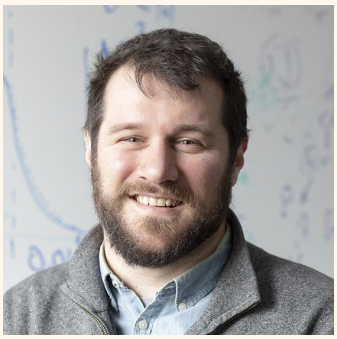
Dec 04, 2025

Time: 2:30 - 4:00 PM
Location: CBB 104

From local to nonlocal models in continuum mechanics: the role of SciML



Nikolaos Bouklas

Associate Professor

Sibley School of Mechanical and Aerospace Engineering

Cornell University

Director for Research in CAD/CAE and ML at Pasteur Labs

ABSTRACT:

Machine learning (ML) techniques are gearing up to play a significant role in the field of computational solid mechanics and multiphysics, enabling the integration of experimental data and physical constraints towards data-driven constitutive laws, acceleration of computational techniques for multi-scale modeling, and new paradigms for the solution of forward and inverse problems, to name a few. This talk will cover three main focus areas surrounding computational solid mechanics, starting from i) automated and trustworthy constitutive modeling enabled by a fusion of data-driven and physics-augmented approaches including new results towards uncertainty quantification, to ii) enabling fast approaches for constitutive modeling from full-field data using extreme sparsification and transfer learning and finally iii) a transition to non-local models for advanced phenomena in solid mechanics (from fracture to multiscale cascades of instabilities).

BIOGRAPHY:

Dr. Bouklas is an Associate Professor at the Sibley School of Mechanical and Aerospace Engineering at Cornell University and Director for Research in CAD/CAE and ML at Pasteur Labs. He received his PhD from the Aerospace Engineering and Engineering Mechanics department at the University of Texas at Austin and obtained his Diploma in Mechanical Engineering from the Aristotle University of Thessaloniki, Greece. Dr. Bouklas' research focuses in the field of computational solid mechanics and scientific machine learning. Developing theoretical frameworks and advanced computational methods, he aims to improve the fundamental understanding of materials and structures, and enhance the predictive capabilities in relevant engineering applications. He is the recipient of the Young Investigator Program award from the Air Force Office of Scientific Research, and served in the leadership of the Cornell SciAI Center funded by ONR.