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Simulations of acoustic waves in channels and phonation in glottal ducts JUBIAO YANG, Rensselaer Polytechnic Institute, MICHAEL KRANE, Pennsylvania State University, LUCY ZHANG, Rensselaer Polytechnic Institute — Numerical simulations of acoustic wave propagation were performed by solving compressible Navier-Stokes equations using finite element method. To avoid numerical contamination of acoustic field induced by non-physical reflections at computational boundaries, a Perfectly Matched Layer (PML) scheme was implemented to attenuate the acoustic waves and their reflections near these boundaries. The acoustic simulation was further combined with the simulation of interaction of vocal fold vibration and glottal flow, using our fully-coupled Immersed Finite Element Method (IFEM) approach, to study phonation in the glottal channel. In order to decouple the aeroelastic and aeroacoustic aspects of phonation, the airway duct used has a uniform cross section with PML properly applied. The dynamics of phonation were then studied by computing the terms of the equations of motion for a control volume comprised of the fluid in the vicinity of the vocal folds. It is shown that the principal dynamics is comprised of the near cancellation of the pressure force driving the flow through the glottis, and the aerodynamic drag on the vocal folds. Aeroacoustic source strengths are also presented, estimated from integral quantities computed in the source region, as well as from the radiated acoustic field.

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