Abstract Submitted
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Low Dimensional kinematic models and hydrodynamic performance of a Trout in steady swimming[1] JUNSHI WANG, University of Virginia, YAN REN, University of Miami, GENG LIU, University of Maine, HAIBO DONG, University of Virginia, VALENTINA DI SANTO, GEORGE LAUDER, Harvard University — Highly flexible body undulations are commonly observed in fish swimming. However, quantifying hydrodynamic advantages of body flexion remains unexplored in live fish swimming. In this work, a combined experimental and computational approach will be introduced to study the hydrodynamic role of body flexibility in a trout's steady swimming. High-speed photogrammetry system and 3D model reconstruction technique are used together to measure the kinematics of body and fins with extraordinary details. A singular value decomposition (SVD)-based model reduction tool is developed to extract the dominant kinematical components of the entire fish for kinematics analysis and computational modeling. An immersed-boundary-method (IBM)-based computational fluid dynamics solver is then used to simulate the corresponding unsteady flows in all their complexity. Vortex dynamics and hydrodynamic benefits of different kinematical components are then studied. The methods and resulted findings from this work are expected to bring new insights on the design of next generation bio-inspired autonomous underwater systems.

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