

## Introduction

This volume of the MATEC Web of Conferences presents the selected peer-reviewed papers from the International Conference on Mechanical and Materials Engineering (ICMME 2025), held during 28–30 April 2025 at Jaypee University of Engineering and Technology, Guna (M.P.), India. The conference was organized by the Department of Mechanical Engineering with the aim of providing an international platform for the dissemination of research related to materials science, engineering technologies, and applied scientific developments.

In line with the scope of MATEC Web of Conferences, the papers included in this volume address a wide spectrum of fundamental and applied research aspects related to materials science, engineering design, manufacturing technologies, and interdisciplinary engineering applications. The contributions reflect ongoing research efforts aimed at improving the performance, efficiency, and sustainability of modern engineering systems through advanced analytical methods, computational modelling, experimental investigations, and intelligent optimization techniques.

Several studies in this volume focus on thermal and energy engineering systems, including numerical and experimental investigations of heat transfer enhancement, cooling technologies for electronic systems, and the optimization of solar thermal collectors. These contributions highlight the role of material properties, thermal transport mechanisms, and system design in improving the efficiency of engineering applications.

Research related to energy harvesting and sustainable technologies is also represented, including studies on piezoelectric footstep energy harvesting and the utilization of waste mechanical energy for electrical power generation. Such investigations demonstrate the importance of materials, electromechanical systems, and innovative design approaches in developing sustainable and energy-efficient technologies.

Another group of papers addresses mechanical design, structural analysis, and manufacturing optimization, where computational tools such as finite element analysis, machine learning algorithms, and genetic algorithms are applied to optimize engineering components and structures. Examples include the structural analysis of mechanical components, the design of cryogenic storage systems, and the optimization of mechanical assemblies used in industrial and transportation applications.

The proceedings further include contributions related to automotive and mechanical systems engineering, covering topics such as dynamic balancing of wheel–tyre assemblies, tire inflation technologies, and predictive modelling approaches for improving vehicle safety and performance. These studies demonstrate the integration of materials behaviour, mechanical design principles, and analytical modelling in the development of reliable engineering systems.

Advances in robotics, intelligent systems, and computational engineering methods are also explored. Papers addressing control strategies for robotic manipulators, propulsion systems for planetary exploration vehicles, and the application of artificial intelligence techniques in engineering design illustrate the increasing role of digital technologies in modern engineering research.

Additionally, the volume includes studies addressing broader technological and societal challenges, such as the environmental impacts of agricultural residue burning and strategies for optimizing resource allocation during natural disasters using computational and game-theoretic approaches. These contributions highlight the interdisciplinary nature of engineering research and its relevance to sustainable development.

Overall, the papers presented in this volume contribute to the advancement of materials science, mechanical engineering, and applied technological research, in accordance with the objectives of MATEC Web of Conferences. The editors hope that this collection of research work will provide valuable insights for researchers, engineers, academicians, and students, and will stimulate further developments in the fields of materials science, engineering design, and innovative technological applications.