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Potential flow predictions for a flapping flat plate wing SWATHI KRISHNA, KAREN MULLENERS, EPFL, MELISSA GREEN, Syracuse University — It is well established that the leading edge vortex is one of the major contributors to the generation of lift on a flapping insect wing. However, the contributions of the trailing edge vortices and the shear layer to unsteady force production mechanisms needs more investigation. The individual contribution of different flow structures is especially important if reliable theoretical predictions of lift and drag are to be made, that eventually assist in the design of micro air vehicles. The current work aims to distinguish different flow features of an unsteady flow field generated by a flapping wing in hover and to quantify the role played by them in the generation of aerodynamic forces. This is achieved by employing a semi-empirical potential flow model that allows for the calculation of lift by theoretically recreating the potential flow field based on the vortex strengths and locations obtained from phase-averaged particle image velocimetry (PIV) data. Individual flow structures are detected in the PIV data based on the vorticity contours. The theoretically predicted lift is compared with direct force measurements to demonstrate the utility and limitations of the model.

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