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Mixing in a Simple Viscoelastic Flow BECCA THOMASES, MICHAEL SHELLEY, Courant Institute, New York University — Recent experiments have shown that low Reynolds number viscoelastic flows exhibit complicated flow patterns which include increased flow resistance and high levels of mixing. To better understand these phenomena we study numerically the 2D Oldroyd-B viscoelastic model at low Reynolds number. A background force is used to create a periodic cell with four-roll mill vortical structure around a hyperbolic fixed point. We consider both steady and time-periodic forcing. For low Weissenberg (Wi) number the elastic stresses are bounded and slaved to the forcing, with mixing confined to small sets near the hyperbolic point. At larger Wi an analog to the coil-stretch transition occurs, yielding large stresses and stress gradients concentrated on sets of small measure, perhaps indicating the development of singularities. The flow then becomes very sensitive to perturbations in the forcing and there is a transition to global mixing in the fluid.

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