Abstract Submitted
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Direct numerical simulation of human phonation[1] DANIEL BODONY, SHAKTI SAURABH, Univ of Illinois - Urbana — The generation and propagation of the human voice in three-dimensions is studied using direct numerical simulation. A full body domain is employed for the purpose of directly computing the sound in the region past the speaker's mouth. The air in the vocal tract is modeled as a compressible and viscous fluid interacting with the elastic vocal folds. The vocal fold tissue material properties are multi-layered, with varying stiffness, and a linear elastic transversely isotropic model is utilized and implemented in a quadratic finite element code. The fluid-solid domains are coupled through a boundary-fitted interface and utilize a Poisson equation-based mesh deformation method. A kinematic constraint based on a specified minimum gap between the vocal folds is applied to prevent collision during glottal closure. Both near VF flow dynamics and far-field acoustics have been studied. A comparison is drawn to current two-dimensional simulations as well as to data from the literature. Near field vocal fold dynamics and glottal flow results are studied and in good agreement with previous three-dimensional phonation studies. Far-field acoustic characteristics, when compared to their two-dimensional counterpart, are shown to be sensitive to the dimensionality.

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