ipam institute for pure & applied mathematics

Green Family Lecture Series

Professor Karen E. Willcox

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), Fellow of the American Institute of Aeronautics and Astronautics (AIAA), Fellow of the US Association for Computational Mechanics (USACM), and member of the National Academy of Engineering (NAE). She was the recipient of the 2023 J.T. Oden Medal and the 2024 Theodore von Karman Prize.

The Important Role of Mathematics in the Digital Twin Revolution

Digital twins represent the next frontier in the impact of computational science on grand challenges across science, technology and society. A digital twin is a computational model or set of coupled models that evolves over time to persistently represent the structure, behavior, and context of a unique physical system, process, or biological entity. Bidirectional interaction between the physical system and its virtual counterpart is central to the digital twin concept. This talk will highlight progress and open challenges in the mathematical foundations for achieving robust, reliable digital twins at scale, with illustrative examples of digital twins in engineering and medicine.

Monday, April 13, 2026

To be announced (typically begins between 4:30 and 5:30 PM)

California NanoSystems Institute (CNSI) Auditorium, 570 Westwood Plaza, Los Angeles, CA 90095

This lecture will be accessible to a general public audience. Reception immediately following at IPAM.

Learning Structure-exploiting Reduced Models with Operator Inference

In silico experimentation is the way of the future: Computing enables engineering designers to explore new ideas beyond what is possible in physical experiments. But simulating complex physics is computationally expensive — just a single simulation can take days on a supercomputer, making it practically impossible for a designer to fully explore the high-dimensional space of design options. Reduced-order models address this challenge, giving a rapid simulation capability while retaining predictive power. Operator Inference is a non-intrusive reduced modeling approach that incorporates physical governing equations by defining a structured polynomial form for the reduced model, and then learns the corresponding reduced operators from simulated training data. I will discuss recent advances in embedding additional structure in Operator Inference models, including a nested formulation that exploits the inherent hierarchy within the reduced space and a block-structured formulation that reflects the structure of a multiphysics system. Incorporating this extra structure improves both the conditioning of the learning problem and the effectiveness of the learned reduced models. Joint work with Nicole Aretz, Anirban Chaudhuri and Benjamin Zastrow.

Tuesday, April 14, 2026

To be announced (typically begins between 4:30 and 5:30 PM)

Royce Hall 314, 10745 Dickson Ct, Los Angeles, CA 90095

This lecture is intended for a scientific audience.

NSF UCLA

For more information, visit the program webpage:
www.ipam.ucla.edu/programs/public-lectures-events/