Agile, robust, and multifunctional micro-aerial-robots powered by soft artificial muscles

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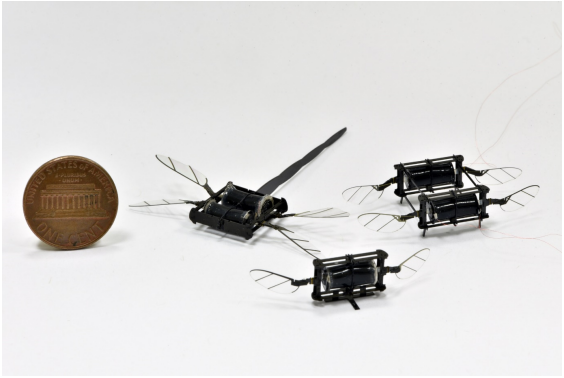
Recent advances in microrobotics have demonstrated remarkable locomotive capabilities such as hovering flights, impulsive jumps, and fast running in insect-scale robots. However, most microrobots that are powered by power-dense rigid actuators have not achieved insect-like collision resilience. In this talk, I will present our recent effort in developing a new class of microrobots – ones that are powered by high bandwidth soft actuators and equipped with rigid appendages for effective interactions with environments. Towards improving collision robustness of micro-aerial robots, we develop the first heavier-than-air aerial robot powered by soft artificial muscles that demonstrates a 40-second hovering flight. In addition, our robot can recover from an in-flight collision and perform a somersault within 0.16 seconds. The robot's maximum lift is comparable to that of the best rigid-powered sub-gram robots. This work demonstrates for the first time that soft aerial robots can achieve agile and robust flight capabilities absent in rigid-powered micro-aerial vehicles, thus showing the potential of a new class of hybrid soft-rigid robots.



Bio-sketch of Kevin Chen

Kevin Chen is currently the D. Reid Weedon, Jr. '41 Career Development Assistant Professor at the Department of Electrical Engineering and Computer Science, MIT, USA. He received his PhD Engineering Sciences at Harvard University in 2017 and his bachelor's degree in Applied and Engineering Physics from Cornell University in 2012. His research interests include developing high bandwidth and robust soft actuators for microrobot manipulation and locomotion. He has published in top journals including Nature, Science Robotics, Advanced Materials, PNAS, Nature Communications, IEEE TRO, and Journal of Fluid Mechanics. He is a recipient of the TRO 2021 best paper award, the RAL 2020 best paper award, the IROS 2015 best student paper award, the RAL 2021 Outstanding Associate Editor award, and a Harvard Teaching Excellence Award.