## Abstract Submitted for the DFD19 Meeting of The American Physical Society

Study for Wall-shear Stress of Pulsatile Flows in 3-D Ducts.<sup>1</sup> XIAOYU ZHANG, SYEEDALIREZ ABOOTORABI, Mechanical and Energy Engineering, Indiana University-Purdue University, Indianapolis, HIROKI YOKOTA, Biomedical Engineering, Indiana University-Purdue University, Indianapolis, HUIDAN YU, Mechanical and Energy Engineering, Indiana University-Purdue University, Indianapolis — Understanding wall shear-stress (WSS) in human tissues and organs such as blood vessels and synovial bursa is critically important in the prevention, pathogenesis, and treatment of varying diseases. Numerical simulation provides a unique tool for a fast and non-invasive quantification of WSS in realistic flows. We use a GPU-accelerated volumetric lattice Boltzmann method (VLBM) to assess WSS of pulsatile flows in 3D ducts with circular and rectangular cross sections. The computational results are validated through the comparisons with analytical solutions of Womersley flows in the two ducts. From the analytical solutions of Womersley flow, driven by pressure gradient  $\partial p/\partial l = P_s + P_o e^{i\omega t}$ , we observed that the WSS is linear to the magnitude of the unsteadiness  $(P_o/P_s)$ . Preliminary analysis indicates that the WSS is promoted/suppressed with small/large Womsley number. The effects of pulsation in more realistic pulsatile pipe flows with and without turbulence will be further examined and presented.

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