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Control volume analysis of phonatory aerodynamics using velocity and pressure measurements[1] TIMOTHY WEI, University of Nebraska, HUNTER RINGENBERG, University of Colorado - Boulder, NATHANIEL WEI, Stanford University, DYLAN ROGERS, University of Nebraska, FEIMI YU, LUCY ZHANG, Rensselaer Polytechnic Institute, MICHAEL KRANE, Penn State Applied Research Lab — In a collaborative effort, flow through simplified models of human vocal folds are being examined both experimentally and computationally. The experimental work described in this talk entails a 10x scaled-up model in a free surface water tunnel. In addition to the 10x physical scale, the reduced kinematic viscosity of water allows for a 1500x reduction in frequency to match the Reynolds numbers and reduced frequencies of human phonation. As such DPIV measurements, coupled with time resolved pressure measurements along the vocal fold model, have sufficiently high spatial and temporal resolution to accurately study the dynamics and energetics of the underlying fluid dynamics. This, in turn, provides direct linkage with aerodynamics analyses done using a matching computational model. In this study, we use integral control volume analysis in both the scaled-up physical experiment and the computational model to examine the momentum and energy balance in the flow. Specific analysis of the Bernoulli equation for a range of Reynolds numbers and reduced frequencies will be examined. Comparison with computational results and observations on the key phenomena related to phonation will be provided.

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