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New insights into insect's silent flight. Part II: sound source and noise control[1] QIAN XUE, BIAO GENG, XUDONG ZHENG, The University of Maine, GENG LIU, HAIBO DONG, University of Virginia — The flapping flight of aerial animals has excellent aerodynamic performance but meanwhile generates low noise. In this study, the unsteady flow and acoustic characteristics of the flapping wing are numerically investigated for three-dimensional (3D) models of Tibicen linnei cicada at free forward flight conditions. Single cicada wing is modelled as a membrane with prescribed motion reconstructed by Wan et al. (2015). The flow field and acoustic field around the flapping wing are solved with immersed-boundary-method based incompressible flow solver and linearized-perturbed-compressible-equations based acoustic solver. The 3D simulation allows examination of both directivity and frequency composition of the produced sound in a full space. The mechanism of sound generation of flapping wing is analyzed through correlations between acoustic signals and flow features. Along with a flexible wing model, a rigid wing model is also simulated. The results from these two cases will be compared to investigate the effects of wing flexibility on sound generation.

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