CENTER FOR FLUID MECHANICS
AND
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A VARIATIONAL APPROACH TO VORTEX CORE IDENTIFICATION

We present a global variational definition of a vortex core in three-dimensional Navier-Stokes flow, and describe its numerical implementation for studying the evolution of principal vortical structures. Our definition is motivated by the observation that the line integral of vorticity along any path worthy of being called a vortex core is likely to be large. Inverting this reasoning, we define a vortex core as a curve for which this line integral is a local maximum in the space of all such curves (with appropriate boundary conditions). We present an algorithm by which candidate curves are evolved according to a Ginzburg-Landau equation in order to locate vortex cores, along with numerical results for a problem of vortex reconnection posed by Aref and Zawadzki. Finally, we describe the VORTONICS software suite used to obtain these results, and its recent deployment on the NSF's TeraGrid using the MPICH-G2 library.

TUESDAY – NOVEMBER 29, 2005
Barus & Holley, Room 190
4:00pm