

Abstract Submitted
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Fish Pectoral Fin Hydrodynamics; Part II: Numerical Simulations and Analysis¹ H. DONG, M. BOZKURTTAS, R. MITTAL, The George Washington University, P.G. MADDEN, G.V. LAUDER, Harvard University — High-fidelity numerical simulations are being used to examine the key hydrodynamic features and thrust performance of the pectoral fin of a bluegill sunfish which is moving at a constant forward velocity. The numerical modeling approach employs a parallelized immersed boundary solver which can perform direct (DNS) or large-eddy simulation (LES) of flow past highly deformable bodies such as fish pectoral fins. The three-dimensional, time-dependent fin kinematics is obtained via a stereo-videographic technique and experiments also provide PIV data which is used to validate the numerical simulations. The primary objectives of the CFD effort are to quantify the thrust performance of the bluegill sunfish pectoral fin as well as to establish the mechanisms responsible for thrust production. Simulations show that the pectoral fin produces a relatively large amount of thrust at all phases in the fin motion while limiting the magnitude of the transverse forces. The motion of the fin produces a distinct system of connected vortices which are examined in detail in order to gain insight into the thrust producing mechanisms.

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