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The Jeffery–Hamel similarity solution and its relation to symmetry breaking in two-dimensional, diverging-channel flow PHILIP HAINES, The University of Adelaide, RICHARD HEWITT, ANDREW HAZEL, The University of Manchester — Jeffery–Hamel (JH) flows describe the steady two-dimensional flow of an incompressible viscous fluid between infinite plane walls separated by an angle 2α. They are are often used to approximate flows with a finite radial extent. However, whilst JH flow is characterised by a subcritical pitchfork bifurcation, studies in expanding channels of finite length typically find symmetry breaking via a supercritical bifurcation. Using the finite element method we calculate solutions for flow in a two-dimensional wedge of finite length bounded by arcs of constant radii, R_1 and R_2. We present a comprehensive picture of the bifurcation structure and nonlinear states for a net radial outflow of fluid. We find a series of nested neutral curves in the Reynolds number-α plane corresponding to pitchfork bifurcations that break the midplane symmetry of the flow. We show that these finite domain bifurcations remain distinct from the JH bifurcation even in the limit $R_2/R_1 \to \infty$. We also discuss a class of stable steady solutions apparently related to a steady, spatially periodic, wave first observed by Tutty (1996).

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