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Scaled Experiments on Rigid and Flexible Wings for Microrobots EMMA SINGER, Univ of Southern California, GEOFFREY SPEDDING, University of Southern California — Sub-gram Flapping-Wing Micro-Air Vehicles (FW-MAVs) in $Re < 1000$ flow regimes have unsteady lift-generating mechanisms that are extremely sensitive to changes in wing topology and actuation timing. At scale, practical testing is difficult, constrained by factors such as human fabrication error, material inhomogeneity, and long assembly times. To isolate a single wing-related variable in such a system, we instead employ a dynamically-scaled experiment in water that contains a single 2-DOF robotic wing, thus eliminating the wing-pair and body dynamics of a complete FW-MAV. The time-resolved forces are measured with a 6-axis force-torque sensor at the wing root, and these are related to wake kinematics measured with a Tomographic-PIV system. Results are grouped by a dimensionless wing parameter *effective stiffness*, which is the bending rigidity normalized by the dynamic fluid pressure. Three examples are compared, from rigid to flexible, and the influence of the effective stiffness on vortex shedding and wake structure are outlined, with a view to understanding the major factors that determine flight efficiency in FW-MAVs.

Emma Singer
Univ of Southern California

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