MATH-IMS Joint Applied Mathematics Colloquium Series
The Chinese University of Hong Kong

This MATH-IMS Joint Colloquium Series is organized by Center for Mathematical Artificial Intelligence (CMAI), under Department of Mathematics and Institute of Mathematical Sciences (IMS) at The Chinese University of Hong Kong. The colloquium series focuses on mathematics and applications of artificial intelligence, big data and related topics.

Date: May 6, 2022 (Friday)
Time: 4:00pm-5:00pm (Hong Kong Time)
Zoom Link: https://cuhk.zoom.us/j/92775210812
Modeling subgrid effects and temporal splitting in machine learning
Speaker: Professor Yalchin Efendiev
Texas A&M University

Abstract: In this talk, we will start with some main concepts in multiscale modeling and temporal splitting. Our goal is to model processes in multiscale media without scale separation and with high contrast. We assume that the coarse grid doesn't resolve the scales and the contrast. To deal with these problems, I will introduce multiscale methods that use multicontinua approaches. These approaches use additional macroscopic variables. I will discuss the convergence of these approaches and show that these methods converge independent of the contrast. The multicontinua approaches can benefit from machine learning techniques, which I will discuss. I will also consider how multiscale methods can be used for temporal splitting. High contrast brings stiffness to the system, which requires small time steps. We will introduce partial explicit methods that construct time discretizations with the time stepping that is independent of the contrast. Numerical results will be shown to back up our theories. We will discuss how these approaches are used in machine learning.

Bio: Prof. Efendiev received his Ph.D in applied mathematics from the California Institute of Technology in 1999. He has been a member of the Texas A&M Department of Mathematics since 2001, served as the Richard E. Ewing ExxonMobil Chair in Computational Science and Director of Institute for Scientific Computation. Prof. Efendiev is a leader in applied mathematics globally known for his research in numerical analysis and scientific computation with applications to porous media fluid flow, primarily ground water and oil recovery modeling. His research goes far beyond mathematics and has substantial impact on various disciplines, such as statistics, geophysics, and petroleum, mechanical and aerospace engineering. Besides being an invited speaker at the International Congress of Mathematicians (2014), a plenary speaker at the International Society of Porous Media (2015), Prof. Efendiev has been recognized with many major awards, including the Alexander von Humboldt Foundation's Fraunhofer-Bessel Research Award (2011) and a Quantum Reservoir Impact (QRI) Scholar (2011). He is a fellow of the American Mathematical Society (2017), SIAM (2020) and a member of the Society of Petroleum Engineers (SPE). In addition to authoring more than 300 peer-reviewed publications, he serves on the editorial board of around 10 prestigious international journals and has mentored many outstanding students and postdocs.