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Fluid Dynamics of Clap-and-Fling with Highly Flexible Wings inspired by the Locomotion of Sea Butterflies ZHUOYU ZHOU, KOUROSH SHOELE, Johns Hopkins Univ, DEEPAK ADHIKARI, JEANNETTE YEN, DONALD WEBSTER, Georgia Institute of Technology, RAJAT MITTAL, Johns Hopkins Univ, JOHNS HOPKINS UNIVERSITY TEAM, GEORGIA INSTITUTE OF TECHNOLOGY TEAM — This study is motivated by the locomotion of sea butterflies (L. Helicina) which propel themselves in the water column using highly flexible wing-like parapodia. These animals execute a complex clap-and-fling with their highly flexible wings that is different from that of insects, and the fluid dynamics of which is not well understood. We use two models to study the fluid dyamics of these wings. In the first, we use prescribed wing kinematics that serve as a model of those observed for these animals. The second model is a fluid-structure interaction model where wing-like parapodia are modeled as flexible but inextensible membranes. The membrane properties, such as bending and stretching stiffness are modified such that the corresponding motion qualitatively matches the kinematics of L. helicina. Both models are used to examine the fluid dynamics of the clap-and-fling and its effectiveness in generating lift for these animals. Acknowledgement – research is supported by a grant from NSF.

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