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Optimization of Flapping Based Locomotion SHAWN WALKER, Louisiana State University, MICHAEL SHELLEY, New York University, Courant Institute — Locomotion at the macro-scale is important in biology and industrial applications, such as for understanding the fundamentals of flight to enable design of artificial locomotors. We present results on optimal actuation profiles for locomotion of a rigid, flapping body at intermediate Reynolds number. The actuation consists of a vertical velocity control attached to a pivot point of an ellongated rigid body, which is allowed to rotate and is affected by a torsional spring; the spring acts as an elastic recoil. No a priori assumption is made on the form of the vertical actuation, except for smoothness. Thus, we pose an infinite dimensional time-varying, PDE-constrained optimization problem (with additional constraints on the vertical control) and solve it by variational methods. We explore the effects of parameter variations on the optimal locomotion profile, such as the torsional spring constant, relative mass density of body to fluid, and discuss the effects on locomotion strategies.

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