Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Secondary Flow Structure Induced by a Multiple-Harmonic Pulsatile Waveform at Low Womersley Number in a Curved Tube CHEKEMA PRINCE, MICHAEL PLESNIAK, Purdue University, SEAN PETERSON, Polytechnic Institute of NYU — Under forced harmonic oscillation at sufficiently high Womersley number, the secondary flow pattern in a tube can exhibit Lyne-type vortices, where an inviscid core in the center of the tube experiences inward centrifuging. The present study investigates the evolution of secondary flow development in a curved tube subjected to a physiologically-inspired pulsatile waveform constructed using 10 harmonics. Specifically, the study seeks to address whether a Lyne-type effect is possible at a nominally low Womersley number. Experimental data were acquired using Laser Doppler Velocimetry (LDV) and numerical simulations were conducted using Fluent. Experimental and numerical results show fully developed flow after approximately 150 degrees for all phases of the driving waveform. This is in agreement with previous studies of harmonic forcing. For the lower Reynolds number portions of the waveform, flow development can occur as early as 135 degrees according to experimental data. Lyne-type vortices were observed at portions of the waveform dominated by higher harmonics, such as the peak associated with systole.

Sean Peterson
Polytechnic Institute of NYU

Date submitted: 05 Aug 2008 Electronic form version 1.4