Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Dynamics of thinning of viscoelastic filaments: scaling analysis and self-similarity PRADEEP BHAT, School of Chemical Engineering, Purdue University, West Lafayette, IN 47907, MATTEO PASQUALI, Department of Chemical and Biomolecular Engineering, Rice University, Houston, TX 77005, OSMAN BASARAN, School of Chemical Engineering, Purdue University, West Lafayette, IN 47907 — Numerical analysis of the formation and pinch-off of viscoelastic filaments is important in numerous applications involving the production of drops. The dynamics in the region close to where pinch-off occurs is known typically to (i) evolve independently of the global dynamics and (ii) be self-similar (Eggers 1993). More recently, Clasen et al. (2006) have demonstrated the existence of self-similar solutions in the corner region where a drop is connected to an adjoining filament. While the former solution is useful in understanding breakup of filaments into drops, the latter could be used in calculating the extensional viscosity of the liquid. Most studies to date have used the 1-D slender filament approximation to probe the self-similar dynamics of thinning viscoelastic filaments. This approximation is clearly invalid in regions where slenderness is lost. Here, we present a full 2-D analysis of the problem in which viscoelasticity is captured using the conformation tensor formalism (Pasquali and Scriven 2002) and the governing equations are solved using a fully-coupled finite element method that has been well benchmarked against experiments (Chen, Notz, and Basaran 2001, 2002).

Osman Basaran
School of Chemical Engineering, Purdue University, West Lafayette, IN 47907

Date submitted: 03 Aug 2007 Electronic form version 1.4