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On the Optimal Settings of Performance Parameters in Hovering MAV Flight MIKE HARFF, Wright State Universtiy, HAIBO DONG, Wright State University, MINGJUN WEI, New Mexico State University — Flapping foils are being considered for lift generation and/or propulsion in Micro-Air Vehicles (MAVs). In the present study, a DNS solver that is capable of simulating these flows in all their complexity will be employed. An analysis of the aerodynamic performance of a rigid flapping wing is conducted for examining the effect of basic morphological and kinematics parameters on unsteady flow field properties, wing loading, and lift efficiency. It focuses primarily on steady hovering flight, with secondary treatment of steady translational motion. Key performance parameters are evaluated to reflect two potential design modes of MAV flight, performance (or high-lift) mode and cruise (or high-efficiency) mode, plus a third design factor: a "sneak" mode which reflects the overall steadiness of a particular set of wing kinematics. Specific cost functions are defined for three operation modes. The corresponding adjoint field is solved to provide the sensitivity information to each performance parameters, and eventually recommend optimal settings for different operation modes through general gradient method.

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