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Title:
State-space visualization
of the onset of turbulence in shear flows

Abstract:
Recent advances in experimental imaging, computational methods, and dynamical systems theory suggest that the unstable recurrent coherent structures observed in wall-bounded shear flows (such as pipes and boundary layers) result from close passes to weakly unstable invariant solutions of the Navier-Stokes equations. These 3D, fully nonlinear solutions (equilibria and periodic orbits) structure the state space of turbulent flows and provide a skeleton for analyzing their dynamics. In presence of continuous translational and rotational symmetries the corresponding invariant solutions are relative equilibria (traveling waves) and relative periodic orbits. We describe the method of slices or moving frames, which reduces the state space to a symmetry-reduced `slice'. The reduction enables us to chart out the connections between these `relative' or `equivariant' solutions in the state-space representation introduced in (Gibson, Halcrow and Cvitanovic, JFM 2008), and examine their role in organizing the dynamics of turbulence.