



CISM-IISc Workshop

Emerging Topics in Architected & Multiscale Materials, Soft Robotics, and Data-Driven Model Discovery

21-25 July 2025



Workshop updates @ tinyurl.com/cism-iisc

Venue on Google
Maps:



Participants'
WhatsApp group:



qrco.de/cism-2025

Contact for accommodation queries

Harshit: +91 90390 00929

Avinash: +91 98842 79516

Wi-Fi at the venue

Network: iiscwlan

guest1.aero@iisc.ac.in | Pwd: Guest1aero@874163

guest2.aero@iisc.ac.in | Pwd: Guest2aero@603984

In case of any health emergencies

IISc Health Center: +91 80 2293 2227

Ramaiah Hospital: 1800 123 1133

Venue: AE Auditorium, Department of Aerospace Engineering, Indian Institute of Science

Course Contents:

Tandem 1: Material Model Identification and Discovery | Laura De Lorenzis and Akshay Joshi

This tandem addresses constitutive modeling across elasticity, hyperelasticity, viscoelasticity, and elastoplasticity. It introduces classical identification methods (e.g., least squares, Equilibrium Gap, Virtual Field Method) and modern data-driven approaches, including model-free versus model-based frameworks, interpretable versus uninterpretable methods, and supervised versus unsupervised learning. Advanced modeling strategies based on sparse regression, symbolic regression, and neural networks are discussed, with specific emphasis on the EUCLID family (standard, Bayesian, and neural network-based variants). The tandem concludes with a hands-on session utilizing both artificial and experimental data for the identification of hyperelastic and elastoplastic material models.

Tandem 2: Architected Metamaterials | Diego Misseroni and Rajesh Chaunsali

This tandem focuses on the static and dynamic mechanical behavior of architected materials. It begins with fundamentals such as auxeticity, stiffness, compressibility, and thermal expansion. Origami-based metamaterials are presented as illustrative systems, with detailed discussions on modeling (in-plane and out-of-plane), physical prototyping, and experimental validation. The tandem then explores wave phenomena in such materials, including vibration, dispersion, bandgaps, and nonlinear effects such as shock propagation. Both periodic and locally resonant systems are considered, with origami serving as a primary exemplar.

Tandem 3: Magnetism in Solids and Soft Robotics | Antonio DeSimone and Vivekanand Dabade

This tandem introduces the continuum theory of ferromagnetism through micromagnetics, including discussions on small-particle and large-body limits, energy scaling, and magnetic microstructures. It then transitions to materials beyond conventional magnetostriction, focusing on magnetoactive polymers (MAPs) and their two-scale analysis. The role of microstructure and geometry in determining macroscopic behavior is emphasized. The latter part addresses magnetically actuated slender structures—planar and three-dimensional elastic rods—and complex systems such as tubular braided meshes. Applications in soft robotics, including shape morphing and bio-inspired locomotion, are explored in detail.