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ABSTRACT

Pulsating Viscoelastic Flows in Networks

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Viscoelasticity is an important fluid feature in the complex rheological behavior of many synthetic and some natural fluids. Numerous industrial processes, including extrusion [1], microfluidic devices [2], subcutaneous drug delivery devices [3], lava flow [4], and many more, involve pressure-driven flows of viscoelastic fluids in tubes. Computational Fluid Dynamics studies are available in the literature that describe the flow of viscoelastic fluids through tubes under various conditions [5], but an analytical solution for these flows in complex flow systems has proven to be a complicated task. Analytical expressions may be extremely valuable and capable of yielding significant insights.
Both viscous and elastic properties are captured by the so-called Maxwell fluids. On a long timescale, they show viscous flow, but when deforming quickly, they show additional elastic resistance. The flow of pulsating Maxwell fluids in systems composed of bifurcating tubes is very important to learn more about how elasticity affects fluid dynamics in these flow systems. This is the motivation for the present study, in which we conduct a detailed analytical analysis of the flows through systems composed of bifurcating tubes.

[1] Z. Tadmor and C.G. Gogos, Principles of Polymer Processing (John Wiley and Sons, 2013).
[2] J. Zhou and I. Papautsky, Microsyst. Nanoeng., 6, 113 (2020).
[3] I. Fischer, A. Schmidt, A. Bryant and A. Besheer, Int. J. Pharm., 493, 70 (2015).
[4] N. Bagdassarov, K Müller and H Pinkerton, J. Volcanol. Geotherm. Res., 132, 99 (2004)
[5] M.A. Alves, P.J. Oliveira, and F.T. Pinho, Annu. Rev. Fluid Mech. 53, 509 (2021).