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Clear Delineation of Added-Mass and Vortex- Induced Forces Generated by Flapping Wing[1] CHAO ZHANG, Johns Hopkins University, TYSON HEDRICK, University of North Carolina at Chapel Hill, RAJAT MITTAL, Johns Hopkins University — The force and moment experienced by a body immersed in a fluid depends strongly on its motion (trajectory, acceleration, rotation etc) as well as nearby flow structures such as vortices and boundary layers. A number of past studies have attempted to delineate the relative contribution of various components such as added-mass, attached and shed vortices, and viscous stresses on the total force produced by biological and bioinspired flapping wings. In the current study, we extend a previous analysis (M. S. Howe, 1995) to more precisely delineate the contributions of each of these components to the total force. The analysis is applied via high-fidelity computational fluid dynamics models and we use this analysis to shed light on the various flow mechanisms and features that are responsible for lift generation in insects over a range of scales.

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Rajat Mittal
Johns Hopkins University

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