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Capturing nonlinear dynamics of two-fluid Couette flows with asymptotic models[1] DEMETRIOS PAPAGEORGIOU, RADU CIMPEANU, Imperial College London, ANNA KALOGIROU, University of Leeds, ERIC KEAVENY, Imperial College London — The nonlinear stability of two-fluid Couette flows is studied using a novel evolution equation whose dynamics are validated by direct numerical simulations (DNS). The evolution equation incorporates inertial effects at arbitrary Reynolds numbers through a nonlocal term arising from the coupling between the two fluid regions, and is valid when one of the layers is thin. The equation predicts asymmetric solutions and exhibits bistability as seen in experiments. Related low-inertia models have been used in qualitative predictions using *ad hoc* modifications rather than the direct comparisons carried out here. Comparisons between model solutions and DNS show excellent agreement at Reynolds numbers of $\mathcal{O}(\infty\prime^{\ni})$ found in experiments. Direct comparisons are also made with the available experimental results of Barthelet et al. (1995) when the thin layer occupies 1/5 of the channel height. Pointwise comparisons of the travelling wave shapes are carried out and once again the agreement is very good.

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