DEPARTMENT OF MECHANICAL AND MATERIALS ENGINEERING
COLLEGE OF ENGINEERING AND APPLIED SCIENCE

RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

APPLICATION DEADLINE: September 22, 2025

PROJECT TITLE: Architectured Materials Development and Testing for Helmet Liner Applications

Physical Requirement :
No particular physical requirement is needed

Project's Technical Skills Requirement :
1. Experience/familiarity with CAD software (e.g., SolidWorks or AutoCAD) ; 2. Knowledge of mechanical engineering principles; 3. Interest in programming and/or sensor integration (e.g., Arduino or similar)

Project's Available Positions : 1

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Project Description

Traumatic brain injuries remain a significant concern across industries such as construction, manufacturing, mining, and firefighting, where traditional safety helmets often fall short in providing optimal protection. This project aims to develop, test, and validate advanced architectured materials (i.e., metamaterials) of helmet liner applications, which provide superior energy absorption and distribution during impacts to mitigate risks for workers. Dr. Jing Shi’s group has developed multiple bio-inspired material structures for this purpose. However, performance improvement is being sought after. Specifically, the goals of this project are to (1) improve the existing designs of bio-inspired material structures; (2) develop new types of architectured materials for helmet liners; and (3) evaluate the performance of material structures.

This research project will be completed at Dr. Jing Shi’s Lab in the Department of Mechanical and Materials Engineering. You will work as part of a multidisciplinary team, collaborating on aspects such as mechanical design and mechatronics, with opportunities to contribute to computer modeling for advanced structures, material fabrication, impact test innovation, design of

experiments, data collection and analysis.

Preferred skills:
• Experience/familiarity with CAD software (e.g., SolidWorks or AutoCAD)
• Knowledge of mechanical engineering principles
• Interest in programming and/or sensor integration (e.g., Arduino or similar)

Training provided:
• Designing advanced architectured materials using CAD software
• Comprehensive material testing and data analysis
• Hands-on experience in mechatronics, including the integration of DAQs, accelerometers, load cells, and other sensors
• Cross-discipline collaboration skills by working with students and faculty from different departments and colleges.
• Involvement in developing research publications, presentations, invention disclosures, and real-world safety innovations