School of Natural Sciences Special Seminar

UCMERCED

Data to Decisions: Computational Methods for the Next Generation of Engineering Systems

By: Dr. Karen E. Willcox

Date:

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Time:

1:30PM-3:00PM

Location:

COB2 140

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Abstract:

New technologies are changing the way we think about designing and operating engineering systems. For example, next-generation aircraft have a combination of sensing technologies and computational power that brings new opportunities for data-driven modeling and data-driven decision-making. Yet data alone cannot deliver the levels of predictive confidence and modeling reliability demanded for these systems. For that, we must build on the decades of progress in rigorous physics-based modeling. This talk discusses our work at the intersection of physics-based and data-driven modeling. Our approaches use the mathematical framework of projection-based model reduction, which traditionally has been a way to derive accurate, low-cost surrogates of high-fidelity physics-based models. We show how these reduced models can be adapted in the face of dynamic data and/or changing conditions. We also show how the projection viewpoint provides a rigorous lens through which to learn low-dimensional models from data while embedding physics-based knowledge and respecting physical constraints.

Biography:

Karen E. Willcox is Director of the Oden Institute for Computational Engineering and Sciences, and a Professor of Aerospace Engineering and Engineering Mechanics at the University of Texas at Austin. She holds the W. A. "Tex" Moncrief, Jr. Chair in Simulation-Based Engineering and Sciences and the Peter O'Donnell, Jr. Centennial Chair in Computing Systems. Before joining the Oden Institute in 2018, she spent 17 years as a professor at the Massachusetts Institute of Technology, where she served as the founding Co-Director of the MIT Center for Computational Engineering and the Associate Head of the MIT Department of Aeronautics and Astronautics. Prior to joining the MIT faculty, she worked at Boeing Phantom Works with the Blended-Wing-Body aircraft design group. Her research has produced scalable computational methods for design of next-generation engineered systems, with a particular focus on model reduction as a way to learn principled approximations from data and on multi-fidelity formulations to leverage multiple sources of uncertain information. She is a Fellow of SIAM and Fellow of AIAA.