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Aeromechanics of the Spider Cricket Jump: How to Jump 60+ Times Your Body Length and Still Land on Your Feet EMILY PALMER, Johns Hopkins University, NICOLAS DESHLER, Washington International School, DAVID GORMAN, CATARINA NEVES, RAJAT MITTAL, Johns Hopkins University — Flapping, gliding, running, crawling and swimming have all been studied extensively in the past and have served as a source of inspiration for engineering designs. In the current project, we explore a mode of locomotion that straddles ground and air: jumping. The subject of our study is among the most proficient of long-jumpers in Nature: the spider cricket of the family Rhaphidophoridae, which can jump more than 60 times its body length. Despite jumping this immense distance, these crickets usually land on their feet, indicating an ability to control their posture during "flight." We employ high-speed videogrammetry, to examine the jumps and to track the crickets posture and appendage orientation throughout their jumps. Simple aerodynamic models are developed to predict the aerodynamic forces and moment on the crickets during 'flight'. The analysis shows that these wingless insects employ carefully controlled and coordinated positioning of the limbs during flight so as to increase jump distance and to stabilize body posture during flight. The principles distilled from this study could serve as an inspiration for small jumping robots that can traverse complex terrains.

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