

Abstract Submitted  
for the DFD15 Meeting of  
The American Physical Society

**Application of a discretized vortex impulse framework to fish maneuvering** LEAH MENDELSON, ALEXANDRA TECHET, MIT — In studies of biological propulsion, metrics for quantitative analysis of the vortex wake, including circulation, impulse, and their time derivatives, are a valuable indicator of performance. To better utilize volumetric PIV data in this type of analysis, a discretized method of deriving vortex impulse relying only on velocity data is developed. The impulse formulation is based on the geometry and distribution of circulation along the vortex core line, which can be detected using critical points in the velocity field. This analysis method is then applied to time-resolved velocity data of a turning giant danio (*Devario aequipinnatus*) and a jumping archer fish (*Toxotes microlepis*) obtained using Synthetic Aperture PIV (SAPIV). In the case of the danio, the vortex force vector derived from the impulse derivative shows good agreement with the kinematics of the fish tail during the turning maneuver. With the archer fish, the model is used to explore the relationship between the number of tail beats prior to the jump and the jump height.

Leah Mendelson  
MIT

Date submitted: 31 Jul 2015

Electronic form version 1.4