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Rotational Flow of Nonlinear Drilling Mud NARIMAN ASHRAFI, MEHDI YEKTAPUR, Young Researchers and Elites Club, Science and Research Branch, Islamic Azad University, Tehran, Iran — To analyze the drilling process, the pseudoplastic flow between coaxial cylinders is investigated. Here, the inner cylinder is assumed to rotate and, at the same time, slide along its axis. A numerical scheme based on the spectral method is used to derive a low-order dynamical system from the conservation of mass and momentum equations under mixed boundary conditions. It is found that the Azimuthal stress develops far greater than other stress components. All stress components increase as pseudoplasticity is decreased. The flow loses its stability to the vortex structure at a critical Taylor number. The emergence of the vortices corresponds to the onset of a supercritical bifurcation. The Taylor vortices, in turn, lose their stability as the Taylor number reaches a second critical number corresponding to the onset of a Hopf bifurcation. The rotational and axial velocities corresponding to the optimum drilling conditions are evaluated. Furthermore, complete stress and viscosity maps are presented for different scenarios in the flow regime.

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