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Nonlinear optimal perturbations of stratified plane Couette flow
T.S. EAVES, DAMTP, University of Cambridge, C.P. CAULFIELD, BP Institute & DAMTP, University of Cambridge — The stability properties of shear flows have received wide attention due to the important engineering applications of understanding how and when turbulence might emerge in a given flow geometry. Research has recently focused on identifying "minimal seeds," i.e. the initial perturbations to a laminar state with the smallest initial perturbation energy $E_0 = E_c$ that ultimately trigger the transition to turbulence. In unstratified plane Couette flow, Rabin, Caulfield & Kerswell (*J. Fluid Mech.* 2012 **712**) identified both such a minimal seed, and other "nonlinear optimal perturbations" (NLOPS) with $E_0 < E_c$ which maximised the gain in kinetic energy over some finite time while the flow still remained laminar. We use the same variational method of "nonlinear adjoint looping" to identify NLOPS and minimal seeds in stably stratified plane Couette flow, where a constant (stabilising) density difference is maintained across the flow. We also identify the mechanisms through which such perturbations may transiently gain both kinetic and potential energy as the bulk Richardson number is varied, identifying how stratification changes the qualitative characteristics of the optimal perturbations.

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