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Computational Mathematics Seminar Series

Data-driven closures for kinetic equations**Daniele Venturi, University of California, Santa Cruz**

Assistant Professor

Digital Media Center 1034
November 07, 2017 - 03:30 pm**Abstract:**

In this talk, I will address the problem of constructing data-driven closures for reduced-order kinetic equations. Such equations arise, e.g., when we coarse-grain high-dimensional systems of stochastic ODEs and PDEs. I will first review the basic theory that allows us to transform such systems into conservation laws for probability density functions (PDFs). Subsequently, I will introduce coarse-grained PDF models, and describe how we can use data, e.g., sample trajectories of the ODE/PDE system, to estimate the unclosed terms in the reduced-order PDF equation. I will also discuss a new paradigm to measure the information content of data which, in particular, allows us to infer whether a certain data set is sufficient to compute accurate closure approximations or not. Throughout the lecture I will provide numerical examples and applications to prototype stochastic systems such as Lorenz-96, Kraichnan-Orszag and Kuramoto-Sivashinsky equations.

Speaker's Bio:

Prof. Venturi received his Ph.D. in Applied Physics from the University of Bologna in 2006. From 2010 to 2015 he joined the Division of Applied Mathematics at Brown University as Research Assistant Professor. Since 2015 he is an Assistant Professor of Applied Mathematics and Statistics at the Baskin School of Engineering at the University of California, Santa Cruz. His research activity has been recently focused on developing theoretical and computational methods for uncertainty quantification and dimensional reduction in large scale stochastic dynamical systems. In particular, he has been working on the Mori-Zwanzig formulation, hierarchical tensor methods for the numerical solution to high-dimensional PDEs, and the numerical approximation of functional differential equations. Webpage: <https://venturi.soe.ucsc.edu>.

This lecture has refreshments @ 03:00 pm