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A Transition to Mixing and Oscillations in a Stokesian Viscoelastic Flow BECCA THOMASES, Dept. of Mathematics, UC-Davis, MICHAEL SHELLEY, Courant Institute, New York University — To understand observations of low Reynolds number mixing and flow transitions in viscoelastic fluids, we study numerically the dynamics of the Oldroyd-B viscoelastic fluid model. The fluid is driven by a simple time-independent forcing that creates a cellular flow with extensional stagnation points. We find that at O(1) Weissenberg number these flows lose their slaving to the forcing geometry of the background force, become oscillatory with multiple frequencies, and show continual formation and destruction of small-scale vortices. This drives flow mixing. These new flow states are dominated by a single large vortex, which may be stationary or move persistently from cell to cell. Increasing the number of degrees of freedom by increasing the number of driving cells broadens the temporal frequency spectrum and improves fluid mixing.

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