Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Analysis of an idealized body-vortex systems[1] JOHAN RØNBY PEDERSEN, HASSAN AREF, Technical University of Denmark — We explore the class of dynamical systems consisting of a body, N point vortices, and one or more passive particles in an ideal, unbounded, planar fluid. The body is represented by a closed curve and is free to move in response to the fluid motion. The vortices have fixed strengths and are intended to model vortices that have been shed by the body or elsewhere in the flow field. The flow at any given time and position is determined by the instantaneous vortex and body positions together with the instantaneous velocity of the body. The equations of motion for this kind of system are reasonably well in hand. They can be analyzed using techniques from the theory of dynamical systems with a finite number of degrees of freedom. The simplest such system, a single point vortex and a circular body, is integrable. If we add vortices, or change other features of the system such as the body shape, the motion may become chaotic. Various solutions are shown and analyzed with an emphasis on the transition to chaos and its physical meaning. The motion of passively advected fluid particles is also investigated. This class of systems provides a rich family of few-degree-of-freedom systems that capture essential fluid-body interaction physics.

[1]Supported by the Danish National Research Foundation

Hassan Aref
Technical University of Denmark

Date submitted: 30 Jul 2008 Electronic form version 1.4