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Transition to turbulence: highway through the edge of chaos is charted by Koopman modes T. S. EAVES, DAMTP, University of Cambridge, C. P. CAULFIELD, BPI & DAMTP, University of Cambridge, I. MEZIC, Mechanical Engineering, UCSB — We present evidence of low-dimensional dynamical state-space structures enabling transition to turbulence using an extension of the recently advanced operator-theoretic approach to turbulence of Mezi (2005). To do this, we use the dynamic-mode-decomposition (DMD) algorithm of Schmid Sesterhenn (2008) on the minimal seed trajectories in plane Couette flow of Rabin et al. (2012) and Eaves Caulfield (2015), which transition to turbulence via the most energy-efficient finite amplitude perturbation from the laminar state. The methodology enables identification of low dimensional structures associated with stable and unstable manifolds of exact solutions to the Navier-Stokes equations, even though the state space is very high-dimensional. In consequence, the results provide a low-dimensional representation of the transition to turbulence and also identify the first known dynamical signature of the importance of edge states in this transition.

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