Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Vortex Formation and Acceleration of a Fish-Inspired Robot Performing Starts from Rest ADAM DEVORIA, JONATHAN BAPST, MATTHEW RINGUETTE, The State University of New York at Buffalo — We investigate the unsteady flow of a fish-inspired robot executing starts from rest, with the objective of understanding the connection among the kinematics, vortex formation, and acceleration performance. Several fish perform "fast starts," where the body bends into a "C" or "S" shape while turning (phase I), followed by a straightening of the body and caudal fin and a linear acceleration (phase II). The resulting highly 3-D, unsteady vortex formation and its relationship to the acceleration are not well understood. The self-propelled robotic model contains motor-driven joints with programmable motion to emulate phase II of a simplified C-start. The experiments are conducted in a water tank, and the model is constrained to 1 direction along rails. The velocity is measured using digital particle image velocimetry (DPIV) in multiple planes. Vortex boundaries are identified using the finite-time Lyapunov exponent, then the unsteady vortex circulation is computed. The thrust is estimated from the identified vortices, and correlated with the circulation and model acceleration for different kinematics.

Matthew Ringuette
The State University of New York at Buffalo

Date submitted: 07 Aug 2009 Electronic form version 1.4