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Comparison of linear and nonlinear optimal perturbation transient growth in plane Couette flow S.M.E. RABIN, DAMTP, U. of Cambridge, C.P. CAULFIELD, BPI & DAMTP, U. of Cambridge, R.R. KERSWELL, Mathematics, U. of Bristol — Previous approaches to the question of transient growth have focused upon the study of linearised disturbances, with the assumption that it is the growth in the linear regime of linear optimal perturbations (LOPs) that nevertheless lead to a nonlinear regime and hence trigger the transition to turbulence. In this study we take a different approach by considering the full nonlinear problem. We look to extend the work considering pipe flow of Pringle (C. C. T. Pringle Ph.D. Bristol 2009) and use variational techniques to examine both the spatial structure and the normalised kinetic energy growth (gain) achieved by nonlinear optimal perturbations (NLOPs) in plane Couette flow. We show that in certain circumstances the gain achieved by the NLOP is significantly larger and has a noticeably different (and more complex) spatial structure from its counterpart LOP. We investigate the dependence on initial perturbation energy of the maximum predicted gain for selected Reynolds numbers and optimization times and propose that these inherently nonlinear structures may well be more significant in the transition to turbulence than LOPs.

C. P. Caulfield
BPI & DAMTP, U. of Cambridge

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