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Performance of a reduced-order FSI model for flow-induced vocal fold vibration HAOXIANG LUO, Vanderbilt University, SIYUAN CHANG, Corning Inc., YE CHEN, Vanderbilt University, BERNARD ROUSSEAU, Vanderbilt University Medical Center, PHONOSIM TEAM — Vocal fold vibration during speech production involves a three-dimensional unsteady glottal jet flow and three-dimensional nonlinear tissue mechanics. A full 3D fluid-structure interaction (FSI) model is computationally expensive even though it provides most accurate information about the system. On the other hand, an efficient reduced-order FSI model is useful for fast simulation and analysis of the vocal fold dynamics, which can be applied in procedures such as optimization and parameter estimation. In this work, we study performance of a reduced-order model as compared with the corresponding full 3D model in terms of its accuracy in predicting the vibration frequency and deformation mode. In the reduced-order model, we use a 1D flow model coupled with a 3D tissue model that is the same as in the full 3D model. Two different hyperelastic tissue behaviors are assumed. In addition, the vocal fold thickness and subglottal pressure are varied for systematic comparison. The result shows that the reduced-order model provides consistent predictions as the full 3D model across different tissue material assumptions and subglottal pressures. However, the vocal fold thickness has most effect on the model accuracy, especially when the vocal fold is thin.

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