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Model-Based Optimization for Flapping Foil Actuation JACOB IZRAELEVITZ, MICHAEL TRIANTAFYLLOU, Massachusetts Institute of Technology — Flapping foil actuation in nature, such as wings and flippers, often consist of highly complex joint kinematics which present an impossibly large parameter space for designing bioinspired mechanisms. Designers therefore often build a simplified model to limit the parameter space so an optimum motion trajectory can be experimentally found, or attempt to replicate exactly the joint geometry and kinematics of a suitable organism whose behavior is assumed to be optimal. We present a compromise: using a simple local fluids model to guide the design of optimized trajectories through a succession of experimental trials, even when the parameter space is too large to effectively search. As an example, we illustrate an optimization routine capable of designing asymmetric flapping trajectories for a large aspect-ratio pitching and heaving foil, with the added degree of freedom of allowing the foil to move parallel to flow. We then present PIV flow visualizations of the optimized trajectories.

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