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Nonlinear optimization of multiple perturbations and stochastic forcing of subcritical ODE systems DANIEL LECOANET, UC-Berkeley, RICH KERSWELL, Bristol University — Subcritical transition between states has been proposed to explain a variety of phenomena, including transition to turbulence in shear flows, and the generation of a magnetic dynamo in accretion discs. These systems feature an easily specified linearly stable "laminar" equilibrium state, along with at least one other stable "turbulent" state. We present simple 2D ODE model systems with these features, and study how the systems react to different types perturbations. First, we extend variational techniques used to study transition to turbulence in shear flows (e.g. Pringle & Kerswell 2010, Rabin et al 2012) to find the optimal (that is, closest to the "turbulent" state at late time) set of multiple perturbations, each occurring at a different time, that will cause a transition to the "turbulent" state. We find that some systems transition to the "turbulent" state much more easily with multiple perturbations than with a single perturbation. Second, we introduced random noise into the model systems, and determined the mean exit time from the attractor of the "laminar" state. We find that systems in which "turbulence" is more easily triggered by multiple perturbations have shorter mean exit times when subjected to noise.

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