MR2323714 (Review) 76D10 (76M10)
Arada, Nadir (P-TULT-CEM); Pires, Marilia (P-EVOR); Sequeira, Adélia (P-EVOR)
Viscosity effects on flows of generalized Newtonian fluids through curved pipes. (English summary)

From the introduction: “The aim of this paper is to present a numerical study for steady fully developed flows of generalized Newtonian fluids in curved pipes with circular cross-section and arbitrary curvature ratio. After introducing the governing equations in non-dimensional polar coordinates, to describe the curved pipe geometry, we outline their discretization using a finite element method to obtain approximate solutions to the original problem, and the methodology used for solving the resulting system of non-linear algebraic equations. Finally, Section 6 contains numerical results. We compare the quantitative and qualitative behavior of the axial velocity, the secondary streamlines and the wall shear stress for both Newtonian and generalized Newtonian flows, performing computations for different values of the Reynolds number, the curvature ratio and of the non-dimensional viscosity parameters involved in the governing equations.

“In particular, we observe interesting viscosity effects that, as far as we know, have never been discussed in the literature: for small curvature ratio and within a certain range of viscosity parameters, the secondary streamline contours undergo a counter-clockwise rotation and lose symmetry.

“Conclusions are summarized at the end of the paper.”

© Copyright American Mathematical Society 2007