THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT COLLOQUIUM SERIES PRESENTS:

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## *Machine Learning and Computer Vision for Deformation Mechanism Analysis*

The influence of microstructure on deformation and failure mechanisms, such as twinning, slip, grain boundary sliding, and multi-crack systems, includes complex stochastic and deterministic factors whose interactions are currently under active debate. In this talk, the application of machine learning and computer vision to microscale displacement data for the segmentation and identification of deformation mechanisms – in this example, deformation twinning in magnesium – and their evolution under load across mm-scale fields of view is discussed. A recently developed experimental approach to obtain high-resolution, large FOV microscale deformation maps is presented, obtained using a combination of scanning electron microscopy and digital image correlation, aided with chemically-functionalized nanoparticle assembly for speckle patterning and external codes for improved electron beam scan control, test automation, and experimental analysis. The newly developed experimental and analytical approaches are length scale independent and material agnostic, and can be modified to identify a range of deformation and failure mechanisms. The advantages and disadvantages of various large data analysis approaches will be discussed, where the balance between computational cost and incurred error are considered.

Sam Daly is an Associate Professor in the Department of Mechanical Engineering at the University of California at Santa Barbara. She received her Ph.D. from Caltech in 2007 and subsequently joined the University of Michigan, where she was on the faculty until 2016 prior to her move to UCSB. Her interests lie at the intersection of experimental mechanics and materials science, with an emphasis on using novel methods of experimentation coupled closely with theoretical and computational modeling. Group research focuses on the statistical quantification of microstructural features of materials and their effect on meso- and macro-scale properties. Currently, the group is engaged in the development of novel methods of multi-scale material characterization, with application to structural metallic alloys, active materials, advanced composites, high cycle and dwell fatigue mechanisms, plasticity, fracture, and material behavior at the microscale. Her recognitions include the NSF CAREER Award, the ASME Eshelby Mechanics Award, the Journal of Strain Analysis Young Investigator Award, the Experimental Mechanics Best Paper of the Year Award, the IJSS Best Paper of the Year Award, the DOE Early Career Award, the AFOSR-YIP Award, the ASME Orr Award, and the Caddell Award.

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