PHYSICAL MATHEMATICS SEMINAR

VORTEX MERGER AND A NEW NOTION OF BIFURCATION

STEFAN SIEGMUND
Department of Mathematics
J.W. Goethe University

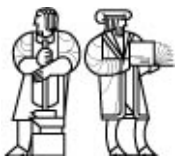
ABSTRACT:

Nowadays huge amounts of observational and numerical data are available to reconstruct and predict the behavior of an underlying dynamical system, e.g. velocity fields in oceanography. However, the dynamics is typically non-stationary, i.e. time-varying and the available data is discrete in time and space and available only over a finite time interval. As a consequence the classical asymptotic methods of dynamical systems theory do not apply.

In this talk we study such an example namely the merging of two vortices modelled by the Poisson and Vorticity equation. Since the vortices merge after some time, the velocity field of the particles is not stationary, is not known analytically and is given only numerically as the solution of the PDE. The solution of the PDE gives rise to a time-dependent (nonautonomous) ODE which is discretized in time and space and is known only on a finite-time interval. This nonautonomous ODE undergoes a bifurcation as two vortices come close together and merge to one big vortex. However, classical methods do not apply, since the bifurcation does not depend on a parameter but on time. The description of this merging process as a bifurcation in time leads to a new aspect of nonautonomous bifurcation theory, an actual topic of research.

TUESDAY, OCTOBER 18, 2005
2:30 PM
Building 3, Room 370

Refreshments at 3:30 PM outside of Room 370.



Massachusetts Institute of Technology
Department of Mathematics
Cambridge, MA 02139