10th Anniversary

The AMSS-PolyU Joint Research Institute

Lecture Series

Professor Chi-Wang Shu
Brown University

Discontinuous Galerkin Method for Hyperbolic Equations with Delta-Singularities

Abstract

Discontinuous Galerkin (DG) methods are finite element methods with features from high resolution finite difference and finite volume methodologies and are suitable for solving hyperbolic equations with nonsmooth solutions. In this talk we will describe our recent work on the study of DG methods for solving hyperbolic equations with δ-singularities in the initial condition, in the source term, or in the solutions. For such singular solutions, many numerical techniques rely on modifications with smooth kernels and hence may severely smear such singularities, leading to large errors in the approximation. On the other hand, the DG methods are based on weak formulations and can be designed directly to solve such problems without modifications, leading to very accurate results. We will discuss both error estimates for model linear equations, in negative norm and in strong norm after post-processing, and applications to nonlinear systems including the rendez-vous systems and pressureless Euler equations involving δ-singularities in their solutions. For the nonlinear case a high order accuracy bound-preserving limiter is crucial to maintain nonlinear stability and to avoid blowups of the numerical solution. This is joint work with Yang Yang, Dongming Wei and Xiangxiong Zhang.

Biography

Chi-Wang Shu obtained his BS degree from the University of Science and Technology of China in 1982 and his PhD degree from the University of California at Los Angeles in 1986. He has been a Brown University faculty since 1987, served as the Chair of the Division of Applied Mathematics between 1999 and 2005, and is now the Theodore B. Stowell University Professor of Applied Mathematics. His research interest includes high order numerical methods, with applications to areas such as computational fluid dynamics, semi-conductor device simulations and computational cosmology. He served as the Managing Editor of Mathematics of Computation between 2002 and 2012, is now the the Chief Editor of Journal of Scientific Computing, and serves in the editorial boards of several other journals as co-chief editor, editor or associate editor. He is the recipient of the First Feng Kang Prize of Scientific Computing in 1995 and the SIAM/ACM Prize in Computational Science and Engineering in 2007, is an ISI Highly Cited Author in Mathematics, a SIAM Fellow in the inaugural class, an AMS Fellow in the inaugural class, and an invited speaker in the International Congress of Mathematicians in 2014.

Date : 13 February 2015 (Friday)
Time : 3:30 - 4:30pm
Venue : Y302, PolyU

ALL ARE WELCOME !

For enquiry, please contact Miss Eunice Hung at 3400 3908 or eunice.hung@polyu.edu.hk