Abstract Submitted
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Computational flow-structure-aeroacoustics modeling of ultrasound generation in the larynx of echolocating bats[1] CHUANXIN NI, JUNGHEE SEO, SUSANNE STERBING-D'ANGELO, CYNTHIA MOSS, Johns Hopkins University, LOUIS CATTAFESTA, Florida State University, RAJAT MITTAL, Johns Hopkins University — Echolocating bats produce extremely high-frequency sounds from their larynx using a similar phonating organ as other mammals. Significant knowledge gaps, however, still exist in our understanding of the underlying mechanism of ultrasound generation in bat larynx including the precise role of its anatomical structures during the generating process. One hypothesis is that the unique laryngeal membrane and ventricle structures in the bat larynx may play an important role in the high-intensity ultrasound generation. The objective of this study is to develop and employ a high-fidelity computational model based on high-resolution micro-CT scans of bat larynx to investigate the mechanism of bat ultrasound production. Using the geometrical parameters obtained from the micro-CT scan, a lumped-element model is constructed to investigate the frequency response and the resonance characteristics of the bat larynx and vocal tract. By leveraging the results of this linear acoustic analysis, coupled flow-structure-aeroacoustics interaction simulations are performed on a canonical model of the bat larynx with the laryngeal membranes to resolve the nonlinear behavior of ultrasound generation.

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