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Dynamical systems characterization of inertial effects of fluid flow in a curved artery model under pulsatile flow forcing[1] MICHAEL LEGGIERO, KARTIK V. BULUSU, MICHAEL W. PLESNIAK, The George Washington University — The main objective of this study was to examine inertial effects in a 180-degree model of curved arteries under pulsatile inflow conditions. Two-component, two-dimensional particle image velocimetery (2C-2D PIV) data were acquired upstream of and at several cross-sectional locations in the curved artery model. A blood-analog fluid comprised of 71% saturated sodium iodide solution, 28% glycerol and 1% distilled water (by volume) was subjected to multi-harmonic pulsatile inflow functions. First, signal time-lag was quantified by cross-correlating the input (voltage-time) supplied to a programmable pump and the output PIV (flow rate-time) measurements. The experiment was then treated as a linear, time-invariant system, and frequency response was estimated for phase shifts across a certain spectrum. Input-output signal dissimilarities were attributable to intrinsic inertial effects of flow. By coupling pressure-time and upstream flow rate-time measurements, the experiment was modeled using system identification methods. Results elucidate the role of inertial effects in fluid flow velocity measurements and the effect of these delays on secondary flow structure detection in a curved artery model.

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