Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Wavelet analysis of hemispheroid flow separation toward understanding human vocal fold pathologies[1] DANIEL H. PLESNIAK, Haverford College, IAN A. CARR, KARTIK V. BULUSU, MICHAEL W. PLESNIAK, George Washington University — Physiological flows observed in human vocal fold pathologies, such as polyps and nodules, can be modeled by flow over a wall-mounted protuberance. The experimental investigation of flow separation over a surface-mounted hemispheroid was performed using particle image velocimetry (PIV) and measurements of surface pressure in a low-speed wind tunnel. This study builds on the hypothesis that the signatures of vortical structures associated with flow separation are imprinted on the surface pressure distributions. Wavelet decomposition methods in one- and two-dimensions were utilized to elucidate the flow behavior. First, a complex Gaussian wavelet was used for the reconstruction of surface pressure time series from static pressure measurements acquired from ports upstream, downstream, and on the surface of the hemispheroid. This was followed by the application of a novel continuous wavelet transform algorithm (PIVlet 1.2) using a 2D-Ricker wavelet for coherent structure detection on instantaneous PIV-data. The goal of this study is to correlate phase shifts in surface pressure with Strouhal numbers associated with the vortex shedding. Ultimately, the wavelet-based analytical framework will be aimed at addressing pulsatile flows.

[1]This material is based in part upon work supported by the National Science Foundation under Grant Number CBET-1236351, and GW Center for Biomimetics and Bioinspired Engineering (COBRE).

Michael Plesniak
George Washington University

Date submitted: 28 Jul 2014 Electronic form version 1.4