PHYSICAL MATHEMATICS SEMINAR

SHOCKS AND SONIC POINTS

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The flow ahead of a shock discontinuity is always supersonic relative to the shock and the flow behind is subsonic. If the subsonic flow accelerates and becomes sonic, then the region between the shock and the sonic surface becomes isolated from the flow behind the sonic surface. This two-front structure arises in variety of problems, such as detonation waves, hydraulic jumps, flows in flexible tubes (e.g. blood flows in arteries), astrophysical accretion flows, and others. While steady-state structure is relatively easy to characterize in terms of the critical points of the governing differential equations, it is a nontrivial thing to extend the notion of the sonic locus to unsteady situations. I will discuss these issues with particular emphasis on detonation waves and hydraulic jumps. On detonations, I will discuss a reduced evolution equation that describes two-dimensional detonations, and introduce a new and simple numerical algorithm for simulating multi-dimensional detonations (or any shocks) that can almost entirely eliminate lead-shock errors inherent in shock-capturing schemes. On the hydraulic jump, I will discuss a simple theory that gives a rational way of determining its steady-state one-dimensional structure. An analogy between detonations and hydraulic jumps will be pointed out.

TUESDAY, MAY 13, 2008
2:30 PM
Building 4, Room 370

Refreshments at 3:30 PM in Building 2, Room 349
(Applied Math Common Room)

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