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: September 25, 2020 (Friday)
Time: 10am – 11am (Hong Kong Time)
Zoom Link: https://cuhk.zoom.us/j/92775210812

Stability of time discretizations for semi-discrete high order schemes for time-dependent PDEs

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Abstract: In scientific and engineering computing, we encounter time-dependent partial differential equations (PDEs) frequently. When designing high order schemes for solving these time-dependent PDEs, we often first develop semi-discrete schemes paying attention only to spatial discretizations and leaving time tyes continuous. It is then important to have a high order time discretization to maintain the stability properties of the semi-discrete schemes. In this talk we discuss several classes of high order time discretization, including the strong stability preserving (SSP) time discretization, which preserves strong stability from a stable spatial discretization with Euler forward, the implicit-explicit (IMEX) Runge-Kutta or multi-step time marching, which treats the more stiff term (e.g. diffusion term in a convection-diffusion equation) implicitly and the less stiff term (e.g. the convection term in such an equation) explicitly, for which strong stability can be proved under the condition that the time step is upper-bounded by a constant under suitable conditions, and the explicit Runge-Kutta methods, for which strong stability can be proved in many cases for semi-negative linear semi-discrete schemes. Numerical examples will be given to demonstrate the performance of these schemes.

Bio: Professor Chi-Wang Shu obtained his BS degree from the University of Science and Technology of China in 1982 and his PhD from the University of California at Los Angeles in 1986 under the supervision of Professor Stanley Osher. He is currently the Theodore B. Stowell University Professor of Applied Mathematics at Brown University. Professor Shu is well-known for his research in the fields of computational fluid dynamics, numerical solutions of conservation laws and Hamilton–Jacobi type equations. He has won numerous prestigious awards, including the Feng Kang Prize of Scientific Computing in 1995, SIAM/ACM Prize in Computational Science and Engineering in 2007. In 2009, he was selected as one of the first 183 Fellows of the Society for Industrial and Applied Mathematics (SIAM). In 2012, he became a fellow of the American Mathematical Society (AMS). He was an invited speaker in the International Congress of Mathematicians in 2014. He is also an ISI Highly Cited Author in Mathematics.