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Transient Non-Newtonian Screw Flow NARIMAN ASHRAFI, Azad University — The influence of axial flow on the transient response of the pseudoplastic rotating flow is carried out. The fluid is assumed to follow the Carreau-Bird model and mixed boundary conditions are imposed. The four-dimensional low-order dynamical system, resulted from Galerkin projection of the conservation of mass and momentum equations, includes additional nonlinear terms in the velocity components originated from the shear-dependent viscosity. In absence of axial flow the base flow loses its radial flow stability to the vortex structure at a lower critical Taylor number, as the pseudoplasticity increases. The emergence of the vortices corresponds to the onset of a supercritical bifurcation which is also seen in the flow of a linear fluid. However, unlike the Newtonian case, pseudoplastic Taylor vortices lose their stability as the Taylor number reaches a second critical number corresponding to the onset of a Hopf bifurcation. Existence of an axial flow, manifested by a pressure gradient appears to further advance each critical point on the bifurcation diagram. In addition to the simulation of spiral flow, the proposed formulation allows the axial flow to be independent of the main rotating flow. Complete transient flow field together with viscosity maps are also presented.

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