PDE, Complex Analysis and Differential Geometry Seminar

UNIVERSITY OF NOTRE DAME
Department of Mathematics

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Tuesday, April 8, 2014
11:00 AM
258 Hurley Hall

Title: A New Runge-Kutta Discontinuous Galerkin Method with Conservation Constraint to Improve CFL Condition for Solving Conservation Laws

Abstract:

We present a new formulation of the Runge-Kutta discontinuous Galerkin (RKDG) method for solving conservation Laws with increased CFL numbers. The new formulation requires the computed RKDG solution in a cell to satisfy additional conservation constraint in adjacent cells and does not increase the complexity or change the compactness of the RKDG method. Numerical computations for solving one-dimensional and two-dimensional scalar and systems of nonlinear hyperbolic conservation laws are performed with approximate solutions represented by piecewise quadratic and cubic polynomials, respectively. From both numerical experiments and the analytic estimate of the CFL number of the newly formulated method, we find that: 1) this new formulation improves the CFL number over the original RKDG formulation by at least three times or more and thus reduces the overall computational cost; and 2) the new formulation essentially does not compromise the resolution of the numerical solutions of shock wave problems compared with ones computed by the RKDG method.