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Flapping of Insectile Wings YANGYANG HUANG, EVA KANSO, University of Southern California — Insects use flight muscles attached at the base of the wings to produce impressive wing flapping frequencies. Yet the effects of muscle stiffness on the performance of insect wings remain unclear. Here, we construct an insectile wing model, consisting of two rigid wings connected at their base by an elastic torsional spring and submerged in an oscillatory flow. The wing system is free to rotate and flap. We first explore the extent to which the flyer can withstand roll perturbations, then study its flapping behavior and performance as a function of spring stiffness. We find an optimal range of spring stiffness that results in large flapping amplitudes, high force generation and good storage of elastic energy. We conclude by conjecturing that insects may select and adjust the muscle spring stiffness to achieve desired movement. These findings may have significant implications on the design principles of wings in micro air-vehicles.

Yangyang Huang
University of Southern California

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