Indian Institute of Technology Delhi

School of Interdisciplinary Research (SIRe)

SIRe Project Number

2025-01-33

(will be assigned by SIRe)

Project Proposal for Ph.D.

Project Details (The research problem must clearly indicate the need for an interdisciplinary approach)	
Project Title	Design and optimization of lattice structures for high strain rate impact applications
Project Summary (Minimum 500 and maximum 2000 characters)	This project focuses on the design and development of auxetic lattice structures optimized for high strain rate conditions. Lattice structures are periodic, lightweight materials known for their high strength-to-weight ratio, making them ideal for applications requiring both strength and reduced mass. Recently, lattice-based materials have gained attention for protective uses due to their effectiveness under extreme conditions, such as high strain rates, while maintaining lightweight properties. The primary aim of this project is to design auxetic lattice structures, which possess the unique ability to get compressed under impact loading in a way, enhancing its energy absorption capabilities. These structures will be optimized to sustain high strain rates, ensuring they provide superior performance in dynamic loading scenarios. The potential applications for these optimized auxetic lattice materials are vast, particularly in fields requiring protection from high-impact forces, such as ballistics and blast mitigation. The project will involve the creation of computational models, design iterations, and experimental testing to verify the performance of the developed lattice structures under various loading conditions. Ultimately, this research aims to contribute to the development of advanced, lightweight, and highly effective protective materials for defense and safety applications.

Ph.D. Supervisors
(Supervisor 1 and Supervisor 2 cannot be from the same department of IITD)

Role	Name of Faculty	Academic Unit in IITD/Institute/University	Email ID (Official)
Supervisor 1	Kusum Meena	Mechanical	Kusum@iitd.ac.in
Supervisor 2	Souvik Chakraborty	Applied Mechanics	Souvik@am.iitd.ac.in

Project requirements (Student qualifications, experience required, etc)
***The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)**

- M.Tech. or Master of Science (MS) by Research students.
- Applicants with strong fundamental understanding of solid mechanics, structural dynamics, and finite element analysis are most suited. Programming skills in Python/ MATLAB environments will be important. Exposure to optimization techniques and uncertainty quantification will be added advantage

Source of fellowship/funding and project number
(CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)

Project Funding

Role of Faculty Members involved:	
Supervisor-1	Kusum Meena: Design and Experimental Investigation
Supervisor-2	Souvik Chakraborty: Machine learning and topology optimization