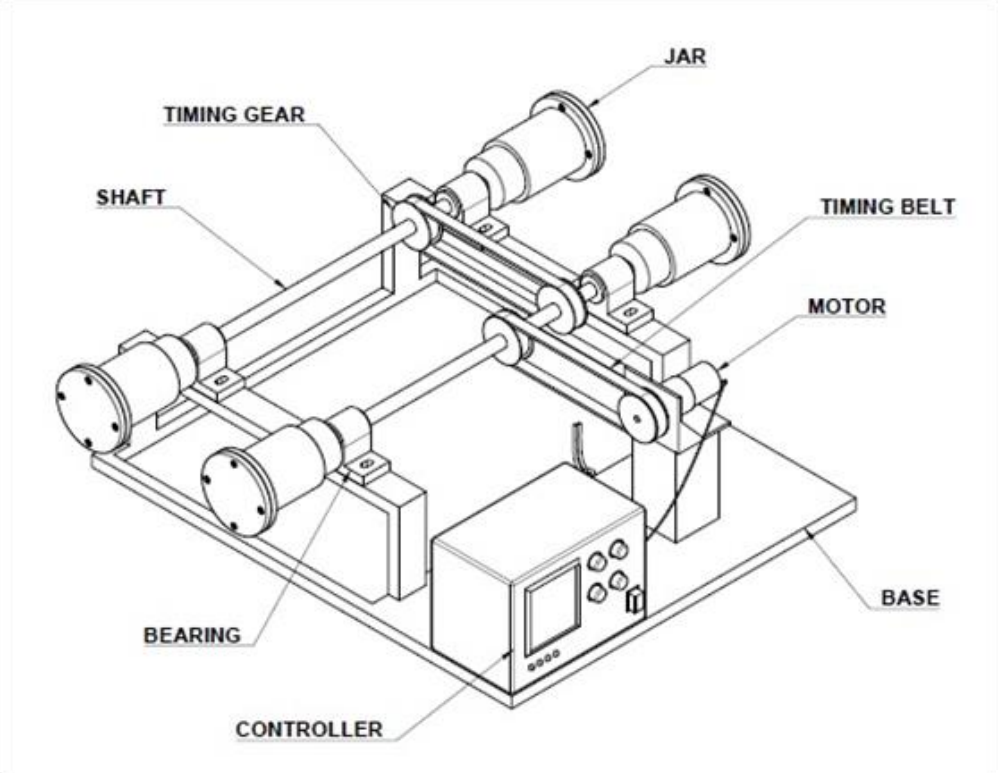
Sourabh Shinde, Taukir Momin, Vispi Karkaria, Parshuram Karandikar

Laboratory grade ball milling machine



Reference: *Sourabh Shinde et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012018. https://doi.org/10.1088/1757-899X/1206/1/012018*

A REVIEW OF WEAR RESISTANCE MATERIALS USED IN POWER-SCREW MECHANISM FOR AEROSPACE APPLICATIONS

ICRAMEN_PAPER_47

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[2]Assistant professor and Head CTAT, Department of Mechanical Engineering, the National Institute of Engineering, Mysore, India

Abstract: In today's industrial requirement, good wear-resistant materials with the same or better mechanical properties are the need of the hour. In the present paper, an actuator that is used to lift the load is under study. It uses a linear actuation mechanism involving a screw-like motion to lift the loads. It employs stainless steel of high quality. Since there are various types of wearing involved in the system, the choice of the materials becomes the prime factor for determining the maintenance cost and the cycle life of the actuator. There are many research advances made in this field which provides us with the best type of material for its particular type of job. The present paper discusses the materials that could be substituted in place of the existing material choice i.e., in place of AMS5659 and aluminum-bronze. The two materials stated above are known for their superior wear handling and excellent mechanical properties.

Keywords: AMS 5659, Aluminium bronze, wear resistance materials.

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Comparison of properties of various Non-metals

Material	Maximum service temperature (^{0}F) (oxidising conditions)	Room temperature hardness (Knoop)	Melting point (^{0}F)
Diamond	1500	7000	1800 (carbonizes)
TiB_2	1800	2700	5250
ZrO_2	4200	-	4850
WC	1200	1880	4770
BeO	4300	1220	4660
TiC	1800	2460	5660 (sublimates)
BC	1800	2800	4430
SiC	1750	2500	4160
Al_2O_3 (dense)	3500	2000	3720
Cr_3C_2	-	-	3600
Cr-Mo-Al_2O_3 cermet	2300	50 RC	3360 (approx.)

Reference: *KS Ujjwal and N Sharath Chandra 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012020. https://doi.org/10.1088/1757-899X/1206/1/012020*

ANALYSIS OF ELECTROMAGNETIC REFLECTION LOSS FOR MESH STRUCTURE WITH AL6061 MMC FOR AEROSPACE APPLICATIONS

ICRAMEN_PAPER_48

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Abstract: One of the major problems facing by the aircraft was a lightning strike. To overcome this problem, fiber-reinforced materials have been used. The fiber-reinforced materials have less conductivity. These fiber-reinforced materials can't eliminate the lightning strike effect. For that purpose, the metal matrix composite materials significantly impacted the aircraft's internal circuits and physical components from the lightning strike effect. To meet industries dynamic and ever-increasing demands, Al6061 metal matrix composite reinforced with fly ash must be utilized to build the aircraft to offer HIRF. The material thickness should be kept low as possible then it can be used to cover the plane's surface. To prevent lightning strikes, it might be used to protect electronic components from a concentrated high-intensity radiated field, primarily in Aeroplan configuration. The electromagnetic characteristics of composites are measured using the X-band for normal incidence. The electromagnetic reflection properties of AL6061 reinforced with fly ash are studied in this study for mesh structure. MAT-LAB Software was used to calculate the maximum reflection loss of 33.88dB for 15% fly ash and 85 percent AL6061 at X-band.

Keywords: High intensity radiated fields, AL6061, Reflection, Fly ash, lightning strike, Fiber-reinforced plastic composites.

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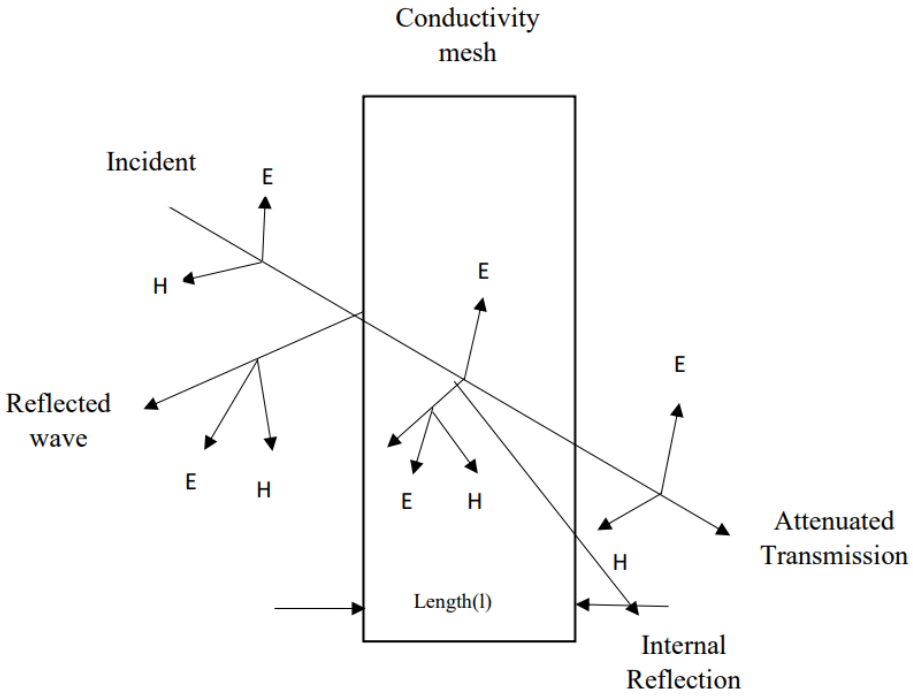
Siva Chakra Avinash Bikkina, P.V.Y. Jayasree

Electromagnetic signal represented with reflection and transmission for normal incidences



Reference: *Siva Chakra Avinash Bikkina and P.V.Y. Jayasree 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012021. https://doi.org/10.1088/1757-899X/1206/1/012021*

ELECTROMAGNETIC SHIELDING EFFECTIVENESS FOR AL6061 METAL MATRIX COMPOSITE BASED MESH WIRE REINFORCED WITH FLYASH FOR OBLIQUE INCIDENCE OF EM WAVE

ICRAMEN_PAPER_52

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[2]Andhra university, Visakhapatnam, Andhra Pradesh, India

Abstract: Nowadays, flywire is used exclusively in aeronautical applications. A plane's complete control is dependent on electronic technology, yet it suffers from high-intensity radiated fields. An electromagnetic shield may be necessary to protect this equipment from external electromagnetic pollution. The current project attempts to create a protective barrier around the operating equipment to enhance its efficiency. AL6061 composite material was used to create a metal matrix mesh shield. It is reinforced with fly ash in various volume fractions, and the electrical characteristics and Shielding Effectiveness are determined (SE). The maximum SE is 45.36dB obtained, which can be effectively used as a shield for aerospace and other applications.

Keywords: Shielding effectiveness, Reflection loss, reinforcement, Flyash, oblique incidence.

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Srinu Budumuru, M. Satya Anuradha

Stir casting equipment for reinforcement of flyash with Al6061

Reference: *Srinu Budumuru and M. Satya Anuradha 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012025. https://doi.org/10.1088/1757-899X/1206/1/012025*

RELIABILITY FAILURE IN MICROELECTRONIC INTERCONNECTS BY ELECTRIC CURRENT INDUCED CHEMICAL REACTION

ICRAMEN_PAPER_53

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[2]Materials Engineering, Indian Institute of Science, Bangalore

Abstract: The electric field-induced chemical reaction in Cr thin film by a micro/ nano-probe has been recently reported with detailed characterization. Although the phenomenon is employed for micro-nano fabrication, this can act as a reliability failure, where Cr is used as an adhesion layer or main interconnects in microelectronic circuits. Here, we present an investigation on the role of electric current density for such failure using a specifically designed sample. A 100 µm width and 100 nm thin Cr film is deposited perpendicular to the Pt film of similar dimensions. The anode probe (20 µm diameter) is positioned onto the Pt film, whereas the cathode probe onto the Cr film. It is observed that the chemical reaction, for an applied voltage, initiates at the edge of the Pt film and not at the cathode probe. The analysis based on the COMSOL multiphysics simulation illustrates that the chemical reaction evolves at the high current density locations. The localized chemical reaction causes to damage the interconnection line. The study also builds a fundamental understanding of the mechanism of evolution of patterning by electric field-induced chemical reaction.

Keywords: Reliability failure, Electric field-induced chemical reaction, Electromigration, Micro-nano fabrication.

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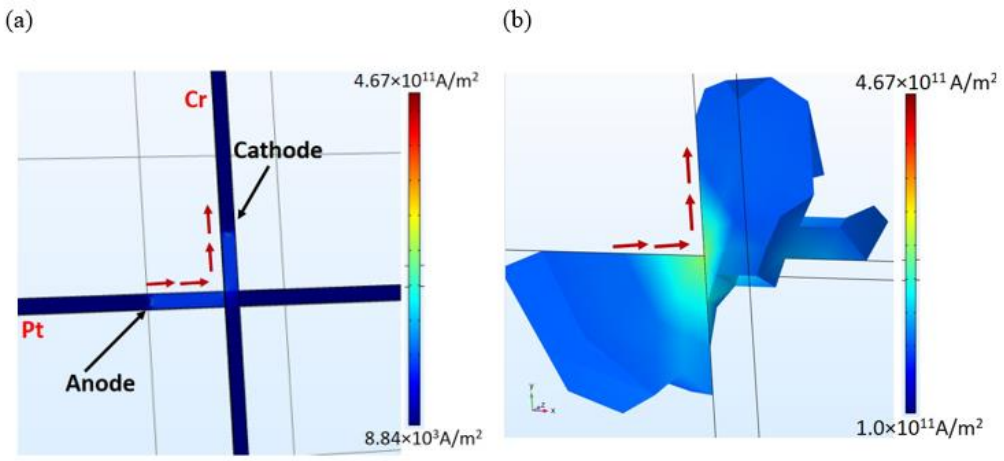
S Kumar, P Kumar, R Pratap

FEA simulation showing the (a) distribution of current density. (b) Isometric views of the model, especially focusing on the edge of Pt and Cr interaction region.



Reference: *S Kumar et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012026. https://doi.org/10.1088/1757-899X/1206/1/012026*

TRACK 3

Thermal Engineering and Fluid Science

IMPACT OF NON-CONVECTIVE ZONE AND LOWER CONVECTIVE ZONE THICKNESS ON THE PERFORMANCE CHARACTERISTICS OF SALINITY GRADIENT SOLAR POND

ICRAMEN_PAPER_18

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[3]Head & Associate Professor, Department of Mechanical Engineering, G. H. Raisoni College of Engineering, Nagpur, 440016, India

Abstract: A solar pond technology employs a layer of salinity gradient to prevent heat loss due to convection from lower convective zone. Thus, the energy received from solar radiation is stored in a lower convective zone. The thickness of various zones significantly affects the behavior of solar pond temperature. In this present study, a transient numerical investigation is conducted to evaluate the impact of different zone thickness on the performance characteristics of solar pond. The variation in maximum temperature and maturation period under the influence of non-convective zone and lower convective zone thickness is discussed. The energy obtained from solar pond is significantly depends on various losses associated with the zones. Thus, an assessment of conduction and ground heat loss is presented for the variation in thickness of zones. An attempt is also made to study the effect of thickness of zones on temperature of lower convective zone.

Keywords: Salinity Gradient Solar Pond, Conduction heat loss, Ground heat loss, Maturation time

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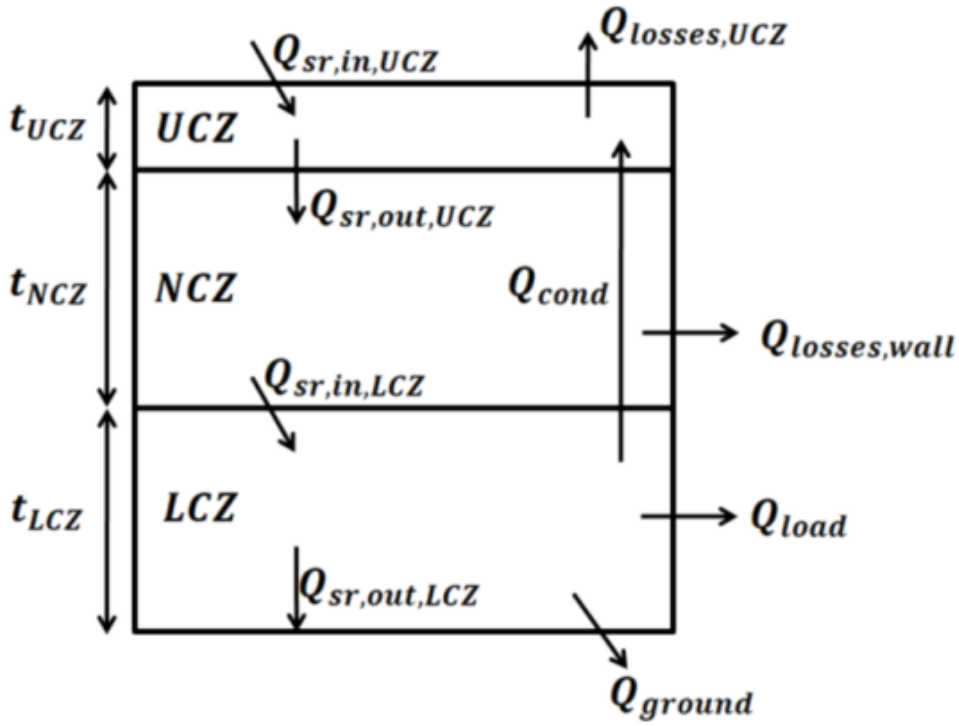
S G Chakrabarty, U S Wankhede and R S Shelke

Schematic diagram exhibiting different zones of solar pond



Reference: *S G Chakrabarty et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012003. https://doi.org/10.1088/1757-899X/1206/1/012003*

ANALYSIS ON PHYSICAL PROPERTIES OF MICROPOLAR NANO FLUID PAST A CONTINUOUSLY MOVING PERMEABLE PLATE

ICRAMEN_PAPER_24

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[2]PG & Research, Department of Mathematics, Loyola College, Chennai, India

Abstract: The present work gives out the computational analysis of heat and mass transfer effect of micropolar nanofluid flow. In the flow model the fluid viscosity is taken as temperature-dependent and varies linearly and the other physical properties such as radiative heat flux, the magnetic field, the viscous dissipation, chemical reaction are also considered in the energy equation and spices concentration equation respectively The PDEs governing the flow have been changed into a framework of dimensionless ODEs and explained mathematically through the 4th order R-K and NS shooting technique. Fluid properties such as velocity, angular velocity, temperature, and concentration are analyzed graphically for a range of solid volume fraction ($0<\phi<2$) of nano-solid particles.

Keywords: MHD, Nanofluid, Boundary layer, Micropolar, heat transfer, and mass transfer

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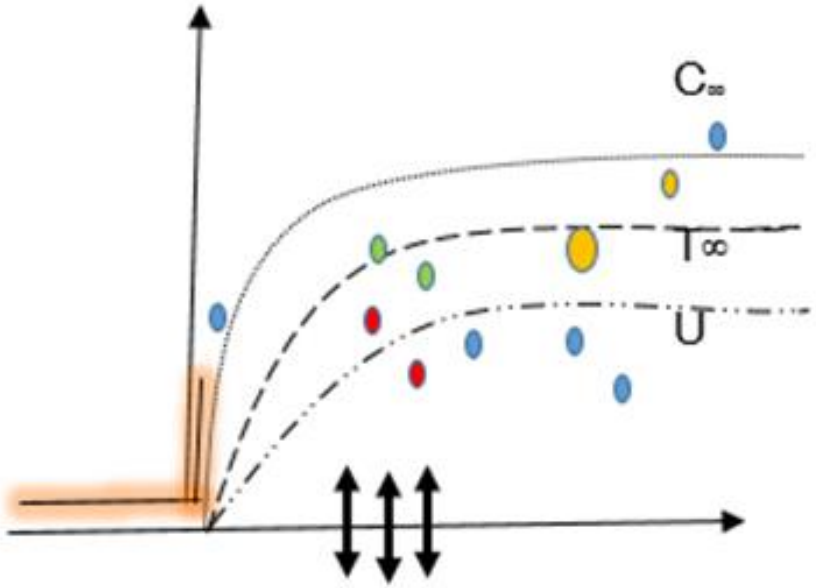
N Golden Stepha and D Kavin Jacob

Flow Model



Reference: *N Golden Stepha and D Kavin Jacob 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012004. https://doi.org/10.1088/1757-899X/1206/1/012004*

GREEN HYDROGEN ECONOMY AND OPPORTUNITIES FOR INDIA

ICRAMEN_PAPER_27

Ujwal Sontakke*, Santosh Jaju

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Abstract: With increasing numbers of vehicles on roads, India is facing the issue of large vehicular emissions. The burning of crude oil is the major issue behind these emissions. India doesn't have enough resources to fulfill all the energy demands of vehicles and hence, imports crude oil from oil-rich countries. To tackle the issues associated with oil imports and vehicular emissions, there is a need to search for carbon-free alternate fuel that is available locally in sufficient quantity to meet India's energy demands. The green economy is a new concept evolving and gaining attention worldwide, the concept focuses on sustainable and environmentally friendly solutions. Hydrogen is such a carbon-free fuel that can help to achieve the targets of the green economy and the best means to store energy for a long time. Hydrogen is a high energy content fuel and has about zero greenhouse gas emissions when used in fuel cells. Hydrogen is not directly available in free form, but it can be produced using electrolyzers and various other techniques. India's continuously growing renewable power generation capacity gives the advantage to produce hydrogen from green sources like solar, and wind at the time of lower demand. The present review work focuses on the opportunities for India in green hydrogen production as the adaption of green hydrogen offers many benefits to India including energy security, and decarbonizing the transport sector.

Keywords: Green Hydrogen, Green Economy, Fuel Cell, Energy Security, Alternate fuels, Renewable Energy

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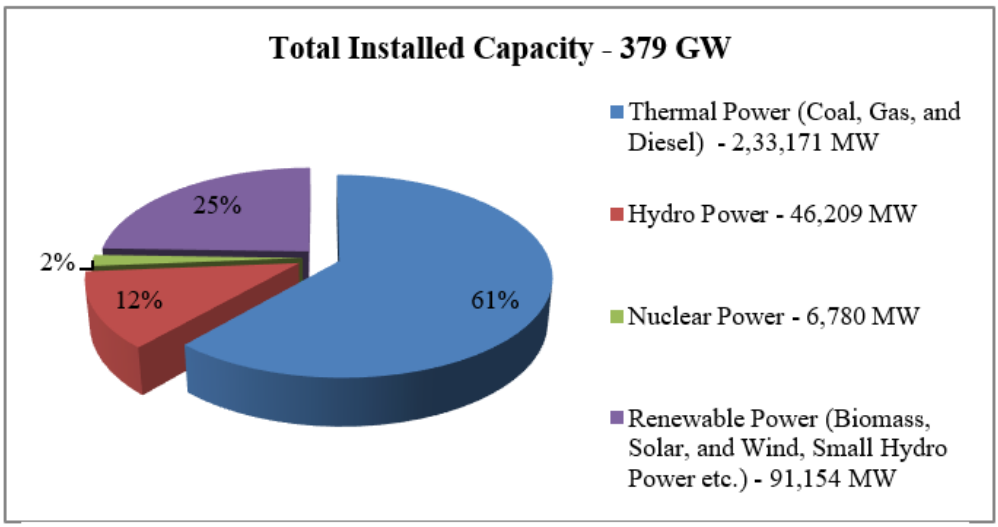
Ujwal Sontakke, Santosh Jaju

India's total installed power capacity from various renewable and non-renewable sources



Reference: *Ujwal Sontakke and Santosh Jaju 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012005. https://doi.org/10.1088/1757-899X/1206/1/012005*

SIMULATION-BASED STUDY OF GRAPHENE-WATER NANOFLUID FLOW THROUGH MICROCHANNEL HEATSINK

ICRAMEN_PAPER_31

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[2]Principal Scientist, Department of Surface Engineering and Tribology, CSIR-Central Mechanical Engineering Research Institute, Durgapur, West Bengal 713 209, India

Abstract: This study presents a CFD analysis of the laminar flow of graphene-water nanofluid through a Silicon microchannel heatsink using commercial software ANSYS FLUENT. The microchannel has a rectangular cross-section of given dimensions, and the base of the heatsink is subjected to a constant heat flux. Simulations of the coolant flow are performed at different fluid inlet velocities for nanoparticle concentrations of 0%, 3% and 6% in the base fluid- Water. Results for temperature and pressure distributions in the microchannel heatsink are presented. The cooling performance of the MCHS improves significantly by increasing the flow velocity and enhancing the nanoparticle concentration in the coolant.

Keywords: microchannel, nanoparticle, base fluid, thermal conductivity, cooling

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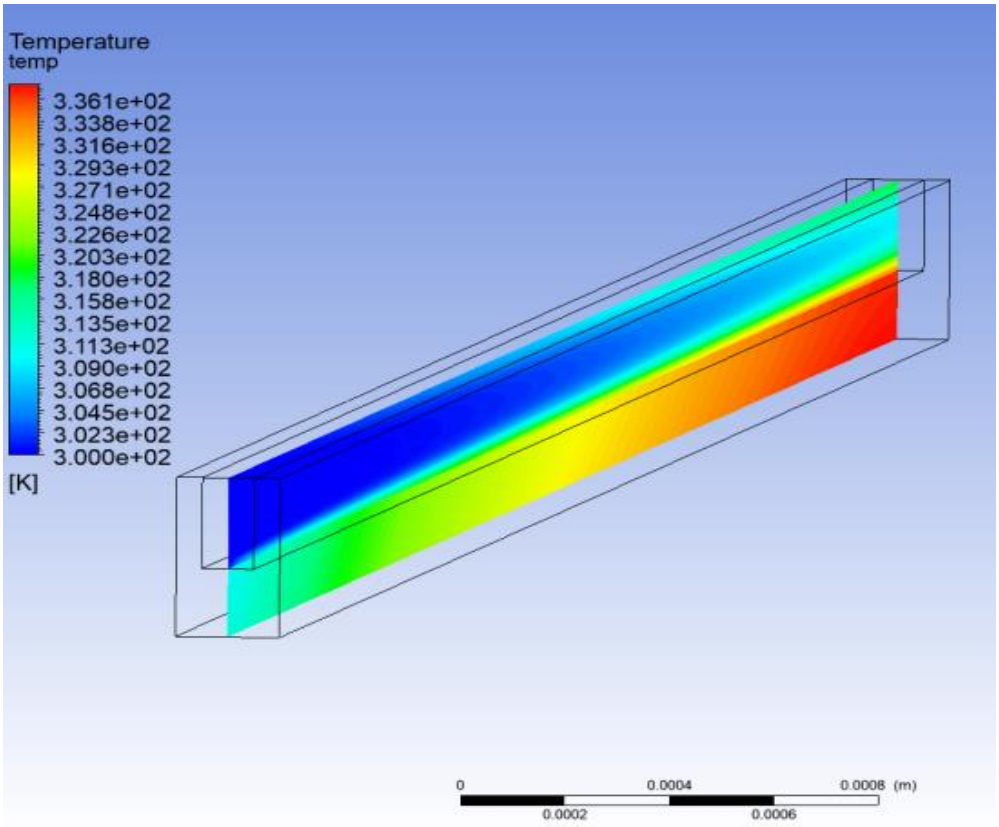
Temperature Distribution at inlet velocity 1.3 m/s using Water



Reference: *Ritwik Bhattacharya and Pranab Samanta 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012008. https://doi.org/10.1088/1757-899X/1206/1/012008*

ECONOMICS-BASED PAYBACK AND LIFE CYCLE COST SAVINGS ASSESSMENT OF INVERTER TYPE AIR CONDITIONERS

ICRAMEN_PAPER_50

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Department of Mechanical Engineering, Delhi Technological University, Delhi-110042, India.

Abstract: This paper investigates the options for a consumer to choose between different inverter and non-inverter type residential air conditioners (ACs) concerning their payback periods and Life Cycle Cost savings. The economics-based analysis carried out to evaluate the by which the costs associated with owning and operating 3-star, 4- star, and 5-star inverter AC models are recoverable compared to non-inverter type (baseline model). The product costs, the repair costs, the maintenance costs, and the energy costs are taken as the decision parameters for evaluating the payback periods. It is shown that strongly depends on the energy cost. Estimates of are calculated as the future value of present cost involved in buying, maintaining, and running the ACs. It is concluded that inverter technology can save electrical energy by 12-22.4% compared to a non-inverter air conditioner. of 3-star inverter AC is estimated 2.17 years while of 4-star and 5-star inverter ACs are 2.42 years and 2.33 years for 10 hours operation in a day when a higher slab of unit energy cost is considered. Depending on and daily usage requirements, a consumer can choose either a less efficient AC priced at a lower initial cost but more running cost or a more efficient AC priced at a higher initial cost but lesser running cost.

Keywords: Inverter AC, life cycle cost, payback period

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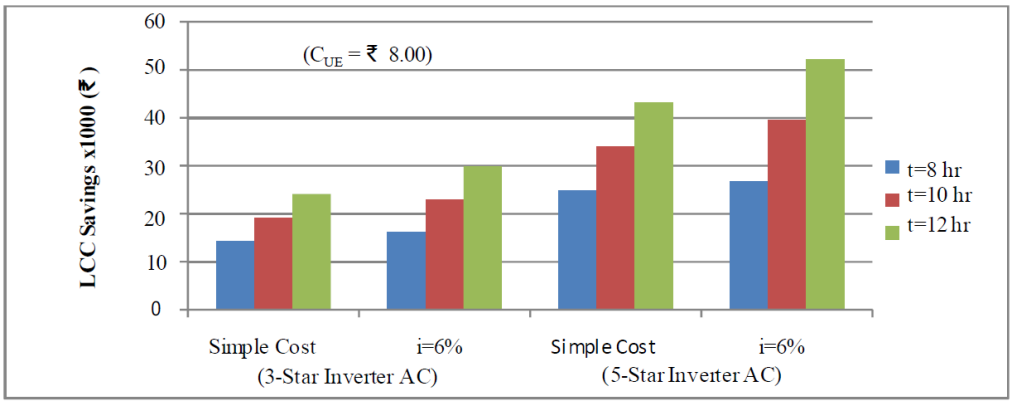
Sunil Kumar Gupta, B B Arora, Akhilesh Arora

Life Cycle Cost Savings for 3-Star and 5-Star Inverter ACs (CUE= ₹ 8.00)



Reference: *Sunil Kumar Gupta et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012023. https://doi.org/10.1088/1757-899X/1206/1/012023*

TRACK 4

Production and Industrial Engineering

OPTIMISATION OF FDM 3D PRINTING PROCESS PARAMETERS ON ABS BASED BONE HAMMER USING RSM TECHNIQUE

ICRAMEN_PAPER_04

Umesh Kumar Vates[1], Nand Jee Kanu[2,3,*] , Eva Gupta[4,5], Gyanendra Kumar Singh[6], Naveen Anand Daniel[1], Bhupendra Prakash Sharma[1]

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[2]PhD Research Scholar, Mechanical Engineering, SVNIT, Surat, India

[3]Assistant Professor, Mechanical Engineering, JSPM Narhe Technical Campus, Pune, India

[4]PhD Research Scholar, ASET, Amity University, Noida, India.

[5]Assistant Professor, Electrical Engineering, TSSM's Bhivrabai Sawant College of Engineering and Research, Pune, India

[6]Faculty, Mechanical Design and Manufacturing Engineering, Adama Science and Technology University, Adama, Ethiopia

Abstract: Rapid Prototyping (RP) uses a cycle where a real model is made by explicitly adding material as thin cross-sectional layers. Fused deposition modelling (FDM) 3D printer is being use for synthesis of ABS based bone hammer. Response surface methodology (RSM) based L27 design of experiment were made to perform the experiment using four influencing parameters like layer thickness, infill percentage, orientation and nozzle temperature for the three responses deflection, hardness and weight. Response surface methodology was used for modelling and optimization of considered process parameters. In present investigation, it is evident that bone hammer fabrication process parameters have been optimized on below data like bone hammer weight 19.8091g, hardness 104.5921, and force of 15-degree deflection 36.0681) has been produced with RSM prediction with influence of process parameters (like layer thickness 0.250, infill percentage 63.3333, orientation 60-degree, nozzle temperature 240°C).

Keywords: RSM, RP, FDM, ABS, Additive Manufacturing, Bone Hammer Optimization

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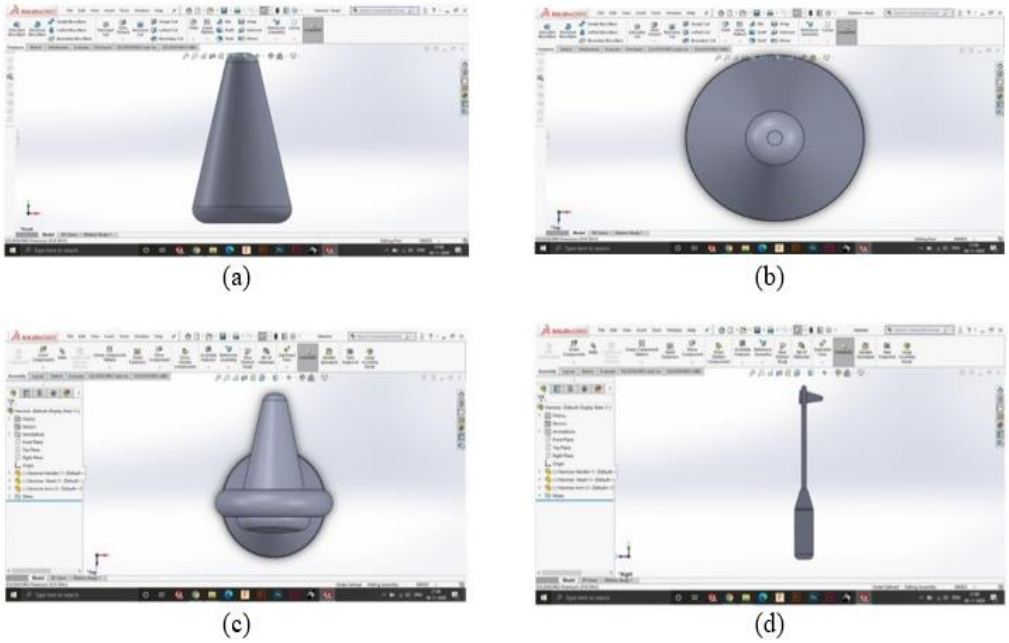
Umesh Kumar Vates, Nand Jee Kanu, Eva Gupta, Gyanendra Kumar Singh, Naveen Anand Daniel, Bhupendra Prakash Sharma

Different portion of Bone hammer



Reference: *Umesh Kumar Vates et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012001. https://doi.org/10.1088/1757-899X/1206/1/012001*

DEVELOPMENT OF ONLINE PLATFORM FOR CHECKING PLACEMENT CAPABILITY OF ENGINEERING STUDENTS

ICRAMEN_PAPER_16

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[1]Nagpur Institute of Technology, Nagpur, Maharashtra, India

[2]KDK College of Engineering, Nagpur, Maharashtra, India

[3]Christian College of Engineering & Technology, Bhilai, Chhattisgarh, India

[4]Pimpri Chinchwad College of Engineering, Pune, Maharashtra, India

[5]GH Raisoni University, Saikheda, Madhya Pradesh, India

Abstract: Nowadays engineering students are losing their campus placement opportunities provided by the institutes due to non-awareness of the market requirements. In this research, the authors try to develop an online platform for checking placement capability as well as level of industry required skills of engineering students in campus placement for IT Sector. Data was collected from the final year engineering students of Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur. Primary data of student's skills performance was collected by using Pen & Paper test and Secondary Data-Placement record was collected directly from the respective institutes. The various models developed and finalized one based on research constraints and R2 value. Online platform was developed for Binary Logistic Regression Model to predict placement capability of engineering students. This online platform will support institutes/students to understand level of preparation for upcoming campus placement season and make systematic plan to enhance required skills up to optimum level.

Keywords: Campus placement, engineering students, skills, online platform, IT sector.

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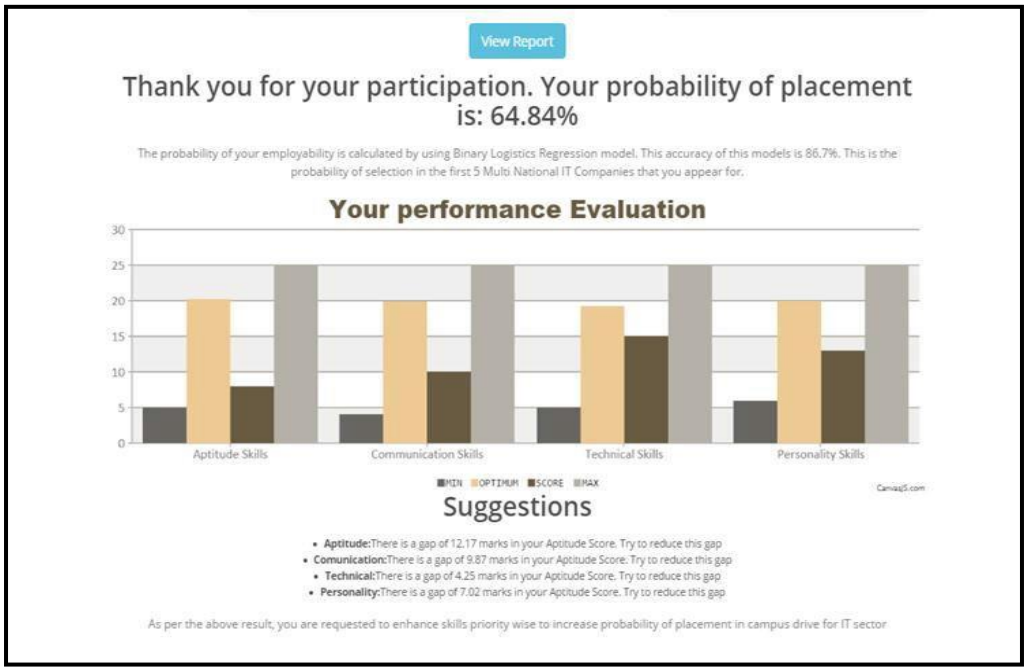
Vijay N Kalbande, Chandrahas C Handa, Radheshyam H Gajghat, Shitalkumar A Rawandale and Arvind B Bodhe

Report of a participated student



NEW APPROACH TO IDENTIFY INDUSTRY INSTITUTE SKILL GAP OF ENGINEERING STUDENTS

ICRAMEN_PAPER_23

Vijay N Kalbande[1*], Chandrahas C Handa[2], Radheshyam H Gajghat[3], Shitalkumar A Rawandale[4] and Arvind B Bodhe[5]

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[2]KDK College of Engineering, Nagpur, Maharashtra, India

[3]Christian College of Engineering & Technology, Bhilai, Chhattisgarh, India

[4]Pimpri Chinchwad College of Engineering, Pune, Maharashtra, India

[5]GH Raisoni University, Saikheda, Madhya Pradesh, India

Abstract: In today's scenario, Information Technology industries are compromising their expectations to fulfil the requirement of fresher's due to non-availability of Job ready students. Industry invests huge cost to train and make them ready for the on-job work. In this research paper, the researcher identified engineering graduate student's employability skill sets and validated with the support of institute placement process stakeholders. All skills are grouped into four categories on the similarity & characteristics for the research work i.e., Aptitude, Communication, Technical and Personality skills set. Primary data was collected by using pen & paper test and secondary data was collected by using questionnaires method. The analysis of collected samples was carried out by using Software Package of Social Sciences (SPSS10). The researcher compared the expected performance by stakeholders and actual student's performance in the designed test. Recruiters were unsatisfied on Communication & Technical skill sets from Placed students in campus recruitment.

Keywords: Placement, skill sets, technical institutes, industry.

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Vijay N Kalbande, Chandrahas C Handa, Radheshyam H Gajghat, Shitalkumar A Rawandale and Arvind B Bodhe

Correlation coefficient of skills set pair at 95 % CL

Pair	Samples	Correlation	Sign at 95% CL	Rank
Aptitude & Communication	362	.265	.000	4
Communication & Technical	362	.270	.000	3
Technical & Personality	362	.315	.000	2
Aptitude & Technical	362	.322	.000	1
Aptitude & Personality	362	.166	.002	6
Communication & Aptitude	362	.196	.000	5

COMPARATIVE ASSESSMENT OF HARD TURNING UNDER DRY AND MINIMUM QUANTITY LUBRICATION

ICRAMEN_PAPER_25

Avez Shaikh[1,*], Ajinkya Shinde[1], Satish Chinchanikar[2], Guruprasad Zagade[1] and Sonia Pardeshi[1]

[1]Department of Mechanical Engineering, Vishwakarma Institute of Information Technology, Pune, India.

[2]Professor, Department of Mechanical Engineering, Vishwakarma Institute of Information Technology, Pune, India.

Abstract: Hard turning using CBN, and ceramic inserts is widely accepted as an economical alternative to the costly grinding process. However, limited attempts on hard turning using coated carbide tools have been also reported as an economical alternative to costly CBN and ceramic cutting tools. However, contradictory results are reported on the use of cutting coolant during hard turning. With this view, in the present work, hard turning experiments were performed on AISI 52100 steel using TiSiN-TiAlN coated carbide tool to address the widely debated topic of the application of coolants in hard turning. In this study, a comparative evaluation of machining performance under dry and MQL conditions is presented by obtaining multi-objective optimization of cutting parameters, namely the cutting speed, feed, and depth of cut. Mathematical models were developed to predict and optimize the machining performance in terms of three components of cutting force, surface roughness, and tool life. The study reveals an optimum cutting speed of 108 m/min, feed value of 0.09 mm/rev, and depth of cut of 0.16 mm under both the dry and MQL conditions. Hard turning under MQL resulted in optimum surface roughness and tool life of 0.88 μm and 64 min respectively. As against hard turning under dry cutting resulted in an optimum value of surface roughness 1.07 μm and tool life of 49 min. Experimental results have shown a significant improvement in tool life, almost by 31% under MQL.

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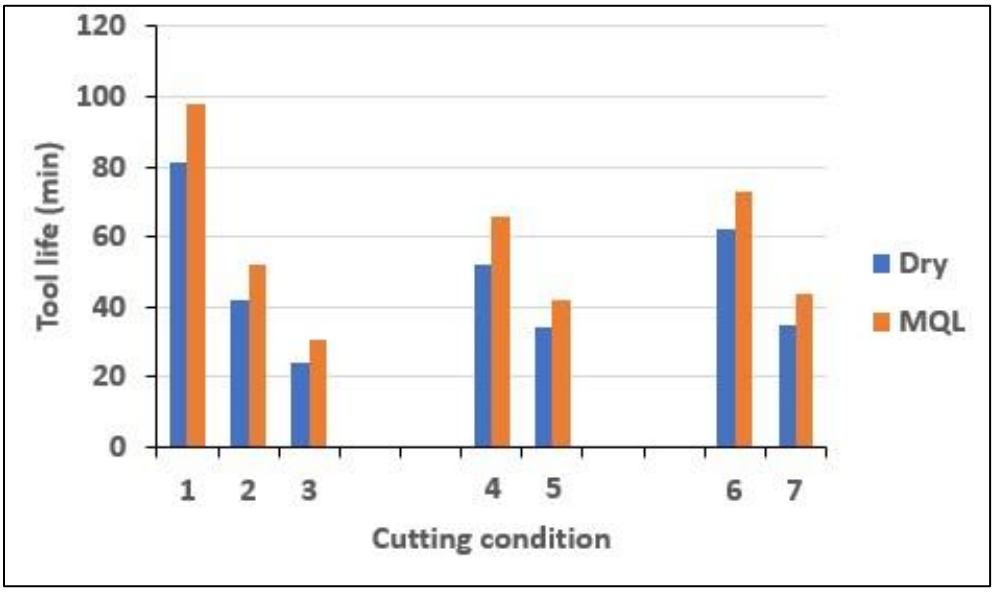
However, no significant difference in the values of cutting forces and surface roughness was observed under dry and MQL conditions.

Keywords: MQL, Dry Turning, Machining Performance.

Avez Shaikh, Ajinkya Shinde, Satish Chinchanikar, Guruprasad Zagade and Sonia Pardeshi

Tool life at different cutting conditions



Reference: *Avez Shaikh et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012007. https://doi.org/10.1088/1757-899X/1206/1/012007*

APPLYING ANALYTICAL HIERARCHY PROCESS FOR ADDRESSING THE AGILE MANUFACTURING DRIVERS

ICRAMEN_PAPER_34

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[2]Associate Professor, Department of Mechanical Engineering, Shambhunath Institute of Engineering & Technology, Prayagraj, India.

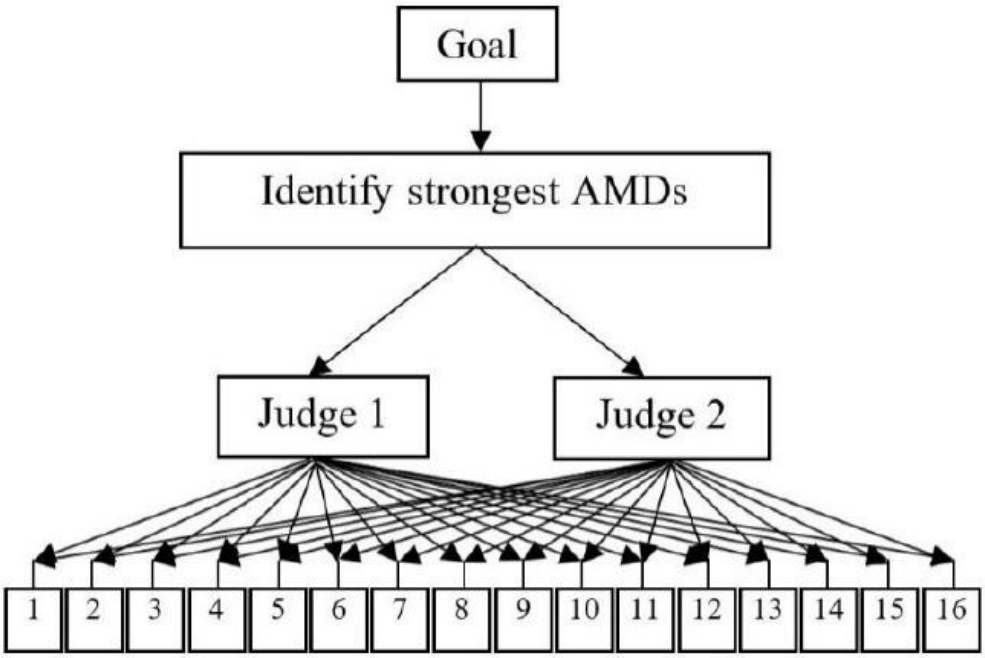
Abstract: In order to incorporate agile manufacturing (AM) in materials and systems, the manufacturing sectors have drivers to face obstacles. Agility is generally accepted for satisfying diverse consumer demands as a new strategic principle in the automotive industry. There has now been a prerequisite for evaluating AM in industry. An organization's effectiveness relies on their ability to find and pay special attention to the crucial success drivers to achieve a high level of efficiency. This paper suggests a number of Agile Manufacturing Drivers (AMDs) to evaluate AM that is deemed suitable to the production industry. In order to prioritise performance drivers, the analytical hierarchy process (AHP) approach is used to summarise the perspective of an expert. The proposed AMDs are believed to encourage and assist the manufacturing sector in producing agile products to achieve higher efficiency so as to improve competition.

Keywords: Agile manufacturing (AM), Agile manufacturing drivers (AMDs), Analytical hierarchy process (AHP), Consistency Ratio (C.R.), Consistency Index (C.I.), Random Index (R.I.).

[*] *Corresponding Author Email: uk.mnit@gmail.com*

Rohit Sharma and Ubaid Ahmad Khan

AHP Model



Reference: *Rohit Sharma and Ubaid Ahmad Khan 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1206 012010. https://doi.org/10.1088/1757-899X/1206/1/012010*

STATISTICAL QUALITY STUDY OF THE PARTS PRODUCED IN AN AUTOMOBILE INDUSTRY: A DAIMLER INDIA CASE STUDY

ICRAMEN_PAPER_49

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Abstract: Every manufacturing industry considers defect-free production in this competitive era. Though it is practically impossible to improve the rate of defect minimization, statistical tools can be used. In this case study, we take data from Daimler India, an automobile part manufacturing industry specialised in manufacturing OEM tools like chassis, oil filter nipple, and so on, and study how many defects are made during the day. The defect-causing process was eliminated after statistical quality control tools such as np charts and cumulative sum charts were used, resulting in higher product quality.

Keywords: Control Charts, np chart, cumulative Sum charts, process quality control, non-conformities, control limits, parts acceptance.

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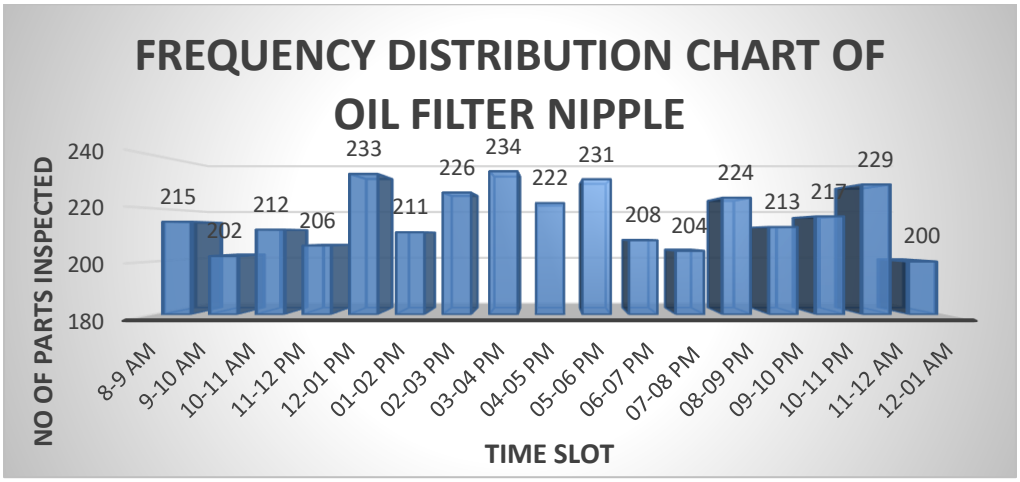
Depiction of the frequency distribution chart of the oil filter nipple



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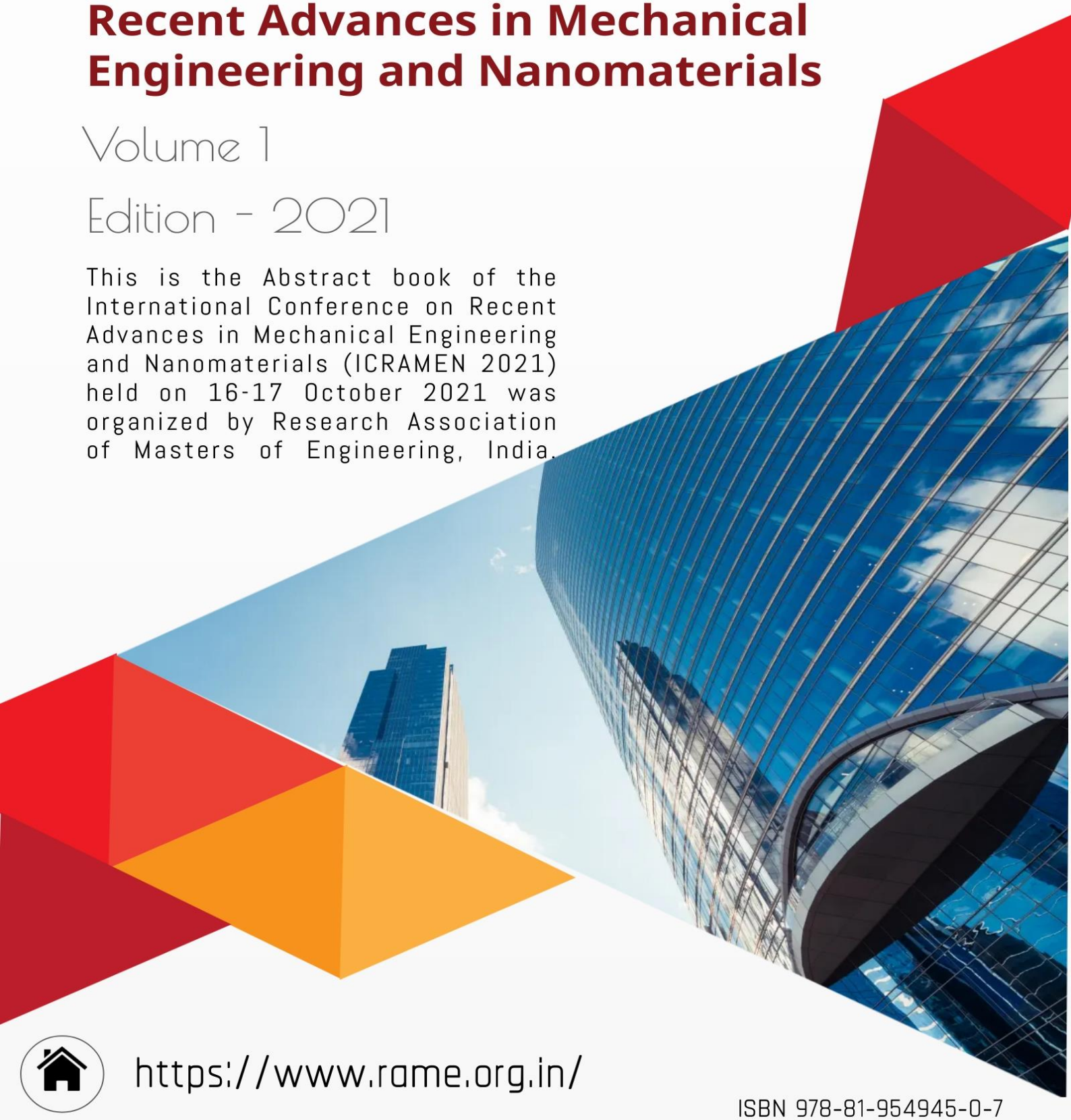

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