Spatio-temporal oscillations and rheochaos in a simple model of shear banding

Suzanne M Fielding\textsuperscript{1,*} and Peter D Olmsted\textsuperscript{1,†}

\textsuperscript{1}Polymer IRC, School of Physics and Astronomy, University of Leeds, Woodhouse Lane, Leeds. LS2 9JT. UK.

Complex fluids commonly undergo flow instabilities and flow induced phase transitions that result in spatially heterogeneous shear banded states. In many cases, these banded states show oscillations or erratic fluctuations suggesting rheological chaos. However most existing theories predict only steady, time-independent bands. We therefore introduce a simple model of shear banding in which the flow induced phase is rendered unstable by coupling between flow and microstructure (eg mean chain length in a wormlike micellar surfactant). By varying the strength of the instability and the applied shear rate, we find a rich variety of oscillatory and rheochaotic shear banded flows.

*Electronic address: physf@irc.leeds.ac.uk
†Electronic address: p.d.olmsted@leeds.ac.uk