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Nonlinear dynamics and flow transitions in viscoelastic shear flows[1]

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Dynamical explorations of viscoelastic flows are of fundamental and practical interest. Elastic forces cause flow instability even in the absence of inertia (creeping flow) and greatly modify the onset and ensuing sequence of flow transitions in flows with finite inertia. While past research has yielded much progress, literature on several intriguing nonlinear phenomena has been only slowly emerging. These include: (i) nonlinear transitions in *linearly stable*, parallel shear flows, (ii) influence of elastic instability on *pressure-flow rate* relationship under creeping flow conditions, (iii) effect of elasticity on *pattern formation* in *curved* shear flows and (iv) novel instabilities caused by thermal effects induced by *viscous heating*. The recent advances and challenges in the abovementioned areas will be discussed.

[1]NSF CTS 9874813, 0132730, 0335348; ACS/PRF; DARPA