Temple University Mathematics Colloquium

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will speak on

Nonlinearity, patterns, and singular behavior

ABSTRACT: Physical systems often present puzzling complex behaviors. Mathematical models for them, even when available, quite often are not able to provide "intuitive" understanding for the phenomena, even when numerical computations indicate that they have them. In this talk we present three examples where the essence of some interesting physical phenomena[1] can be extracted to very simple mathematical models. These models are nonlinear, and exhibit singular behaviors that (with one exception) do not seem to fit within any of the standard mathematical theories for p.d.e.'s. These singular behaviors are crucial. They are not failures of the models, and are associated with simplified versions of the phenomena.

Finally, in the fourth (and last) example we will consider the behavior of the incompressible Navier-Stokes equations on a bounded domain, when "errors" are introduced in the non-slip boundary conditions. Even if in the physics such errors do not occur, they are a concern when solving the equations numerically. We will present an example that shows how singular the response of the equation can be to such errors. This gives a hint as to why the development of accurate and efficient (all the way to the boundary) numerical methods for the Navier-Stokes equations has proven to be a major challenge.

Monday, 15 March 2010
Lecture at 4:00 pm
Coffee, tea, and refreshments from 3-5 pm
Room 617, Wachman Building
Department of Mathematics

[1] In the following areas: surface evolution below the roughening transition, developmental waves in myxobacteria, and waves in rotating fluids.