Meeting: 1000, Albuquerque, New Mexico, SS 9A, Special Session on Mathematical Methods in Turbulence

1000-76-212 **John Steinhoff*** (jsteinho@utsi.edu), 411 B.H. Goethert, Tullahoma, TN 37388. *Modeling Small Vortical Scales as Nonlinear Solitary Waves.*

A computational method, "Vorticity Confinement", is described for efficiently computing the small scales in turbulent flow. The method has been shown to efficiently treat thin vortices, and to convect them over long distances with no spreading due to numerical errors. These vortices are treated as a type of weak solution and, within them, a nonlinear difference equation, as opposed to finite difference equation, is solved that does not necessarily represent a Taylor expansion discretization of a simple PDE. The approach is similar to artificial compression and shock capturing schemes, where conservation laws are satisfied across discontinuities. Effectively, the vortices are treated as multi-dimensional nonlinear discrete solitary waves that "live" on the computational lattice. These obey a "confinement" relation that is a generalization to multiple dimensions of 1-D discontinuity capturing schemes. This involves a single rotationally invariant limiter—that is a function of rotationally invariant variables, in contrast to a concatenation of separate 1-D limiters, each a function of variables along each axis. Results will be shown for convection of thin vortex filaments, and turbulent wakes with small vortical scales. (Received August 24, 2004)