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REALISTIC THREE-DIMENSIONAL FLOW SIMULATION OF VICOELASTIC FLUIDS IN EXTRUDER USING FINITE-VOLUME METHOD

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This study is devoted to simulation of some viscoelastic fluid flows in an extruder considering that screw is turning instead of classical model in which normally barrel turns. A three dimensional finite-volume scheme is used to solve momentum and fluid equations. The real geometrical configuration of the channel without leakage is investigated to obtain best result and show effective profiles same as pressure, flow, and velocity. The simulations concern incompressible fluids obeying different constitutive equations such as Newtonian, generalized Newtonian with shear-thinning properties (Carreau–Yasuda law), and viscoelastic differential model, the Phan–Thien/Tanner (PTT). A staggered grid with a QUICK scheme was used for the convective-type terms for discretizing the equations and unknowns and solve the set of governing equations by a decoupled algorithm, stabilized by a pseudo transient stress term and an elastic viscous stress splitting (EVSS) technique, in the viscoelastic case for the PTT model. The obtained results are shown in contour and vector form based on special position onto axial flow. Numerical results can demonstrate influence of boundary condition (fixed barrel and mobile barrel assumption) and rheological properties upon flow characteristics in considered geometry. The results show that considering screw moving instead of barrel in extruder has significant effects on pressure, stress, and velocity profiles comparing to results obtained from simulation with assumption of fixed barrel boundary that currently are used to model extruder flows.