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Flow-Structure-Acoustic Interaction Simulation of Vocalization of a Non-song Bird. WEILI JIANG, XUDONG ZHENG, QIAN XUE, University of Maine, JEPPE HAVE RASMUSSEN, COEN ELEMANS, University of Southern Denmark, COMPLEX FLOW MODELING SIMULATION LAB TEAM, ELEMANS LAB TEAM — The myoelastic-aerodynamic mechanism of vocalization was recently evidenced in birds across a wide range of taxa, which, for a long time, was believed to generate sound based on the aerodynamic whistle mechanism. The objective of the current study is to: (1) develop a first-principle based, flow-structure-acoustics (FSA) interaction computational model of a non-song bird (rock pigeon); (2) strongly validate the computational model by comparing to the experimental data on the same bird model; (3) examine the data so as to generate new insights into the physics of vocalization of birds. In the current approach, a sharp interface immersed boundary method based incompressible flow solver is utilized to model the air flow; A finite element based solid mechanics solver is utilized to model the LVM(lateral vibratory mass) vibration; A high-order immersed boundary method based acoustics solver is utilized to directly compute sound. Geometric structure of the syrinx, including syringeal lumen, LVM, position of tracheal rings, is based on CT scan of a rock pigeon. The LVM is simulated as isotropic material according to the experimental measurements. Simulation setup about the bronchial pressure, static deformation due to air sac pressure also follows the setup in the experiments. Results including the fundamental frequency, air flow rate, gap, vibration shape will be analyzed and compared to the experimental data.

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