Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

A mechanism for oscillatory instability in viscoelastic cross-slot flow LI XI, MICHAEL GRAHAM, Department of Chemical and Biological Engineering, University of Wisconsin-Madison — Interior stagnation point flows of viscoelastic liquids arise in a wide variety of applications including extensional viscometry, polymer processing and microfluidics. Experimentally, these flows have long been known to exhibit instabilities, but the mechanisms underlying them have not previously been elucidated. We computationally demonstrate the existence of a supercritical oscillatory instability of low- Reynolds number viscoelastic flow in a two-dimensional cross- slot geometry. The fluctuations are closely associated with the "birefringent strand" of highly stretched polymer chains associated with the outflow from the stagnation point at high Weissenberg number. Additionally, we describe the mechanism of instability, which arises from the coupling of flow with extensional stresses and their steep gradients in the stagnation point region.

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Date submitted: 04 Aug 2007 Electronic form version 1.4