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Uncontrolled Stability in Freely Flying Insects JAMES MELFI JR., Z. JANE WANG, Cornell University — One of the key flight modes of a flying insect is longitudinal flight, traveling along a localized two-dimensional plane from one location to another. Past work on this topic has shown that flying insects, unless stabilized by some external stimulus, are typically unstable to a well studied pitching instability. In our work, we examine this instability in a computational study to understand whether it is possible for either evolution or an aero-vehicle designer to stabilize longitudinal flight through changes to insect morphology, kinematics, or aerodynamic quantities. A quasi-steady wingbeat averaged flapping flight model is used to describe the insect. From this model, a number of non-dimensional parameters are identified. The effect of these parameters was then quantified using linear stability analysis, applied to various translational states of the insect. Based on our understanding of these parameters, we demonstrate how to find an intrinsically stable flapping flight sequence for a dragonfly-like flapping flier in an instantaneous flapping flight model.

James Melfi
Cornell University

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