ECE Distinguished Lecture Series

Dr. Karen Willcox

University of Texas at Austin
Director of the Oden Institute for Computational Engineering and Sciences
Associate Vice President for Research
Professor of Aerospace Engineering and Engineering Mechanics
Fellow of SIAM and AIAA

Operator Inference: Bridging model reduction and scientific machine learning

December 8, 2020, 10:00am-11:00am
URL: https://gwu.webex.com/gwu/j.php?MTID=mdb4ea02f53e525cc3ed58e9fbe5ba6de
Meeting Number: 120 480 5265
Password: 2vAU3JHPyV2

Abstract

Model reduction methods have grown from the computational science community, with a focus on reducing high-dimensional models that arise from physics-based modeling, whereas machine learning has grown from the computer science community, with a focus on creating expressive models from black-box data streams. Yet recent years have seen an increased blending of the two perspectives and a recognition of the associated opportunities. This talk presents our work in operator inference, where we learn effective reduced-order operators directly from data. The physical governing equations define the form of the model we should seek to learn. Thus, rather than learn a generic approximation with weak enforcement of the physics, we learn low-dimensional operators whose structure is defined by the physics. This perspective provides new opportunities to learn from data through the lens of physics-based models and contributes to the foundations of Scientific Machine Learning, yielding a new class of flexible data-driven methods that support high-consequence decision-making under uncertainty for physical systems.

Biography

Dr. Karen E. Willcox is Director of the Oden Institute for Computational Engineering and Sciences, Associate Vice President for Research, and Professor of Aerospace Engineering and Engineering Mechanics at the University of Texas at Austin. She is also External Professor at the Santa Fe Institute. 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. She is a Fellow of the Society for Industrial and Applied Mathematics (SIAM) and Fellow of the American Institute of Aeronautics and Astronautics (AIAA).