Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Inherent unsteadiness of glottal flow MICHAEL KRANE, MICHAEL BARRY, TIMOTHY WEI, Rutgers University — This talk describes a test of the quasisteady glottal flow assumption, a fundamentally relevant question which has implications on the glottal impedance and on how aerodynamics may affect voice perturbations and fluctuations. Measurements of the flow velocity field in a scaled-up model of the human glottis are described which used Digital Particle Image Velocimetry during several cycles of model vocal fold motion. Flow data thus obtained were used to calculate waveforms of the unsteady and convective acceleration terms for a single cycle of vocal fold motion. These calculations demonstrate that (1) over the entire glottis, the unsteady acceleration is important throughout the vibration cycle, (2) that the jet flow is primarily responsible for the high levels of unsteady acceleration in glottal flow, and (3) vortex shedding is responsible for high-frequency contributions to both types of acceleration. Measurements made at four cycle frequencies show the frequency dependence of these results. These results all suggest that (1) the quasisteady assumption is highly suspect and (2) jet instability (vortex shedding) strongly influences glottal impedance. This last observation also suggests that glottal jet aerodynamics may contribute strongly to voice perturbations and fluctuations.

Michael Krane
Rutgers University

Date submitted: 07 Sep 2005 Electronic form version 1.4