EASWARI ENGINEERING COLLEGE
An AUTONOMOUS Institution
Affiliated to ANNA UNIVERSITY
RAMAPURAM CHENNAI

DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL MAGAZINE
YEAR: 2021-2022

VISION

To be an acknowledged leader in imparting Mechanical Engineering education, research and be a recognized resource center for industry and society

MISSION

M1:To make the students understand the basic and advanced Engineering concepts in the core fields of Mechanical Engineering through Under-Graduate and Post-Graduate Courses.

M2:To prepare the students and expose them to the basic and applied research, thus fostering creativity through recognized research canters.

M3:To make the students undergo training in the Industries, identify the current problems and solve them with multidisciplinary and professional approach.

M4:To prepare the students to integrate Engineering with business that encourages technological commercialization by inviting eminent entrepreneurs for seminars and workshops.

M5:To make the students do application oriented projects which identify the current problems, solving them and thus contribute to the societal needs.

M6:To inculcate the value of ethics, lifelong learning and widening the knowledge frontiers through long term interaction with other academia and industry.

PROGRAM OUTCOMES (PO)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1: Our graduates will have fundamental technical knowledge and develop core competency in diversified areas of Mechanical Engineering along with Mathematics, Science and other allied engineering subjects in a view to expand the knowledge horizon and inculcate lifelong learning.

PEO2: A fraction of our graduates will pursue advanced studies, research and develop products in the field of Mechanical engineering by developing partnerships with industrial and research agencies thereby serving the needs of the industry, government, society and scientific community.

PEO3: Our graduates will be capable of building their own career upon a solid foundation of knowledge and with a strong sense of responsibility serve their profession and society ethically.

PEO4: Our graduates will be prolific professionals with effective communication, leadership, teaming, problem solving, decision making skills by understanding contemporary issues and improve their overall personality for career development

. PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Students will be competent in design and analysis of thermal and fluid systems.

PSO2: Students will possess the skill to apply design concepts for mechanical structures and systems.

PSO3: Students will be able to design and develop industrial products using modern machines in the field of manufacturing.

PSO4: Students will be able to use software to solve structural, thermal, fluid and manufacturing problems.

JOURNAL ARTICLE

Additive Manufacturing (AM) or 3D Printing:

Additive Manufacturing adds the material to create a 3D object. Additive Manufacturing is also called 3D Printing.

Additive Manufacturing is a process in which the model of an object has to be created in any Modelling Software (CAD Software) and has to save in the format of.STL. [**.STL** stands for Standard Triangular Language]

This format essentially "slices" the object into ultra-thin layers. Each successive layer bonds to the preceding layer of partially melted or melted material.

This file has to be sent to an Additive Manufacturing machine or 3D Printing Machine to produce a 3D object in the form of fine layers.

The 3D Printing Machine understands the data in the (.STL) file created in CAD software by CAD Engineer and processes accordingly in the form of smooth and Fine layers of plastic to create precise geometry shapes.

Additive Manufacturing Materials:

They are a variety of materials used in the Additive Manufacturing machine to create 3D objects and some of them are as follows.

Plastics: (Thermoplastics)

One of the most popular materials used in Additive Manufacturing machines is *Thermoplastics.*

They are used because of the following reasons:

- When it is heated, it turns soft and at this point, we can change the shape of the component.
- Light Weight.
- It is recyclable.

Ex: Acrylonitrile Butadiene Styrene (ABS), Polycarbonate (PC) and Polylactic Acid (PLA) offer distinct advantages in various applications.

Ceramics:

A variety of ceramics are also been used in additive manufacturing such as Zirconia, Tricalcium phosphate, alumina, etc.

Metals:

Metals and Metal alloys are used in additive manufacturing machines from precious metals like gold, silver, etc. to strategic metals like stainless, etc.

Additive Manufacturing Applications:

Aerospace:

Additive Manufacturing excels in producing the components for aerospace applications that are light in weight and stronger enough to withstand the desired load.

Ex: Jet engine parts.

Automotive Industry:

Aluminium alloys are used to produce exhaust pipes and parts of the pump, and polymers are used to produce bumpers of an automobile.

Health Care:

- At, the New York University School of Medicine, a study of 300 patients will evaluate the efficacy of patient-specific, multi-coloured kidney cancer models using additive manufacturing.
- 3D printed surgical implants for patients suffering from bone cancer disease.

Advantages of Additive Manufacturing:

- AM creates the components which are lighter, stronger, and which otherwise by conventional methods(machining, etc.) takes huge time, money, etc.

- In AM, which offers a digital-to-digital process eliminates traditional machining and offers a more dynamic, design-driven process.

- The Lead time is frequently reduced in AM compared to Traditional.
- The parts which are assembled in traditional methods can be eliminated by fabricating into single components in Additive Manufacturing.

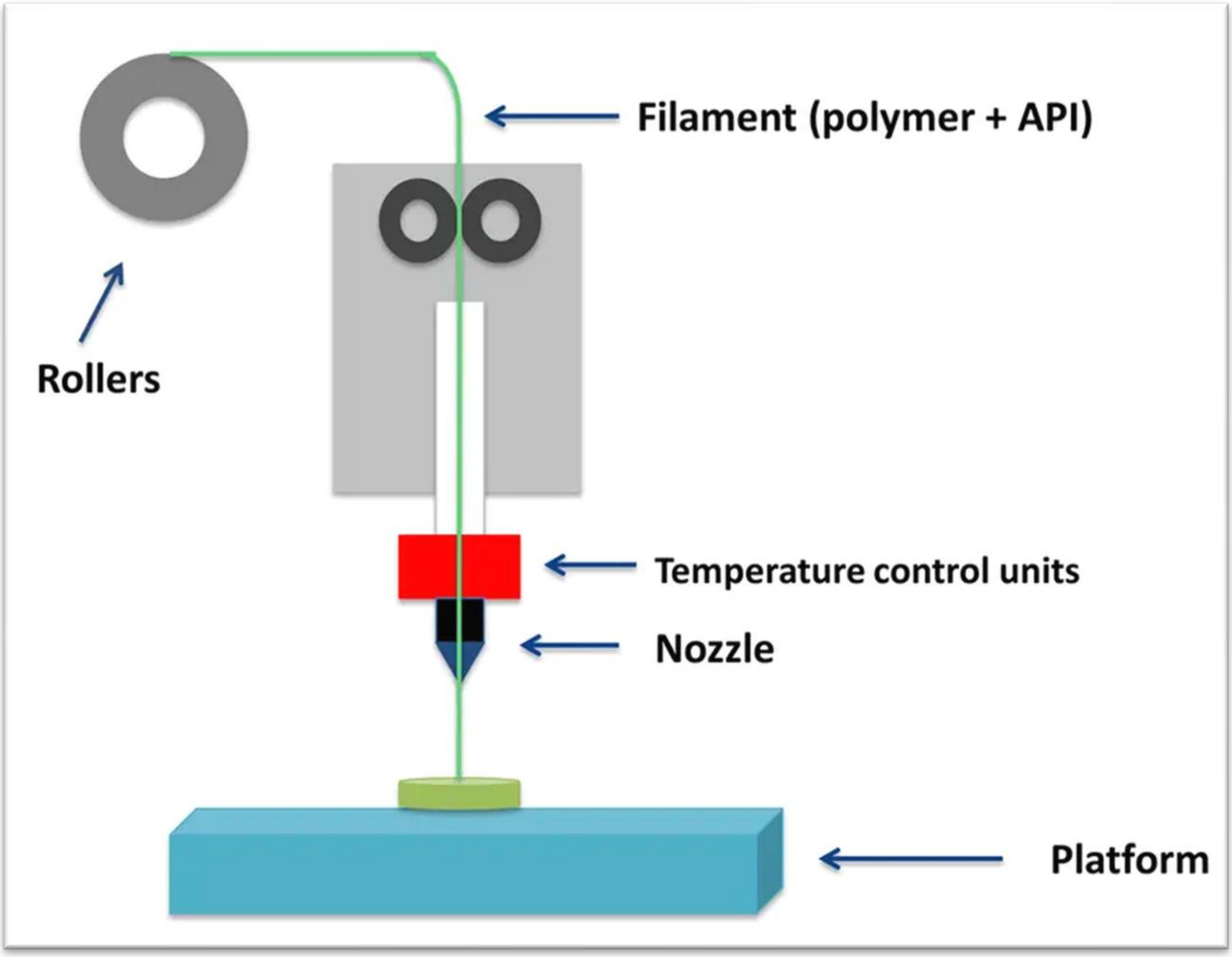
Additive Manufacturing Technologies:

There are various Additive Manufacturing Technologies and a few of them are as follows.

1. **Fused Deposition Modelling(FDM)**
2. **Selective Laser Sintering(SLS)**
3. Vat Photo polymerization
4. Material Jetting
5. Binder Jetting
6. Direct Energy Deposition

Two of the popular additive manufacturing Technologies are presented below

Fused Deposition Modelling (FDM):



It is one of the Rapid Prototyping techniques which fuses or melts the material (similar to the extrusion Process) and deposits in the form of layer by layer in order to construct a component whose data had been taken from the cad (.stl) file.

Parts of Fused Deposition Modelling:

1. Base(For Support)
2. Filament (Plastic Material)
3. Feed Rollers (Provide the proper amount of material)
4. Supply Rollers (Supply plastic material at the beginning)
5. Heating Elements (Heats the Plastic to a semi-liquid state)
6. Nozzle or Extrusion Chamber

Working of Fused Deposition Modelling (FDM):

In this process, the raw material is a plastic component, which is also called a filament in the FDM technique is drawn by means of rollers and is to be passed into the heating chamber by means of Feed rollers.

The plastic material is to be heated up to the formation of semi-liquid and is to be passed into the extrusion chamber.

In the Extrusion chamber, it has to be passed through a nozzle (similar to the extrusion process) and the product is obtained in the form of layers.

This is a detailed explanation of the working of the fused deposition modelling technique in additive manufacturing.

Selective Laser Sintering (SLS):

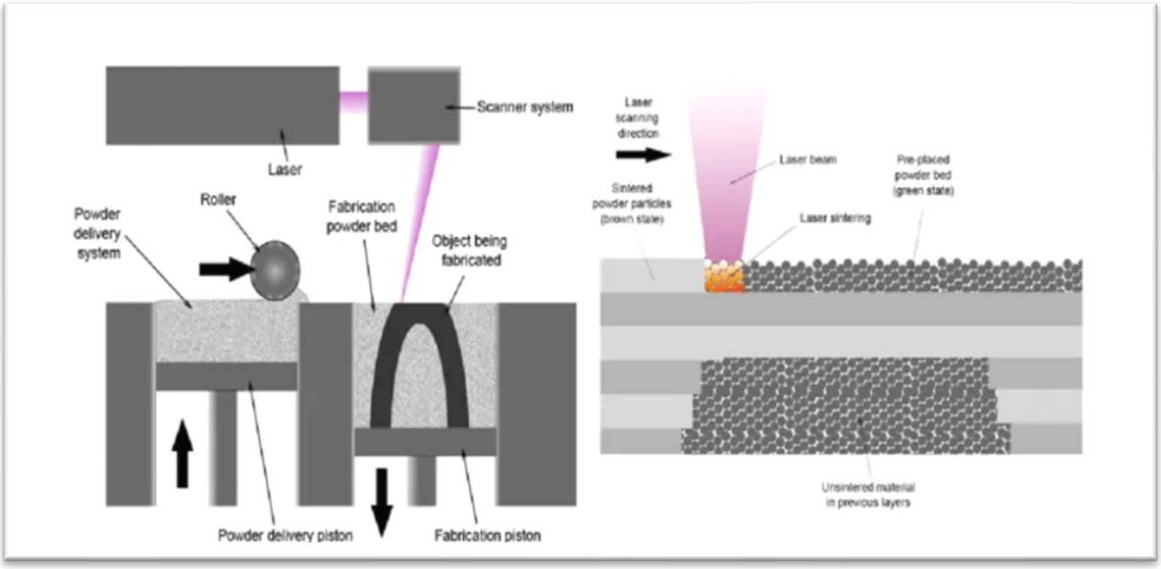
It is also one of the Rapid Prototyping Technique which uses laser machine for sintering the raw material to get the desired shape in the form of layer by layer.

Sintering means heating the raw material (Powder) so that it is melted and converted into a thick layer called sintering.

It is a process that creates a physical object from a digital design. The engineering design of a model can be prepared in CAD software.

The design file (.stl) is then sliced into small layers of equal thickness and Uploaded to an additive manufacturing machine.

The above figure shows the sintering of the material layer by layer to form a final component.



Parts of Selective Laser Sintering:

1. Laser
2. Scanner
3. Powder
4. Chambers with Piston Arrangement
5. Roller

Working of Selective Laser Sintering:

The manufacturing process begins once the thin layer of metal powder is spread across the platform. On the Platform, two chambers are present with Piston arrangement. One piston is moving up and the other piston is moving down as shown in the figure.

The First Chamber Piston pushes up the powder so that it is above the platform. Now roller will push and spread the powder to another chamber. The Second chamber whose piston is pushed down so that the powder material has to be filled in the form of layer by layer.

Now, a heat source such as a laser or electron beam then notes the first layer of the 3D design, and the scanner can scan the work region and post the laser so that the powder melts and deposits on the work platform in the form of layers.

The platform is loaded again and the layer of metal powder is spread across the platform. The layering and melting process is then repeated until the process is complete.

The metallic powder is removed and the physical object is revealed or taken out from the powder and was cleaned so that impurities cannot be deposited. Watch the video below to understand the concept of the SLS Process:

The parts produced by the Selective Laser Sintering are lighter, stronger, and more adorable than traditional or Conventional parts. This is the explanation of Additive Manufacturing. Let's discuss the rest of the technologies in Mechanical Engineering.

HOW TO DO

How to Perform Tolerance Analysis for Mechanical Assemblies

The complexity of a product's components increases beyond fairly simple linear stickups, such as with motion, cams, levers, and springs, you'll want to strongly consider working in 2D and/or 3D. For most mechanisms, Eventide's experience is that 2D is a very effective modelling approach. It lends itself to rapid and intuitive representation of geometric, dimensional & tolerance (GD&T) parameters.

2D functional tolerance analysis products, like Eventide's Concept software, quickly report on the location and likely rates of potential failure modes across a series of GD&T parameter iterations. Through what-if analysis engineers can quickly narrow down their design choices and make optimal GD&T decisions.

With 3D tolerance analysis, you have the most true-to-life GD&T representation of a product and its components. But you also have much more model complexity than with 2D, making it very difficult or even impractical to do rapid iterations of GD&T parameters.

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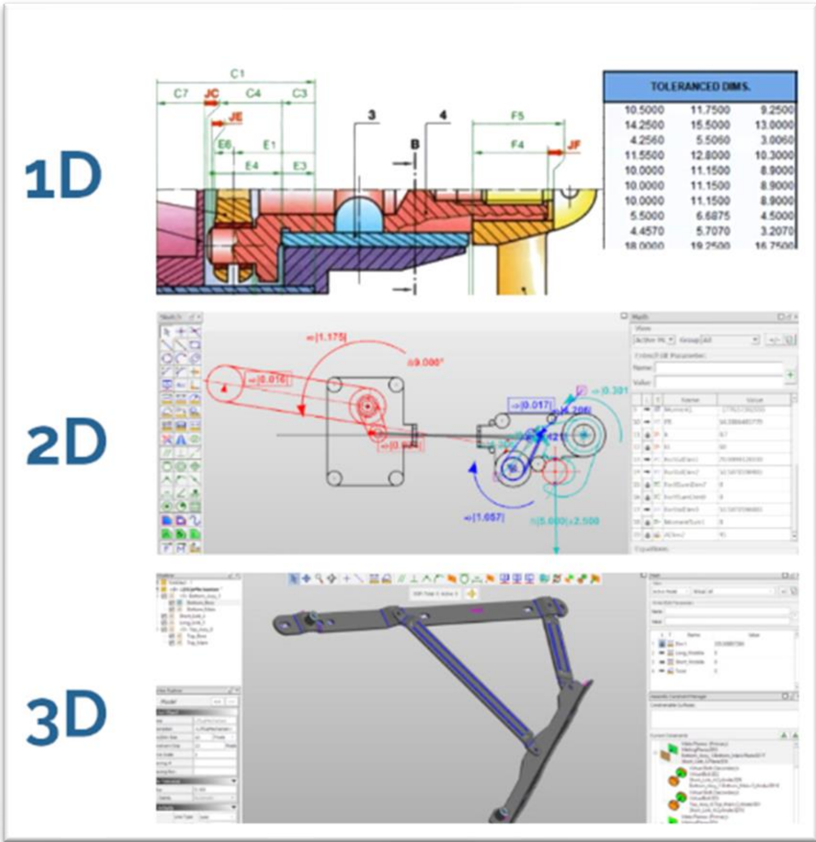


Another common 2D tolerance analysis process is to identify existing 3D CAD model cross sections where functional conditions must be analysed, and then export them with their GD&T values back to a 2D analysis tool, like Inventive Concept, for validating design choices and making any needed changes. In this case Concept is being used for functional tolerance analyses in as many different planes as needed.

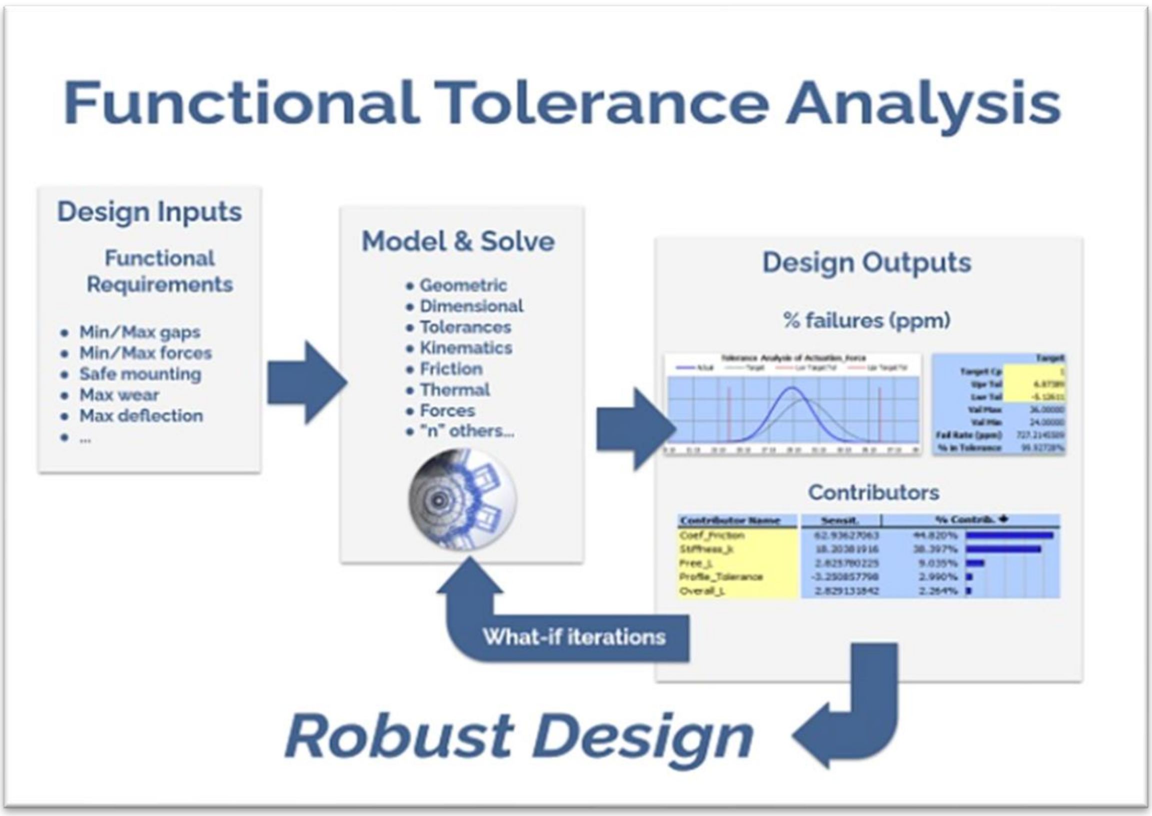
FUNCTION TOLERANCE SYSTEM

While ensuring fit for assembly is of course critical, making sure that the product's functional requirements are met is also critical.

A designer also needs to determine the range of allowable variations in the geometric and dimensional values of components that do not interfere with the product's functionality.

This is where functional tolerance analysis comes in. This type of analysis can tell you, for example, whether or not an assembly has enough clearance for a desired motion, such as the rotation of an electric motor driven cam system.

It is quite possible that the assembly has enough clearance to be assembled, but not enough to reliably meet the functional requirement of a specific motion.

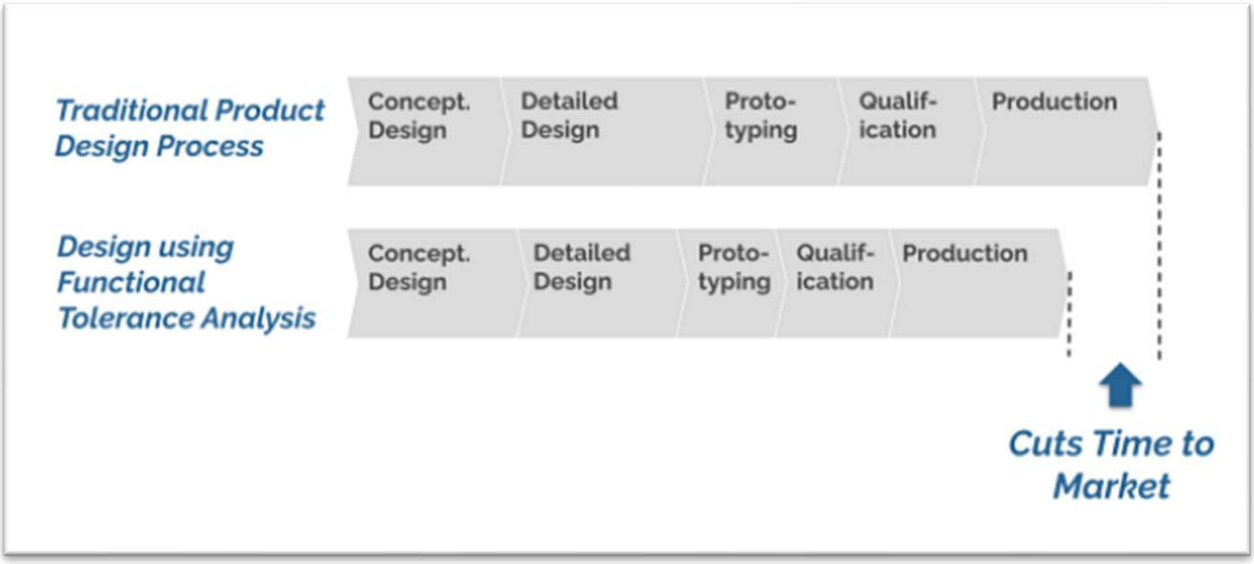


Another type of functionality commonly analysed is force. For example in a mechanical latch, such as in an automobile door or seat, making sure that the forces to open and close the latch meet design requirements is critical to safety and usability. Because the latches are small and with cams, levers and springs, even small

Geometric and dimensional variations in their components can lead to a failure in meeting functional requirements.

This is an example of a product's performance to requirements being highly sensitive to component variations, which is a very common design issue for engineers. Functional tolerance analysis will model those forces as the latch mechanism moves versus candidate GD&T values to help a designer iteratively make optimal decisions for those values.

BENEFITS OF TOLERANCE SYSTEM



- Tolerance analysis tools save time and money by helping to design, build, assemble, and test products more effectively and robustly.
- Functional tolerance analysis, when used at the very beginning phase and during later phases, can cut time for design completion and getting to market.
- For prototyping, tolerance analysis yields design results that are much closer to being production ready versus designs done without tolerance analysis

CASE STUDY

The Kudankulam Nuclear Power Plant - Engineering for Clean Energy (2000s – Ongoing)

Location: Kudankulam, Tamil Nadu, India

Year: Construction started in the 2000s, and it's an ongoing project.

Problem: India, as a growing economy, faced increasing demands for electrical power while seeking to reduce its carbon footprint. To meet this challenge, the country needed to expand its nuclear power generation capabilities. The construction of the Kudankulam Nuclear Power Plant was initiated to address this issue.

Solution: The Kudankulam Nuclear Power Plant represents a significant engineering endeavor aimed at providing clean and reliable energy. Here are key engineering solutions and strategies employed:

Advanced Reactor Technology: The plant uses pressurized heavy water reactor (PHWR) technology for its nuclear reactors, which is known for its safety and reliability.

Safety Measures: The design incorporates multiple layers of safety systems, including passive safety features, to ensure safe operation and mitigate potential risks.

Cooling Systems: The plant uses a seawater-based cooling system to dissipate heat generated during the nuclear fission process, ensuring efficient and continuous operation.

International Collaboration: The project involved collaboration with Russia's state-owned nuclear energy company, Rosatom, for technology transfer and expertise.

Strict Regulatory Compliance: The plant adheres to rigorous regulatory standards and safety protocols, ensuring compliance with international nuclear safety norms.

Outcome: The Kudankulam Nuclear Power Plant is a major contributor to India's clean energy generation. It has multiple units, with some already in operation and others under construction. The outcomes and benefits include:

Significantly increased clean energy capacity in India.
Reduced reliance on fossil fuels, contributing to environmental sustainability.
Reliable and safe nuclear power generation to support the country's growing energy demands.
This case study demonstrates how mechanical engineering, along with interdisciplinary collaboration and strict adherence to safety standards, can lead to the successful establishment of nuclear power plants to meet the energy needs of a developing nation while minimizing environmental impact.

EVENTS HELD DURING 2021-2022

TWO WEEKS ONLINE WORKSHOP ON "COMPUTATIONAL FLUID DYNAMICS"

The event was conducted in online Mode and about participants, 94 Students attended this event This event has helped all the students To update their of the topic of Computational fluid dynamics.

NEW EDUCATION POLICY (NEP) 2020

Dr. V. Antony Aroul Raj

Conducted a Meet on 11th August 2021 Regarding "Research Innovation And Ranking". This meeting was held in google meet from 3:00pm to 4:00pm. Nearly 100 students and 50 faculty members has joined the meet and made the meet grand successful

OXYGEN PRODUCTION AND DISTRIBUTION

The event was conducted online mode and about participants, 84 students attended this event. In this meeting, Dr. V. Antony Aroul Raj, Professor, Dept of Mechanical Engineering explained the ways to produce oxygen and all the other ways to distribute them efficiently. He helped the students to get an in-depth knowledge of how one can produce oxygen.

MEMORANDUM OF UNDERSTANDING

Department of Mechanical Engineering has signed Memorandum of Understanding (MoU) with leading industries for organization of workshops /seminars/guest lectures/ training programs/internship for the students and faculty.

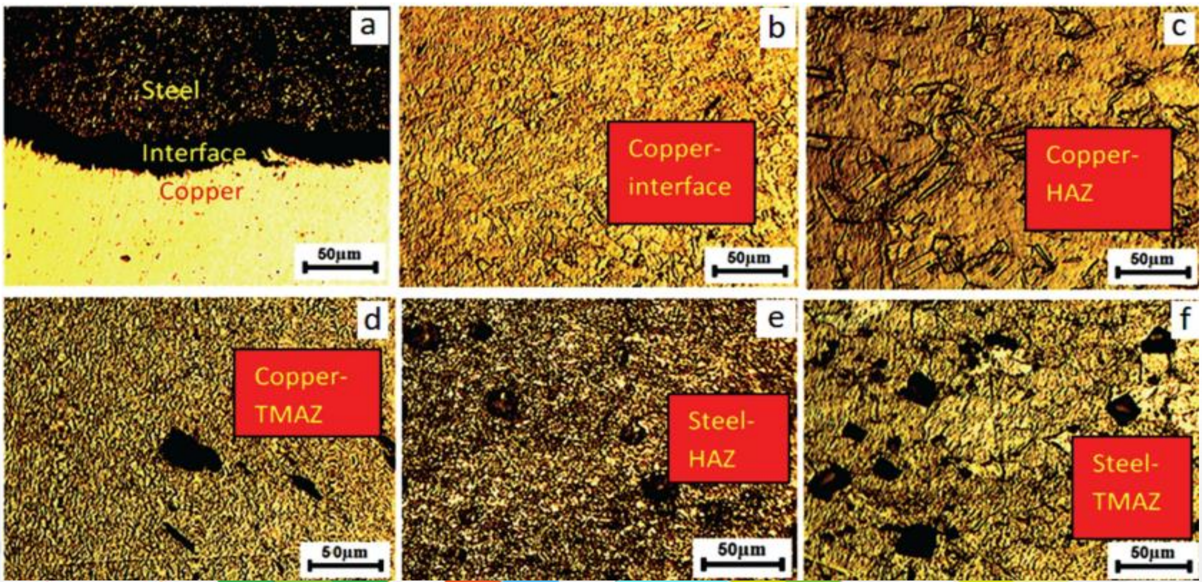
DEPARTMENT PUBLICATIONS

INTERNATIONAL JOURNAL PUBLICATION

INTERNATIONAL JOURNAL PUBLICATION

K. Giridharan, P. Sevvel, R. Ramadoss, and B. Stalin. "Friction stir processing of Nano filler assisted AISI 1010 steel-CDA 101 copper dissimilar welds: a strength factor approach" Metallurgical Research Technology 119, 505 (2022)

Impact factor: 0.946

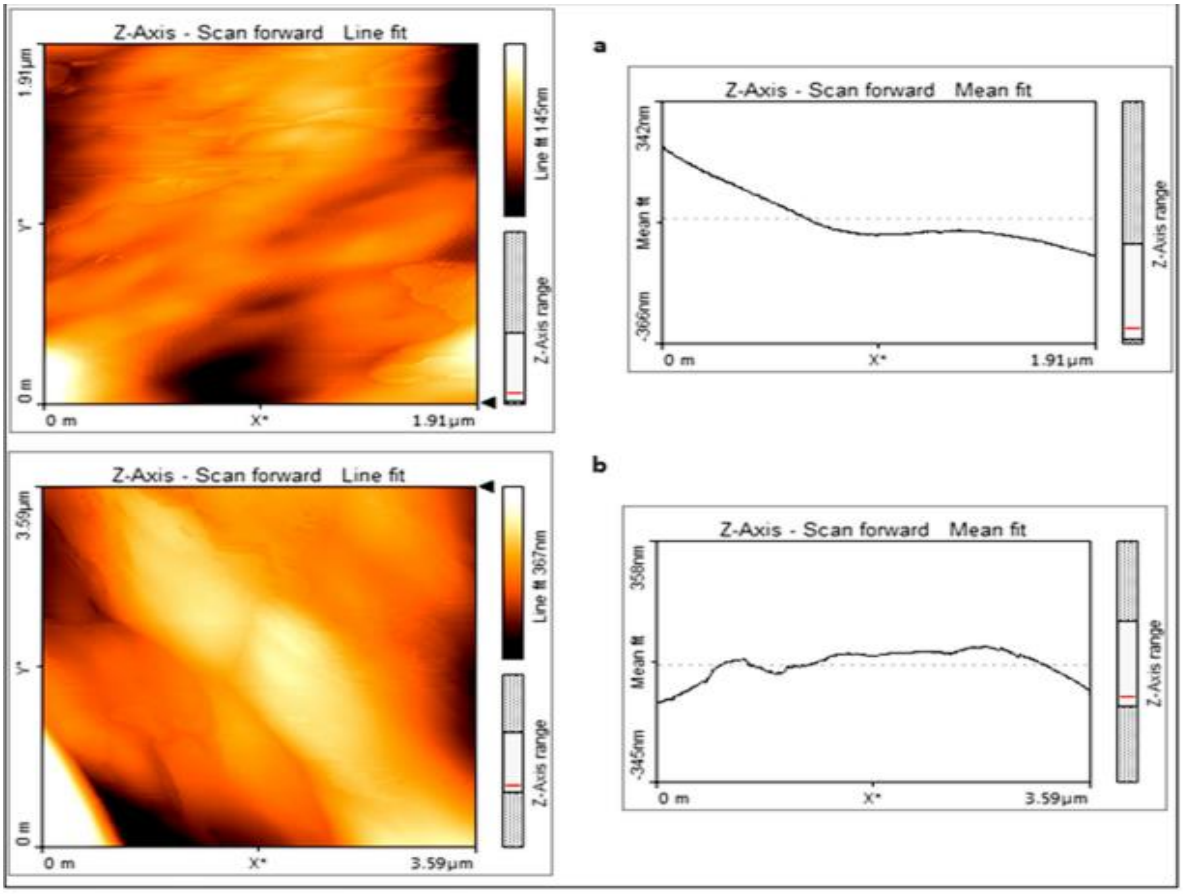


INTERNATIONAL JOURNAL PUBLICATION

INTERNATIONAL JOURNAL PUBLICATION

K. Thavasilingam, A. Senthil Kumar, M. Adam Khan, S. Devanand, K. Giridharan. "Effect of fumed silica in rice bran wax-epoxy coating on aluminium substrate: mechanical, thermal, and water absorption properties" Springer Nature 13, 4229-4240(2023)

Impact factor: 2.6

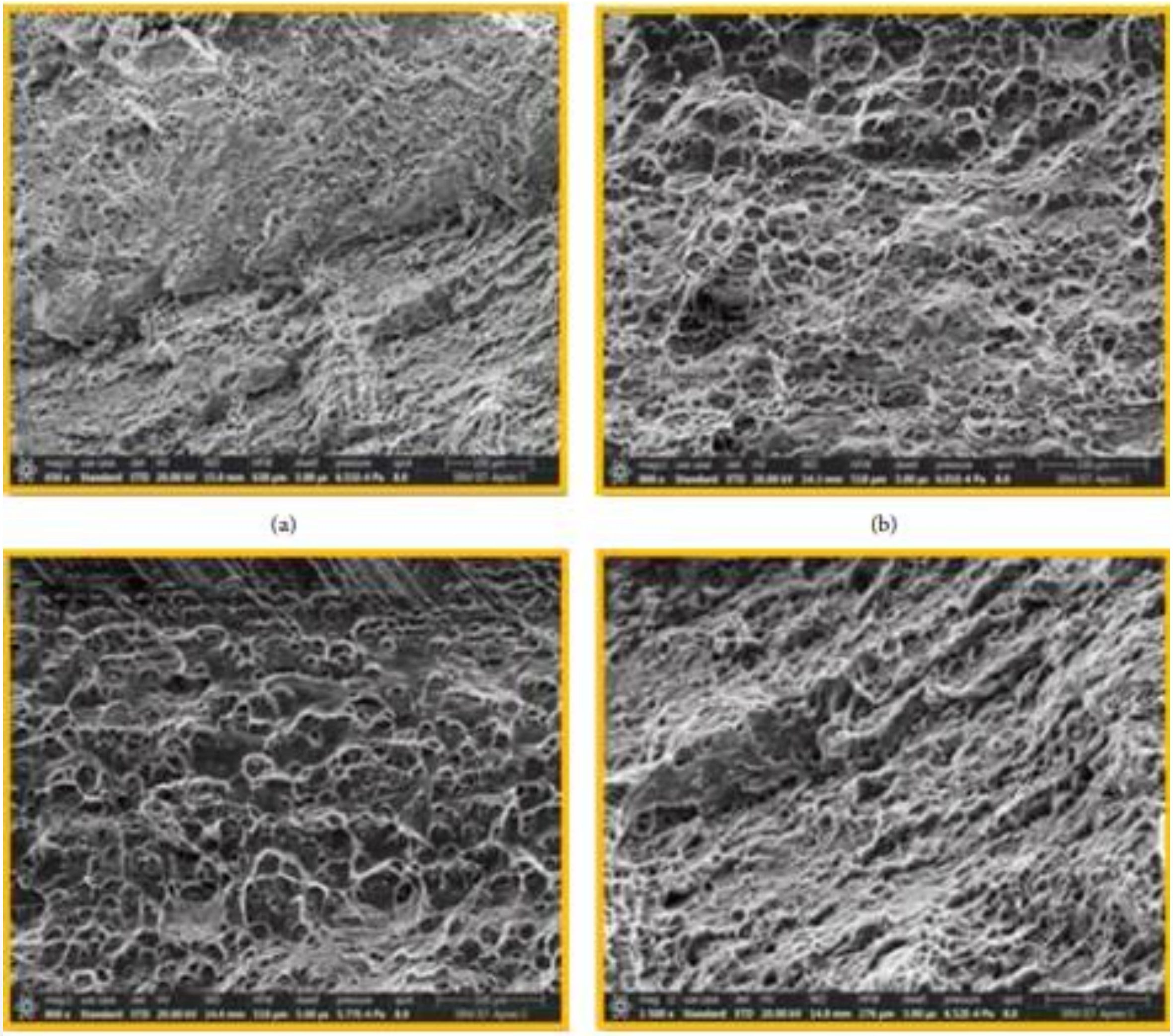


ig. 8 a, b Surface roughness and topography of coated surface

INTERNATIONAL JOURNAL PUBLICATION

INTERNATIONAL JOURNAL PUBLICATION- SCI/CLARIVATE INDEXED

M. Vetrivel Sezhian, K. Giridharan, D. Peter Pushpanathan, G. Chakravarthi, B. Stalin, Alagar Karthick, P. Manoj Kumar,and Murugesan Bharani "Microstructural and Mechanical Behaviours of Friction Stir Welded Dissimilar AA6082-AA7075 Joints" Hindawi volume 2021 (1-13).Impact factor : 3.57



(a) (b) (c) (d)

Figure 10: SEM images of tensile fractured weld samples.

Academic Year (2021-2022)

Sl. No.	Name of the faculty	Research Paper Title	Index	Impact factor	Month & Year	Volume/ Issue/ Pg. no.	Journal Name
1.	Giridharan. K.	Sustainability and Environmental Impact of Ethanol and Oxyhydrogen Addition on Nanocoated Gasoline Engine	SCIE	7.778	Jan-22	Volume 2022	Bioinorganic Chemistry and Applications
2.	Prasanna Raj Yadav. S.	Experimental study of feasibility of orange peel oil as a partial replacement for gasoline fuel in SI engine with and without MAO coated piston	SCIE	6.609	Jan-22	Volume 315	Fuel
3.	Antony Aroul Raj. V	Performance evaluation of phase change material integration in buildings using novel non-dimensional performance parameters for different cities and months in India	SCIE	6.583	Aug-2021	Volume 42	Journal of Energy Storage
4.	NareshBabu.M, VetrivelSezhian. M	Influence of graphene nanofluid on various environmental factors during turning of M42 steel	SCIE	5.684	Jul-21	Volume 68, Pages 90-103	Journal of Manufacturing Processes
5.	Giridharan. K	Energy recovery of waste plastics into diesel fuel with ethanol and ethoxy ethyl acetate additives on circular economy strategy	SCIE	4.996	Mar-2022	Volume 12 Issue 1	Scientific Reports

6.	Thavasilingam..K,Giridharan.K.	Effect of fumed silica in rice bran wax-epoxy coating on aluminum substrate: mechanical, thermal, and water absorption properties	SCIE	4.987	Sep-21	Volume 2021	Biomass Conversion and Biorefinery
7.	Babu. M	Role of cashew shell biochar on EMI shielding behaviour of carbon fibre epoxy nanocomposites in E, F, I and J ban microwave frequencies	SCIE	4.987	Mar-22	Volume 2022	Biomass Conversion and Biorefinery
8.	Karthick.S, Giridharan. K	Effect of brown rice husk α-Si3N4 on Ni–P composite coating of austenitic AISI 316L steel: Taguchi grey relational approach	SCIE	4.987	Nov - 2021	Volume 2022	Biomass Conversion and Biorefinery
9.	Naresh Babu. M,VetrivelSezhian.M	Effect of ionic liquid as lubricants in turning H 13 tool steel- an experimental study	SCIE	4.616	Mar-2022	Volume 2022	Materials and Manufacturing Processes
10.	Kalimuthu Gopi Kannan	Thermodynamic and economic analysis of heat pump-assisted solar still using paraffin wax as phase change material	SCIE	4.223	Nov-21	Volume 29 , Issue 2	Environmental Science and Pollution Research
11.	Yuvaraj.G	Evaluation of Physicothermal Properties of Silicone Oil Dispersed with Multiwalled Carbon Nanotubes and Data Prediction Using ANN	SCIE	3.791	Dec-21	Vol 2021, Article number 3444512	Journal of Nanomaterials

12.	Prasanna Raj Yadav.S	Sustainability Improvement of Ethanol Blended Gasoline Fuelled Spark Ignition Engine by Nanoparticles	SCIE	3.791	May-2022	Volume 2021	Journal of Nanomaterials
13.	VetrivelSezhian.M	Energy absorption performance of Kevlar/snake grass fiber composites under ballistic impact test with nano Al2O3 inclusion	SCIE	6.609	Jun-22	Volume 2022	Polymer Composites
14.	Ashok. K.G	Experimental studies on interlaminar shear strength and dynamic mechanical analysis of luffa fiber epoxy composites with nanoPbO addition	SCIE	2.926	Dec-2021	Volume 51/ Issue 3	Journal of Industrial Textiles
15.	Peter Pushpanathan.D.	Investigations on the properties of composite coatings electro co-deposited on AZ80 Mg alloy using triangular waveform pulse current	SCIE	2.352	Dec-21	Vole 9, Issue 4, Article No 045048	Surface Topography : Metrology and Properties
16.	Elumalai. B	The effect of discharge energy and nano Al2O3 on µED milling of Inconel 718	SCIE	2.352	Dec-21	Volume 9, Issue 4 2021	Surface Topography : Metrology and Properties
17.	Antony Aroul Raj, V.	A pathway towards healthy and naturally ventilated indoor built environment through phase change material and insulation	SCIE	1.882	Nov-21	Vol 236 / Issue 3	Proceedings of the Institution of Mechanical Engineers, Part A: Journal of Power and Energy

		techniques for office buildings in India					
18.	Prasanna Raj Yadav.S	Performance and Emission Characteristics of Pyrolysis Oil Obtained from Neem de Oiled Cake and Waste Polystyrene in a Compression Ignition Engine	SCIE	1.726	Dec-2021	Volume 2021	Advances in Materials Science and Engineering
19.	VetrivelSezhian. M, Giridharan.K., Pushpanathan.D, Chakravarthi.G	Microstructural and Mechanical Behaviors of Friction Stir Welded Dissimilar AA6082-AA7075 Joints	SCIE	1.726	Sep-21	Vol 2021, Article number 4113 895	Advances in Materials Science and Engineering
20.	Babu.M	Optical Microstructure, FESEM, Microtensile, and Microhardness Properties of LM 25-B4Cnp-Grnp Hybrid Composites Manufactured by Selective Laser Melting	SCIE	1.726	Jan-22	Volume 2022	Advances in Materials Science and Engineering
21.	VetrivelSezhian. M	Investigation of Friction Stir-Welded B4C Particles-Reinforced Copper Joint: Mechanical, Fatigue, and Metallurgical Properties	SCIE	1.726	May-22	Volume 2022	Advances in Materials Science and Engineering
22.	Jothiprakash. V.M	Optimization of Process Parameters for Friction Stir Welding of Different Aluminum Alloys AA2618 to AA5086 by Taguchi Method	SCIE	1.726	Jan-22	Volume 2022	Advances in Materials Science and Engineering

23.	Yuvaraj. G	Characterization of the Aluminium Matrix Composite Reinforced with Silicon Nitride (AA6061/Si3 N4) Synthesized by the Stir Casting Route	SCIE	1.726	Jan-22	Volume 2022	Advances in Materials Science and Engineering
24.	Giridharan. K.	Microstructural Analysis and Mechanical Behaviour of Copper CDA 101/AISI-SAE 1010 Dissimilar Metal Welds Processed by Friction Stir Welding	SCIE	1.524	Jan-22	Volume 25	Materials Research
25.	Elumalai. B	Experimental investigations on µeD milling of inconel 718 with nanoSiC abrasive mixed dielectric	SCIE	1.524	Nov-21	Volume 25	Materials Research
26.	Naresh Babu. M	Turning SKD 11 steel using silver nanofluids with minimum quantity lubrication	ESCI	1.03	Jul-21	Volume 11, Issue 3, Pages 74-95	International Journal of Manufacturing, Materials, and Mechanical Engineering
27.	Ramadoss. R	Surface Ignition using ethanol on Mo and Al2 O3-TiO2 coated in CI engine for environmental benefits	Scopus	0.3	Aug-21	Volume 7, Issue 1, Pages 19-27	Advances in Environmental Technology
28.	Peter Pushpanathan. D,	Investigations on the microstructure and microhardness of the friction stir processed AZ80 surface composites	Scopus	0.402	May-22	Volume 2463	AIP Conference Proceedings
29.	Joel.C	Numerical Investigation on Temperature Distribution of	Scopus	0.52	May-22	Pages 225-233	Lecture Notes in Mechanical Engineering

		Triangular and Rectangular Shaped Aluminum and Copper Fins					
30.	Raju. M	Optimization of friction surfaced deposits of aluminium alloy 6068 over low carbon steel	Scopus	1.46	May-22	Volume 62	Materials Today: Proceedings
31.	Babu.M	Design and optimization of linear Fresnel reflector concentrating solar system using particle swarm optimization algorithms	Scopus	1.46	April-22	Volume 66	Materials Today: Proceedings
32.	Jeremiah.R, Paulmer Pushparaj. J	Optimization of Parameters to Improve Effectiveness of Plate and Fin Heat Exchangers using Taguchi Method and CFD Analysis	Scopus	0.953	June-2022	Volume 14, Issue 3,397-400	International Journal of Vehicle Structures and Systems
33.	Joel.C	Evaluation of Waste Plastic Pyrolysis Oil Performance with Diethyl Ether Additive on Insulated Piston Diesel Engine	WoS	0.7	November 2021	Volume 20, Issue 5, Pages 2079-2086	Nature Environment and Pollution Technology

Thank You!

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