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Dynamics and Stability of Nonisothermal Film Casting Process Using 2-D Phan-Thien and Tanner (PTT) Model

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Dynamics and several instability modes in nonisothermal film casting process have been theoretically investigated using 2-D Phan-Thien and Tanner model. To effectively analyze transient dynamical behaviors as well as base flows of this system, the Arbitrary Lagrangian Eulerian (ALE) algorithm together with the spine method well-suited for free surface tracking was incorporated in the finite element simulations. Edge beads and neck-in behaviors predicted from this model quantitatively agreed with experimental results for both extensional thickening (i.e., LDPE) and extensional thinning (i.e., HDPE) fluids. Also, it has been confirmed that this model is superior to 1-D varying film width model, which previously developed by our group, in describing nonlinear dynamics such as draw resonance instability as well as above two defects.