MATH COLLOQUIUM

Finite volume methods for nonlinear hyperbolic conservation laws on manifolds

Baver Okutmuştur
Université de Pierre et Marie Curie

Date : Wednesday, July 21, 2010
Time : 14:00
Place : TB 250, Boğaziçi Üniversitesi

Abstract: The first part of presentation is devoted to the study of finite volume methods for conservation laws on manifolds. We study first an approach based on a metric on Lorentzian manifolds. Our main result establishes the convergence of monotone and first-order finite volume schemes for a large class of (space and time) triangulations. Next, we consider another approach based on differential forms. We establish a new version of the finite volume methods which only requires the knowledge of family of n-volume form on an (n + 1)-manifold.

The second part is concerned with error estimates for finite volume methods and the implementation of a model of relativistic compressible fluids. We consider first nonlinear hyperbolic conservation laws posed on a Riemannian manifold, and we establish an L1 -error estimate for a class of finite volume schemes allowing for the approximation of entropy solutions to the initial value problem. Next, we consider the hyperbolic balance laws posed on a curved spacetime endowed with a volume form, and, after imposing a natural Lorentz invariance property we identify a unique balance law which can be viewed as a relativistic version of Burgers equation. Numerical experiments demonstrate the convergence of the proposed finite volume scheme.

Tea and coffee will be served at 15:00