Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Detection of multi-scale secondary flow structures using anisotropic 2D Ricker wavelets in a bent tube model for curved arteries[1]
DANIEL H. PLESNIAK, Haverford College, KARTIK V. BULUSU, MICHAEL W. PLESNIAK, The George Washington University — Interpretation of complex flow patterns observed in this study of a model curved artery required characterization of multiple, low-circulation secondary flow structures that were observed during the late systolic deceleration and diastolic phases under physiological inflow conditions. Phase-locked, planar vorticity PIV data were acquired at various cross-sectional locations of the 180-degree bent tube model. High circulation, deformed Dean- and Lyne-type vortices were observed during early stages of deceleration, while several smaller scale, highly deformed, low-circulation vortical patterns appeared in the core and near-wall regions during late systolic deceleration and diastolic phases. Due to the multiplicity of vortical scales and shapes, anisotropic 2D Ricker wavelets were used for coherent structure detection in a continuous wavelet transform algorithm (PIVlet 1.2). Our bio-inspired study is geared towards understanding whether optimizing the shape of the wavelet kernel will enable better resolution of several low-circulation, multi-scale secondary flow morphologies and whether new insights into the dynamics of arterial secondary flow structures can accordingly be gained.

[1]Supported by the National Science Foundation, Grant No. CBET-0828903 and GW Center for Biomimetics and Bioinspired Engineering (COBRE).

Michael Plesniak
The George Washington University

Date submitted: 02 Aug 2012 Electronic form version 1.4