

MATHEMATICS & STATISTICS COLLOQUIUM ANNOUNCEMENT

Friday, March 14, 2008

3:30 – 4:30 PM

THORV 124

SPEAKER

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TITLE

*Modern Symmetry Methods for Partial Differential Equations.
Applications to Mathematical Modeling and Analysis*

ABSTRACT:

Contemporary mathematical models often involve systems of nonlinear partial or ordinary differential equations (PDE, ODE), which present significant difficulties in analytical treatment. In particular, no general method of solution of such systems is available. This talk is devoted to the geometrical framework of symmetry transformations, applicable to most DE systems. Symmetry transformations prove to be useful in many aspects of analysis of nonlinear ODE/PDE systems, in particular, asymptotic and numerical analysis, and often yield meaningful exact solutions, which are useful for modeling. As examples, I will discuss several mathematical models I have been working with recently: plasma dynamics and equilibria, flame front propagation, gas/fluid dynamics and elastodynamics.

For a DE system, a symmetry transformation is defined generally as a mapping of its solution manifold into itself. It is important that many admitted symmetry transformations (Lie point symmetries, contact, higher, discrete symmetries) of a PDE system can be in fact computed algorithmically. Due to its geometric origin, the algorithm is the same for algebraic equations, ODEs, and PDEs. I will discuss the algorithm and associated computational challenges, and demonstrate recently developed symbolic software in action.

I will also mention advanced symmetry methods, in particular, the framework of nonlocally related systems. The nonlocal framework is useful on its own (for PDE analysis). It also leads to a significant extension of the set of calculable symmetries for a given PDE system. I will outline interesting mathematical problems that arise.

Coffee and Cookies will be available in the Lounge (201 McLean Hall) at 3:00 pm.