Meeting: 1005, Newark, Delaware, SS 7A, Special Session on Frontiers on Complex Fluid Flows: Analytic and Computational Methods

1005-76-51 **R Sureshkumar*** (suresh@che.wustl.edu), Department of Chemical Engineering, Washington University, Campus Box 1198, Saint Louis, MO 63130. *Analytical results for thermoelastic instability.* Preliminary report.

Thermal effects, including those caused by viscous heating, can alter the stability characteristics of curvilinear flows of Newtonian and viscoelastic liquids [e.g. 1-4]. I will present a minimal model to describe the role of thermal effects caused by viscous heating on the stability of viscoelastic Taylor-Couette flow (i.e. flow generated within the gap of infinitely long concentric cylinders by their relative rotation) in the creeping flow regime. This model illustrates how small differences (1-2 K) in the gap temperature can be amplified by a thermoelastic coupling mechanism to produce O(1) effects on the critical conditions and qualitative changes in mode selection. Further, the dependence of the critical Weissenberg number, defined as the product of the fluid relaxation time and the shear rate at the onset, on the gap width is qualitatively different for isothermal ("purely elastic") and thermoelastic instabilities. Model predictions will be compared to numerical simulations. 1.D.G. Thomas, R. Sureshkumar & B. Khomami, J. Fluid Mech., 517: 251-279 (2004) 2.J.P. Rothstein &.H. McKinley, Phys. Fluids, 13, 382 (2001) 3.J.M. White & S.J. Muller, Phys. Rev. Lett., 84, 5130-33 (2000) 4.U. Al-Mubaiyedh, R. Sureshkumar & B. Khomami, Phys. Fluids, 11:3217-26 (1999) (Received January 21, 2005)