ME Seminar

Engineered electromechanical coupling through data-driven design and additive manufacturing

Dr. Saurav Sharma, Marie Curie Postdoctoral Fellow, Department of Aerospace Structures and Materials, TU Delft, Netherlands

ABSTRACT

Piezoelectricity is the most utilized electromechanical phenomenon due to the wide availability of materials that display precise and reliable coupling. However, the inherent directionality of these materials is constrained by the symmetry of their crystal structure. In this talk, I will discuss my work on designing and 3D-printing piezoelectric truss metamaterials with customizable anisotropic responses. Generative machine learning is used to optimize truss topology and geometry to achieve target piezoelectric properties, while the developed in-gel 3D printing method fabricates polymer-ceramic structures from a photo-curable resin and lead-free piezoelectric particles. Our approach enables customizable piezoelectric responses and paves the way toward the development of a new generation of electro-active animate materials. I will also discuss my ongoing and future efforts toward addressing challenges in this direction, including miniaturization, computational methods and scalable fabrication of these materials. Finally, I will conclude with my latest work on engineering this phenomenon into biological materials, opening pathways towards bio-based transducers.

ABOUT THE SPEAKER

Dr. Saurav Sharma is a Marie Curie Postdoctoral Fellow in the Faculty of Aerospace Engineering at TU Delft. Prior to this, he was an Alexander von Humboldt Fellow at the Institute of Structural Mechanics, Bauhaus University Weimar, Germany. He received his Ph.D. in Mechanical Engineering from the Indian Institute of Technology Mandi in 2021. His research focuses on multiphysics modeling, computational mechanics, and the development of advanced numerical methods for complex materials and structures, including piezoelectric, flexoelectric, and architected materials. He has also worked at the interface of simulation and machine learning, applying ML-based approaches for inverse design and performance optimization.

15th October 2025, 4:00 PM, AR Auditorium, Department of Mechanical Engineering, IISc