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Combining subject-specific and low-order modeling techniques to study fluid-structure interaction of rabbit phonation SIYUAN CHANG, HAOXIANG LUO, CAROLYN NOVALESKI, BERNARD ROUSSEAU, Vanderbilt University — A subject-specific computational model has been developed to simulate flow-induced vocal fold vibration for evoked rabbit phonation. A freshly excised larynx was scanned using micro magnetic resonance imaging. Images were segmented to identify the vocal fold tissue and lumen surface. The 3D fluid-structure interaction (FSI) model was then constructed with experimentally measured flow parameters as input. The tissue deformation is assumed to be finite, and a previously developed FSI solver is used to simulate the coupled flow and nonlinear tissue mechanics. In addition, a one-dimensional flow model based on heuristic estimate of the flow separation point is used as an efficient tool to guide the full 3D simulation. This low-order model is motivated by presence of uncertainties in the tissue properties and boundary conditions, and it has proven to be very useful in our study. Similarities and differences in the vibration characteristics of the vocal fold predicted by these two models will be discussed.

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