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*Guest Editorial*

# Advances in Solid Mechanics and Composites

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Applied mechanics is a scientific discipline that focuses on the study of various laws of mechanics and their application in solving engineering problems. The Indian Society for Applied Mechanics (ISAM) organizes conferences focused on various areas of applied mechanics, encompassing solid mechanics, fluid mechanics, and biomechanics. The fifth Indian Conference on Applied Mechanics (INCAM-2022) was jointly organized by the Department of Mechanical Engineering, National Institute of Technology (NIT) Jamshedpur, and ISAM during November 11-13, 2022 at Jamshedpur in India. It provided a technical platform for researchers and academicians to present their research work and discuss the broad field of applied mechanics.

The technical program included two plenary talks, five keynote lectures, and oral presentations on solid mechanics, biomechanics, composites, material modeling, and impact dynamics. A total of 156 papers, which were accepted following a peer review process, were presented. This special issue of the Defence Science Journal comprises the select and peer-reviewed articles of INCAM-2022 on advances in solid mechanics and composites. The authors of the selected articles have submitted full-length articles after incorporating the remarks made during their presentations. These articles were again sent for further peer review as per the journal policy. After a rigorous review process, ten papers covering the latest research in the application of unified mechanics theory, damage-healing model, composites, material modeling, impact dynamics, and creep in metal alloys, have been accepted for publication in this special issue.

Kumar and Singh discussed the trajectory of a taut horizontal string moving at a constant velocity, considering its rotary inertia. The equation of motion is solved using Galerkin's method. It was observed that the jump in the trajectory of a moving mass remains unaffected by rotary inertia. Harini and Shantanu discussed the development of a one-dimensional constitutive model based on continuum damage mechanics to capture the elastic damage-healing response in self-healing materials by coupling a secondary damage variable. The model response is demonstrated for different loading histories using an implicit energy-based damage evolution function. Brahmadathan and Rao discussed the development of a constitutive model for Alumina based on micromechanics, considering the micro-cracking energy dissipation mechanism using unified mechanics theory. A representative volume element (RVE) technique is employed to predict the stress-stress response for all possible micro-crack lengths and orientations and to calculate the thermodynamic state index, an entropy-based damage parameter, for Alumina.

Khan, *et al.* examined the effects of cyclic loading on the structural integrity and lifespan of a composite repair system for a corroded steel pipeline. An experimental setup has been developed to test the corroded pipeline, where pre-impregnated chopped strand mat (CSM) and pre-impregnated woven-roven mat (WRM) glass fibers are combined to repair the defects. The composite repair system specimens experienced through-thickness failure and debonding at a cyclic loading severity of 0.33. Chethana et al. demonstrated the constitutive response of the particulate composite material under uniaxial tension using elasto-plastic and visco-plastic material models. Material constants are obtained by combining the nonlinear least square Levenberg-Marquardt algorithm and stress update. The response of inelastic material to different loading rates is analyzed. Singh et al. studied the response of a layered elastic medium to a one-dimensional impact by examining the interaction between waves and the interface. A model that utilizes stress and particle velocity expressions is presented to provide exact solutions for the impact problem and also offers good computational efficiency over the finite element method.

Sudhamsu, *et al.* have developed a creep estimation model that uses damage mechanics and unified mechanics theory to predict damage. The model employs an entropy-based thermodynamic state index parameter to track the evolution of damage in nickel-based superalloys. Shashank Pandey investigated the effect of porosity on the fundamental vibration modes of a rotating pre-twisted sandwich blade with an FGM core in a thermal environment. The paper discusses a layerwise FEM formulation for two different models of porosity. The effect of volume fraction index, rotational velocity, porosity distribution, and temperature gradient on the blade's natural frequencies is being studied. Mangal et al. studied the stress relaxation behaviour of nickel-based superalloys during creep-fatigue interaction using a one-dimensional damage model based on unified mechanics theory. To understand the material's health over time, the evolution of creep strain energy and the thermodynamic state index are utilized. Chaurasia and Kumar presented the modeling of CFRP composites under compressive loading with high strain rates. The Split Hopkinson Pressure Bar test models are used in experiments

and numerical simulations to investigate the stress-strain behaviour of CFRP composites. To predict damage, a user-defined Hashin damage model and a VUMAT subroutine for material degradation were used. The stress distribution in the three-dimensional model of the composite lamina with a cohesive interface was comparable to that observed in the experiments.

I hope that this special issue serves as a valuable resource for researchers and practitioners, and will serve as a catalyst for initiating further investigations. It is an honour for me to serve as the Guest Editor of this special issue on advances in solid mechanics and composites. I express my gratitude to the President of the Indian Society for Applied Mechanics for his timely advice. I sincerely thank all the authors for their outstanding contributions and for addressing all the reviewers' comments. I am grateful to all the reviewers for their voluntary time and effort, and for their valuable comments and suggestions to improve the articles. I thank Dr. KVN Surendra, Assistant Professor at IIT Palakkad, for his help during the initial phase of this work. Together with all the authors, I wish to express my sincere gratitude to the Editor-in-Chief and Director of DESIDOC for his kind permission to publish this special issue. I acknowledge the editorial team of Defence Science Journal, including Alka Bansal, Yogesh Modi, Purbi Dey Kanungo, Faizul Nisha, and TC Chauhan, for their continuous help in publishing this special issue.