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Flapping Flight In Air and Water: Bio-inspiration From Tiny Insects and Sea Butterflies

ABSTRACT:

The flapping of wings is a common locomotion technique for tiny animals in both air and water. Insects flap their wings to fly in air, and zooplanktonic marine snails called sea butterflies flap wing-like appendages (called parapodia) to "fly" in water. Despite the thousand-fold difference in density between air and water, the flight systems of these very different animals show surprising similarities in how the wings move and in how they generate lift. These similarities point towards the possibility of designing a bio-inspired micro-aerial vehicle capable of aerial and aquatic flapping flight, but the fluid dynamics of such flight systems are not well understood. Using high speed stereophotogrammetry and micro particle image velocimetry (PIV), we investigate the fluid dynamics of small-scale biological flapping systems flying in air and in water.



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BIOGRAPHY:

Dr. David Murphy began as an Assistant Professor in the USF Department of Mechanical Engineering in 2016. He was awarded a National Academies of Science Gulf Research Program Early Career Research Fellowship in 2017 and received an NSF CAREER award in 2019. His research focuses on biological, ecological, and environmental fluid mechanics, and his work has taken him from Antarctica to Bermuda. Dr. Murphy received his PhD in Civil and Environmental Engineering in 2012 from the Georgia Institute of Technology and subsequently served as postdoctoral fellow in Mechanical Engineering at Johns Hopkins University. He also received an MS in Mechanical Engineering from Georgia Tech and an MPhil in Biological Science from Cambridge University. He completed a double BS in Mechanical and Biomedical Engineering from the University of Alabama at Birmingham.