Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Pulsatile flows in pipes with finite curvature SARAH WATERS, JENNIFER SIGGERS, University of Nottingham — Motivated by the study of blood flow in a curved artery, we consider fluid flow through a curved pipe of uniform curvature, δ, driven by a prescribed pulsatile axial pressure gradient. The pipe has finite (as opposed to asymptotically small) curvature, and we determine the effects of both the centrifugal and Coriolis forces on the flow. The flow is parameterised by δ, the Dean number D, the Womersley number α, and a secondary streaming Reynolds number R_s. Asymptotic solutions are developed for the cases when $D \ll 1$, $R_s \ll 1$ and $\delta \ll 1$ using regular perturbations techniques, and also when $\alpha \gg 1$ using matched asymptotic expansions. For intermediate values of the governing parameters a pseudospectral code is used to obtain numerical solutions. For flows driven by a purely oscillatory pressure gradient ($D = 0$) we identify three distinct classes of stable solutions corresponding to periodic symmetric, periodic asymmetric, and quasi-periodic asymmetric. The transition between solutions is dependent on the value of δ, indicating that finite curved pipes exhibit a qualitatively different solution structure from curved pipes with asymptotically small curvature. We then determine the effect of a non-zero steady component of the pressure gradient ($D \neq 0$) and show that for certain parameter values, when D is above a critical value the periodic asymmetric solutions regain spatial symmetry. The effects of finite curvature can lead to substantial quantitative differences in the wall shear stress distribution, and we discuss the physiological implications.

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Date submitted: 01 Sep 2005