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VOLUME XIX, ISSUE IV

NEWSLETTER

Oct-Dec 2024

From Chief Editor's Desk

Dr. Nitin Kumar Waghmare

HOD, Mechanical Engineering

Dear Readers,

I am delighted to welcome you to the latest edition of our quarterly newsletter. This publication is a testament to our collective achievements, ongoing projects, and the vibrant spirit that drives our Department forward. We strive to bring you the most relevant and inspiring stories each quarter, highlighting our team's incredible work and dedication.

During the last quarter (Oct-Dec 2024), the department has made significant contributions in various domains such as teaching and research, product development, sponsored projects, outreach activities and students' achievements. I am sure this issue will give a glimpse of the above.

We are marching with 'Team Spirit and Synergy'. I wish to quote William Shakespeare, who said,"You know what you are, but you also know what you can be". The Team Spirit and Synergistic approach can help us evolve. Synergy is not only the answer to human conflicts; it transcends the conflicts and creates something new and rewarding. Synergy is based on combining the individuals' strengths, producing results far greater than anyone could achieve alone. For example, a chord comprising several notes creates music that a single note cannot. The individual notes do not lose their identity; together, they produce music. Like musical notes, synergistic people do not lose their identity; together, they can create something new and fulfilling. This needs internal strength to think about us, which is a key to transforming the situation. Synergy leads to mutual understanding and growth. New ideas breathe best in an atmosphere of mutual understanding.

Lack of synergy is one of the greatest tragedies since so much potential remains unexplored and unused. Egoism is the greatest barrier to synergy, which prevents the creative blending of human energies, puts walls around and stops them from moving forward.

Let us march forward with Team Spirit and Synergistic approach, leading to excellence.

Thank you and best wishes

Dr. Nitin Kumar Waghmare
Chief Editor & HOD
Dept. of Mechanical Engineering

The only way to
do great work is to
love what you do
~ Steve Jobs

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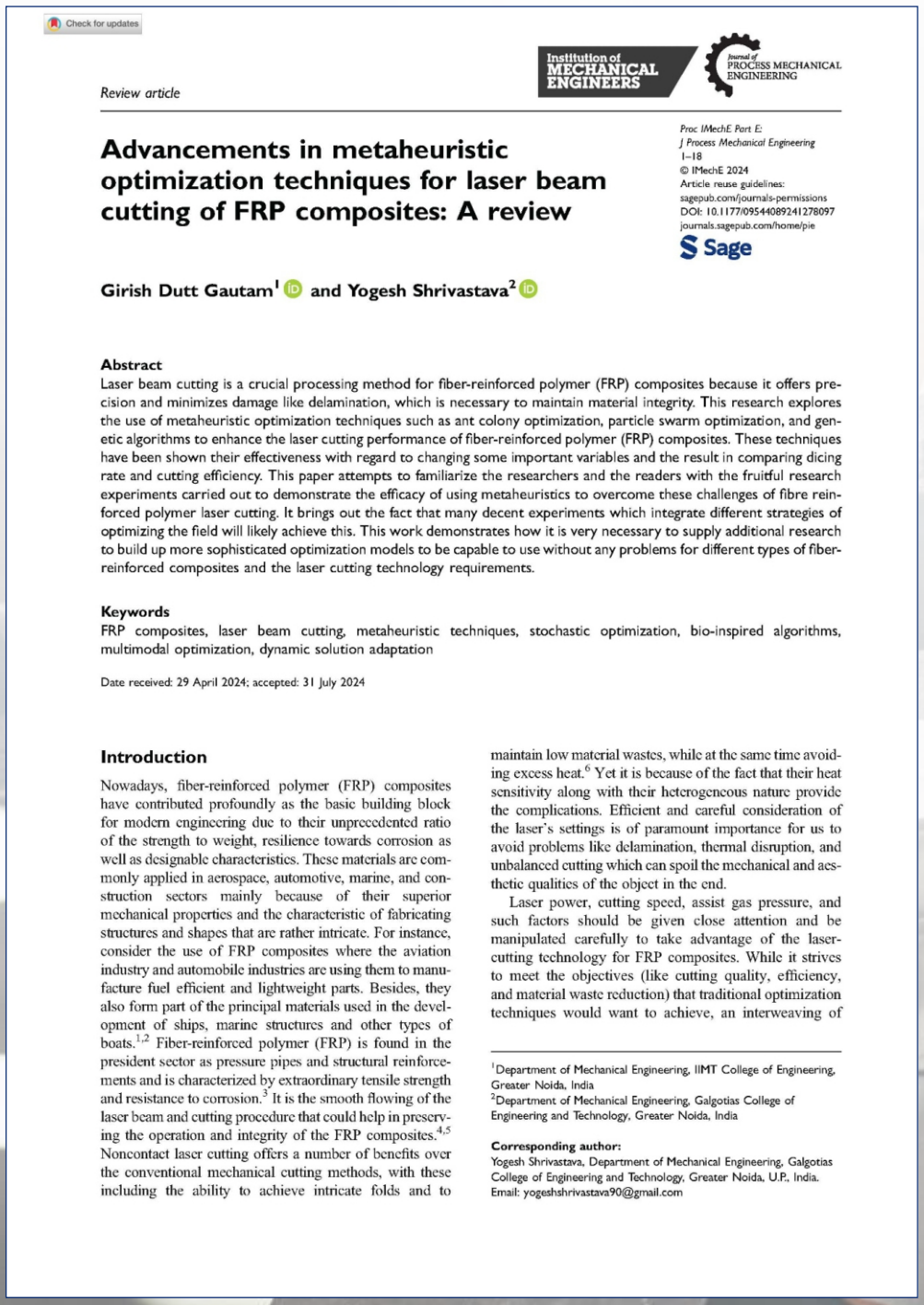
TECHNOLOGY VISION

Research Publication Update: Dr. Girish Dutt Gautam, Associate Professor of Mechanical Engineering has published SCI paper in the Journal of Process Mechanical Engineering, SAGE.



Check for updates

Institution of MECHANICAL ENGINEERS

Journal of PROCESS MECHANICAL ENGINEERING

Review article

Proc IMechE Part E: J Process Mechanical Engineering
1–18

DOI: 10.1177/09544089241278097
journals.sagepub.com/home/pie

Sage

Advancements in metaheuristic optimization techniques for laser beam cutting of FRP composites: A review

Girish Dutt Gautam[1] and Yogesh Shrivastava[2]

Abstract

Laser beam cutting is a crucial processing method for fiber-reinforced polymer (FRP) composites because it offers precision and minimizes damage like delamination, which is necessary to maintain material integrity. This research explores the use of metaheuristic optimization techniques such as ant colony optimization, particle swarm optimization, and genetic algorithms to enhance the laser cutting performance of fiber-reinforced polymer (FRP) composites. These techniques have been shown their effectiveness with regard to changing some important variables and the result in comparing dicing rate and cutting efficiency. This paper attempts to familiarize the researchers and the readers with the fruitful research experiments carried out to demonstrate the efficacy of using metaheuristics to overcome these challenges of fibre reinforced polymer laser cutting. It brings out the fact that many decent experiments which integrate different strategies of optimizing the field will likely achieve this. This work demonstrates how it is very necessary to supply additional research to build up more sophisticated optimization models to be capable to use without any problems for different types of fiber-reinforced composites and the laser cutting technology requirements.

Keywords

FRP composites, laser beam cutting, metaheuristic techniques, stochastic optimization, bio-inspired algorithms, multimodal optimization, dynamic solution adaptation

Date received: 29 April 2024; accepted: 31 July 2024

Introduction

Nowadays, fiber-reinforced polymer (FRP) composites have contributed profoundly as the basic building block for modern engineering due to their unprecedented ratio of the strength to weight, resilience towards corrosion as well as designable characteristics. These materials are commonly applied in aerospace, automotive, marine, and construction sectors mainly because of their superior mechanical properties and the characteristic of fabricating structures and shapes that are rather intricate. For instance, consider the use of FRP composites where the aviation industry and automobile industries are using them to manufacture fuel efficient and lightweight parts. Besides, they also form part of the principal materials used in the development of ships, marine structures and other types of boats.[1,2] Fiber-reinforced polymer (FRP) is found in the president sector as pressure pipes and structural reinforcements and is characterized by extraordinary tensile strength and resistance to corrosion.[3] It is the smooth flowing of the laser beam and cutting procedure that could help in preserving the operation and integrity of the FRP composites.[4,5] Noncontact laser cutting offers a number of benefits over the conventional mechanical cutting methods, with these including the ability to achieve intricate folds and to maintain low material wastes, while at the same time avoiding excess heat.[6] Yet it is because of the fact that their heat sensitivity along with their heterogeneous nature provide the complications. Efficient and careful consideration of the laser's settings is of paramount importance for us to avoid problems like delamination, thermal disruption, and unbalanced cutting which can spoil the mechanical and aesthetic qualities of the object in the end.

Laser power, cutting speed, assist gas pressure, and such factors should be given close attention and be manipulated carefully to take advantage of the laser-cutting technology for FRP composites. While it strives to meet the objectives (like cutting quality, efficiency, and material waste reduction) that traditional optimization techniques would want to achieve, an interweaving of

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DEPARTMENTAL ACTIVITIES

IDEA GENERATION COMPETITION (UNDER INNOVATION CLUB) THEME: ELECTRICAL VEHICLE, RETROFIT, HYBRID VEHICLE, AUTONOMOUS VEHICLE

On10th October 2024, the Department of Mechanical Engineering organised an idea generation Competition on new and emerging technologies, electric vehicles, retrofits, hybrid vehicles, and autonomous vehicles. Students used their thoughts, knowledge, and skills to generate an innovative idea.

A total of 48 Students attended the session. The session was arranged with the objective of students thinking about new ideas on emerging technology in automobiles. The session began with problem identification. The event Coordinator explained in detail how we can develop great ideas by identifying problems. The session was followed by a brainstorming session, which gave a complete understanding of the students; at the end, students wrote their ideas on plain paper. The entire session was refreshing and boasted of our students' confidence. Students also raised a lot of doubts that the event coordinator clarified.

Students write their Ideas on theme

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WORKSHOP

Difference Between Good And Bad Inventions

Department of Mechanical Engineering had organized workshop on“Difference between good inventions and bad inventions”. Dr. Manish Dev had presented excellent examples to our students about how various products havebeen invented and how they ease human lives. He started his talk with a brilliant example of Alfred Nobel,and how the theory of relativity helps humans in construction work and how his finding will bem is used to make war weapons.He gives motivational talk to the students to always keep pushing your self to think out of the box and implement ideas for the betterment of the society.

Students focus on motivational talk

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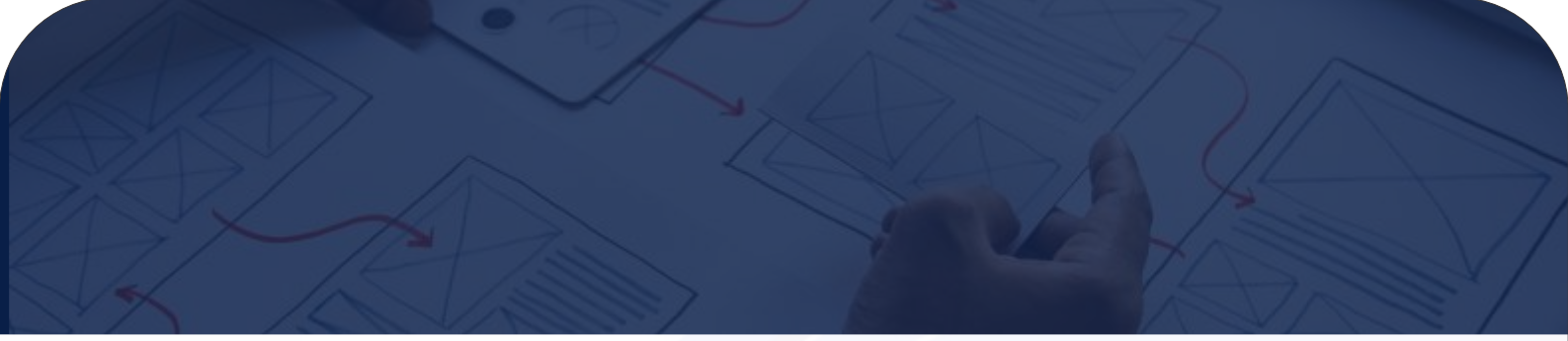

WORKSHOP

Use of Software for Analysis of Refrigeration & Air-Conditioning Systems

The workshop on "Use of Software for Analysis of Refrigeration & Air-Conditioning Systems" was organized to bridge the gap between theoretical concepts and practical applications, focusing on the latest software tools essential for optimizing refrigeration and air-conditioning (RAC) systems. In recent years, the field of RAC has witnessed significant advancements, especially with the introduction of various simulation and analysis tools that allow engineers and researchers to model complex systems, predict performances, and enhance system efficiency. This workshop was designed to cater to the growing demand for such skills, particularly among students, researchers, and professionals in engineering disciplines, enabling them to keep up with the latest technological developments and methodologies in the RAC industry.

The program began with an introduction to the fundamental principles of RAC systems, covering essential thermodynamic concepts such as the refrigeration cycle, vapor compression and absorption cycles, cooling loads, and the significance of energy efficiency in air-conditioning. This foundational overview was critical for participants, setting the stage for understanding how software tools can simplify and refine these calculations and analysis. The experts then introduced the main software tools used in the workshop, including Engineering Equation Solver (EES), CoolPack, TRNSYS, and MATLAB. Each tool offers specific features tailored to RAC analysis: EES specializes in solving thermodynamic equations, CoolPack is designed specifically for refrigeration applications, TRNSYS is widely used for transient simulation of thermal systems, and MATLAB provides a flexible platform for custom modeling and simulation tasks.

Following the software introductions, each tool's unique capabilities and applications were demonstrated. The trainers highlighted how EES could be employed to solve complex thermodynamic equations related to RAC systems, making it invaluable for tasks that involve extensive mathematical modeling. CoolPack was introduced as an intuitive tool for handling common refrigeration applications, making it particularly accessible for beginners or those working directly in refrigeration settings. TRNSYS was showcased for its capacity to model dynamic systems, such as solar-powered cooling setups, which allowed participants to explore its utility in simulating the interactions of RAC systems with other energy sources. MATLAB was presented as a versatile platform for creating custom models and performing detailed data analysis, adding an extra layer of flexibility for more advanced users.

The workshop included multiple hands-on exercises, allowing participants to work through real- world scenarios and apply their theoretical knowledge to practical tasks. These exercises covered topics like simulating vapor compression cycles, evaluating system performance under different environmental conditions, and calculating key performance metrics such as the Coefficient of Performance (COP) and Energy Efficiency Ratio (EER). Participants learned how to vary parameters within the software to study how changes in operating conditions, refrigerant properties, and system configurations affect overall efficiency. This interactive format enabled attendees to visualize the impact of these variables on system performance, equipping them with insights on optimization strategies.

One of the highlights of the workshop was the case study segment, which demonstrated real-world applications of software-based RAC analysis. Trainers presented examples of how companies use these tools to conduct energy audits, reduce operational costs, and ensure compliance with environmental regulations. Participants analyzed these case studies to understand the significance of software in troubleshooting and optimizing RAC systems. By examining these practical applications, attendees gained a broader perspective on the role of simulation in addressing industry challenges, such as enhancing energy efficiency, minimizing environmental impact, and adapting to new refrigerant regulations.

The workshop concluded with an open discussion, where participants shared feedback and raised questions on specific software tools and their applications. Many expressed that the workshop offered valuable insights into modern RAC practices and underscored the importance of software proficiency in achieving high-performance system designs. The trainers emphasized that mastering these tools not only simplifies the analysis process but also empowers engineers to make data-driven decisions that improve system reliability and sustainability. This aspect of the training resonated well with the participants, many of whom were keen to apply their new skills in professional and research settings.

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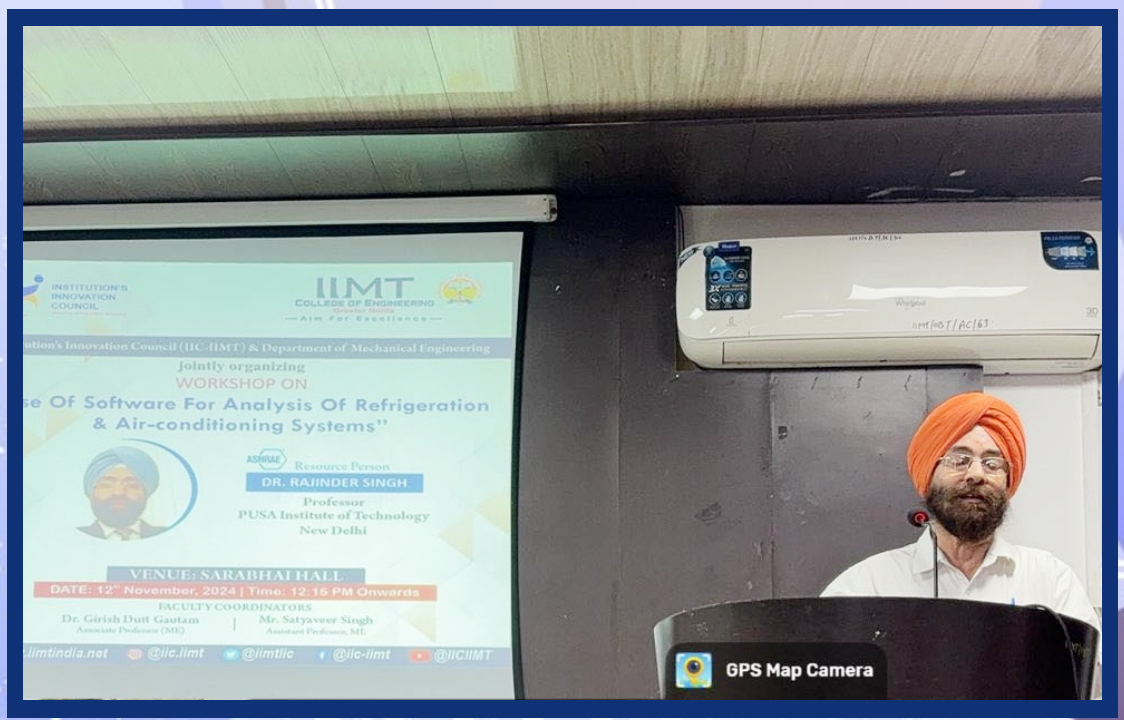

Brief about the RAC Software

INDUSTRIAL VISIT & PLACEMENT DRIVE

Air Flow Industry, Kasna

On 3rd December 2024, the Department of Mechanical Engineering at IIMT College of Engineering, Greater Noida, organized an insightful Industrial Visit and Placement Drive at Air Flow Industry, located in Kasna, Uttar Pradesh. This initiative was undertaken under the guidance and support of the Indian Society of Heating, Refrigerating and Air Conditioning Engineers (ISHRAE) India Chapter.The visit provided an excellent opportunity for the students to gain firsthand exposure to the working of an established industry in the field of air conditioning and refrigeration. The students were able to observe the advanced manufacturing processes, technological innovations, and the real-world applications of concepts they have been studying in their academic curriculum. Additionally, the placement drive conducted during the visit aimed to connect students with career opportunities within the industry. Students interacted with industry professionals, learned about potential job roles, and explored the requirements and expectations of the company from prospective employment. In this event three students namely Arijeet Banerjee, Ankit Sengar and Aadilwere selected for internship in air flow industry.

Industrial visit picture

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