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Secondary flow structures under simple harmonic inflow in a bent pipe model for curved arteries[1] AUTUMN GLENN, PENELOPE SEAGRAVE, FANGJUN SHU, KARTIK BULUSU, MICHAEL W. PLESNIAK, George Washington University — Inward centrifuging of fluid in the inviscid core of a 180 degree curved pipe leads to Lyne-type vortices under zero-mean harmonic oscillations, along with the formation of vortices in the Stokes' layer, that rotate in the same directional sense as their steady flow counterpart (Dean vortices). Under physiological conditions, the development of the Lyne-type vortices is believed to be influenced by the systolic pulse, and its associated rapid acceleration and deceleration. Experimental data acquired using Particle Image Velocimetry (PIV) for three harmonic waveforms of different frequencies clarify the conditions under which Lyne vortices form. Multiple vortex pairs were observed for all waveforms and frequencies investigated, including Dean and Lyne-type vortex structures at a Womersley number of 4.22, much lower than previously reported. Hence, frequency alone is not an adequate governing parameter to characterize secondary flow structures in pulsatile flows. A regime map of the secondary flow was sought by using an acceleration-based parameter and the Dean number.

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