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Characterizing the Edge of Turbulence for Shear Flows LINA KIM, JEFF MOEHLIS, UCSB — We characterize the edge of turbulence, the boundary which separates the basins of attraction of the laminar and turbulent states, for a nine-dimensional model for sinusoidal shear flow in order to gain a greater understanding of the nature of and transition to turbulence. The model has three qualitatively distinct trajectories which either decay to the laminar state, or become transiently chaotic before decaying to the laminar state, or become transiently chaotic before moving towards a non-trivial attractor. The boundary which separates the laminar and chaotic behavior is the eight-dimensional stable manifold of an unstable periodic orbit, at least for moderately small Reynolds numbers. Furthermore, a probabilistic analysis of the transition to turbulence is performed by computing the probability, for a large range of Reynolds numbers, that perturbations of a given energy will lead to turbulence and/or linear transient energy growth, a mechanism which may trigger nonlinear effects that lead to sustained turbulence in shear flows.

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