COLLEGE OF ENGINEERING
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Mechanical Engineering Seminar Series

Data Driven Modeling of Unknown Systems with Deep Neural Networks

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Room 1200 EECS

Tuesday, February 7, 2023

3:00 PM

ME Seminar Zoom link

Passcode 309714

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Abstract

We present a framework of predictive modeling of unknown system from measurement data. The method is designed to discover/approximate the unknown evolution operator behind the data. Deep neural network (DNN) is employed to construct such an approximation. Once an accurate DNN model for evolution operator is constructed, it serves as a predictive model for the unknown system and enables us to conduct system analysis. We demonstrate that residual network (ResNet) is particularly suitable for modeling autonomous dynamical systems. Extensions to other types of systems will be discussed, including non-autonomous systems, systems with uncertain parameters, and, more importantly, systems with missing variables, as well as partial differential equations (PDEs).

Bio

Dr. Dongbin Xiu received his Ph.D. degree from the Division of Applied Mathematics of Brown University in 2004. He conducted post-doctoral studies at Los Alamos National Laboratory, Princeton University, and Brown University before joining the Department of Mathematics at Purdue University as an Assistant Professor in the fall of 2005. He was promoted to the rank of Associate Professor in 2009 and to Full Professor in 2012. In 2013, he moved to the University of Utah as a Professor in the Department of Mathematics and Scientific Computing and Imaging (SCI) Institute. In 2016, he moved to the Ohio State University as a Professor of Mathematics and Ohio Eminent Scholar. He received the NSF CAREER award in 2007, as well as a number of teaching awards at Purdue. He has served on the editorial board of several journals, including the SIAM Journal on Scientific Computing and the Journal of Computational Physics. He is the founding Associate Editor-in-Chief of the International Journal for Uncertainty Quantification (IJUQ), and the founding Editor-in-Chief of the Journal of Machine Learning for Modeling and Computing (JMLMC). His research focuses on developing efficient numerical algorithms for uncertainty quantification, stochastic computing, and machine learning.