ANALYZING LINEAR MOMENTUM AND COANDA DIRECTION USING CONTROL VOLUME ANALYSIS OF A NOMINALLY SYMMETRIC SCALED UP VOCAL FOLD MODEL

By

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ABSTRACT

Experimental results derived from DPIV measurements and control volume analysis are presented for a nominally symmetric, scaled up human vocal fold model. Experiments were dynamically scaled to analyze a range of physiologically-relevant life frequencies: 50, 100, 150, and 200 Hz. Utilizing water as the working fluid allowed very high spatial and temporal resolution. The locus of center of the model vocal fold and the minimum glottal width time trace confirmed the model was nominally symmetric. Volumetric flow rate and maximum velocity measurements are presented for several control surfaces in the glottal flow. The entire glottal flow is visualized by incorporating the control surfaces into a surface plot. The direction of the glottal jet (coandă) was instantaneously observed for each life frequency. Instantaneous data relating the volumetric flow rate and the direction of the coandă showed that the direction of the coandă has no effect on the volumetric flow rate measurement for the four life frequencies studied. The pressure forces acting in the glottis were calculated using the streamwise and transverse linear momentum equations and control volume analysis. The direction of the coandă did not affect pressure forces within the glottis. The study as a whole demonstrated the ability to apply control volume analysis to allow detailed examination of the glottal flow, which included a noninvasive technique to measure the pressure forces within the glottis. In addition, the study found that the direction of the coandă has no effect on the aero acoustics of a vocal fold.