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Efficient passive pitching motion caused by elastic deformation in flexible flapping wing MAVs TRONG NGUYEN, TIEN TRUONG, KHOON SENG YEO, TEE TAI LIM, National University of Singapore — Computational and experimental models which mimic Hawkmoth wings were constructed to investigate the effects of wing flexibility. The wing actuation mechanism is minimal with only one degree of freedom in sweeping motion with neither active pitching nor elevation. Despite the simplicity of the imparted motion, the wing models in both computations and experiments delivered convincing deformation features such as wing twisting and camber which closely resembles the ones observed in real Hawkmoth wings. The generated aerodynamic forces are remarkable both in magnitude and efficiency. The study hence reveals that a complicated actuation mechanism might not be required to produce the sophisticated and efficient motion of insect wings, which in fact could be the result of collective elastic deformation thanks to their highly optimized structure mainly comprised of well-organized veins and membranes.

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