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High-order numerical simulations of pulsatile flow in a curved artery model[1] CHRISTOPHER COX, CHUNLEI LIANG, MICHAEL W PLESNIAK, George Washington University — Cardiovascular flows are pulsatile, incompressible and occur in complex geometries with compliant walls. Together, these factors can produce an environment that can affect the progression of cardiovascular disease by altering wall shear stresses. Unstructured high-order CFD methods are well suited for capturing unsteady vortex-dominated viscous flows, and these methods provide high accuracy for similar cost as low-order methods. We use an in-house three-dimensional flux reconstruction Navier-Stokes solver to simulate secondary flows and vortical structures within a rigid 180-degree curved artery model under pulsatile flow of a Newtonian blood-analog fluid. Our simulations use a physiological flowrate waveform taken from the carotid artery. We are particularly interested in the dynamics during the deceleration phase of the waveform, where we observe the deformed-Dean, Dean, Lyne and Wall vortices. Our numerical results reveal the complex nature of these vortices both in space and time and their effect on overall wall shear stress. Numerical results agree with and complement experimental results obtained in our laboratory using particle image velocimetry.

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