1048-65-36 **John Paul Roop*** (jproop@ncat.edu), Greensboro, NC 27411, and **Traian Iliescu**, Blacksburg, VA 24061. *Two-level finite element approximation of Navier-Stokes equations with nonlinear subgridscale artificial viscosity.*

In this talk, we review the concept of a two-level finite element method and discuss theoretical and numerical results from the application of a two-level method to Navier-Stokes equations with nonlinear subgridscale artificial viscosity. In the two-level finite element method, the solution to a fully nonlinear coarse mesh problem is utilized in a single step linear fine mesh problem. It is important to note that the two-level finite element method is not the same as multigrid. Two-level finite element methods for Navier-Stokes equations are well studied. However, we examine mathematical complications which arise from the inclusion of subgridscale artificial viscosity into the modeling equations. A corresponding variational problem is formulated in the appropriate Sobolev spaces; stability, error convergence, and scaling estimates are proven; and numerical results are given which illustrate the utility of two-level algorithms in reducing the computational cost of the numerical simulation of turbulent flows. (Received December 23, 2008)