Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

An Immersed-Boundary Method for Fluid-Structure Interaction in the Human Larynx HAOXIANG LUO, XUDONG ZHENG, RAJAT MITTAL, STEVEN BIELAMOWICZ, George Washington University — We describe a novel and accurate computational methodology for modeling the airflow and vocal fold dynamics in human larynx. The model is useful in helping us gain deeper insight into the complicated bio-physics of phonation, and may have potential clinical application in design and placement of synthetic implant in vocal fold surgery. The numerical solution of the airflow employs a previously developed immersed-boundary solver. However, in order to incorporate the vocal fold into the model, we have developed a new immersed-boundary method that can simulate the dynamics of the multi-layered, viscoelastic solids. In this method, a finite-difference scheme is used to approximate the derivatives and ghost cells are defined near the boundary. To impose the traction boundary condition, a third-order polynomial is obtained using the weighted least squares fitting to approximate the function locally. Like its analogue for the flow solver, this immersed-boundary method for the solids has the advantage of simple grid generation, and may be easily implemented on parallel computers. In the talk, we will present the simulation results on both the specified vocal fold motion and the flow-induced vocal fold vibration. Supported by NIDCD Grant R01 DC007125-01A1.

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Date submitted: 07 Aug 2006 Electronic form version 1.4