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An Assessment of Thrust, Drag, and Momentum Exchange of Undulation-Based Propulsion GEORGE LOUBIMOV, MICHAEL KINZEL, University of Central Florida — Studies have shown increases in efficiency for undulating propulsion through interactions with unsteady wakes. Specifically, performance gains are related to favorable interactions between an undulation-like swimmer and an oncoming, unsteady wake such as in the case of schooling fish. In this study, Computational Fluid Dynamics (CFD) is used to evaluate the unsteady fluid interactions associated with undulation-based propulsion. The numerical accuracy of the CFD model is established and also shown to correlate well with benchmark experiments. While a number of optimization methods have been used to successfully design an undulation-based swimmer taking advantage of these unsteady wakes, the fundamental physics of the fluid mechanics responsible for propulsion is not fully understood. The aim of the effort is to refine the understanding of the forces associated with the unsteady wakes on an undulating foil. It is proposed that through evaluating the total pressure changes, shear forcing, and control-volume momentum changes during these interactions, additional insight can be developed. Using this approach, we believe we can identify the key fluid criteria responsible for increasing the propulsive efficiency of undulating swimmers.

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