Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Passive locomotion in unsteady flows BABAK GHAEMI OSKOUEI, EVA KANSO, University of Southern California — The passive locomotion of a submerged body in unsteady flow is studied. This work is motivated by recent experimental evidence that live and dead trout exploit vortices in the wake of an oscillating cylinder to swim upstream. We consider a simple model of a rigid body interacting dynamically with idealized wake models. The wake models consist of point vortices periodically introduced into the fluid domain to emulate shedding of vortices from an external un-modeled fixed or moving obstacle producing a "drag" or "thrust" wake, respectively. Both symmetric and staggered vortex configurations are considered. The submerged body is free to move in the plane, that is to say, it is not pinned at a given point. We do not prescribe a background flow, we rather consider the two-way coupled dynamics between the body's motion and the advection of ambient vortices. We show that both circular and elliptical bodies could "swim" passively against the flow by extracting energy from the ambient vortices. We obtain periodic trajectories for the body-vortex system and analyze their linear stability. We propose active feedback control strategies to overcome the instabilities.

Babak Ghaemi Oskouei
University of Southern California

Date submitted: 06 Aug 2010 Electronic form version 1.4