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A Computational Study of Vertical Force Production in the Smallest Flying Insects HRITHIK AGHAV, University of Arizona — Two-dimensional immersed boundary simulations were performed to determine how stroke plane angle and wing flexibility affect vertical force production for the smallest flying insects. Experimental data pertaining to small insect flight is limited and therefore, their flight mechanisms are still largely unknown. The immersed boundary method was used to solve the fully-coupled fluid-structure interaction problem of a flexible wing immersed in a two-dimensional viscous fluid. We considered five different strokes: a horizontal stroke, three hybrid strokes, and a vertical stroke. We also considered five different wing flexibilities ranging from rigid to highly flexible. Our results indicate that at Reynolds numbers relevant to small insect flight, the vertical force produced by a wing decreases with increasing stroke plane angle regardless of its flexibility and a rigid wing generates more vertical force than flexible wings at all stroke plane angles. This implies that the combination of a rigid wing with a horizontal stroke plane could possibly be the wing flexibility and stroke plane angle combination that generates the most vertical force in the flight of the smallest insects.

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