Department of Applied Mathematics and Statistics
The Johns Hopkins University

SEMINAR

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304 Whitehead Hall
Refreshments: 3:30 p.m.
Seminar: 4:00 p.m.

HYPERBOLIC CONSERVATION LAWS: THEORY AND NUMERICAL ANALYSIS OF SHOCK REFLECTION PROBLEMS

Abstract

The first part of this talk is an introduction to the first-order quasilinear systems of partial differential equations, known as hyperbolic conservation laws. We will outline the physical interpretation of these equations and show a few applications. Concepts of weak solutions and admissibility criteria for selecting physically relevant weak solutions will be discussed.

The second part of the talk is on analysis of two-dimensional Riemann problems that model shock reflection. Written in self-similar coordinates, these problems lead to mixed-type systems and free-boundary problems for the reflected shock and the subsonic state behind the shock. We will present our recent results (joint work with Barbara L. Keyfitz and Suncica Canic) on analysis of these problems for gas dynamics equations using the theory of second-order elliptic equations and fixed-point theorems.

The talk will conclude with an introduction to a spacetime discontinuous Galerkin method for approximating solutions of systems of conservation laws, and this numerical method's relevance in the study of the aforementioned shock reflection problems.