

Meeting: 1005, Newark, Delaware, SS 10A, Special Session on Symmetry Methods for Partial Differential Equations

1005-35-113 **Phil Broadbridge*** (pbroad@math.udel.edu), Newark, DE 19716. *Use of classical and non-standard symmetries in fluid mechanics.*

Ultimately, the value of symmetry methods will be judged by their ability to produce useful solutions to practical applied problems. A couple of recent problems in fluid mechanics will be considered. Firstly, we consider allowing temperature-dependent viscosity and thermal conductivity in a compressible fluid. Temperature dependence has been found to destabilize the Couette flow. For some interesting nonlinear fluids, the complicated full Navier-Stokes system for density, velocity and temperature may be fully reduced by classical symmetries. The full solution can be obtained explicitly for steady circular Couette flow. This has been done for water-glycerin, whose viscosity decreases exponentially with temperature, and for the Boltzmann hard-sphere gas, whose viscosity and conductivity increase as the square root of temperature. Secondly, we consider the nonlinear parabolic equation for transport of a solute through a porous medium under conditions of adsorption-desorption equilibrium. A naive classification of potential symmetries using the standard integrable variable has missed some very important symmetries. We have a conceptually simple technique for systematically finding non-standard potential symmetries. (Received February 02, 2005)