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Minimal seeds in mixing layers SAMUEL RABIN, DAMTP, University of Cambridge, COLM CAULFIELD, BP Institute & DAMTP, University of Cambridge, RICHARD KERSWELL, School of Mathematics, University of Bristol
— Recent studies on transition have investigated the nonlinear transient growth properties of the Navier-Stokes equations by using variational techniques to optimize perturbation structure in order to reveal the "minimal seed" for turbulence (Cherubini et al 2010, Monokrousos et al 2011, Pringle et al 2012). These studies were performed on geometries and Reynolds numbers that were linearly stable, yet experimental results demonstrated could transition to turbulence, such as Plane Couette Flow (PCF). In contrast to PCF, one of the most commonly studied transition mechanisms is the Kelvin-Helmholtz instability (KHI) of inflectional shear layers, which layers can be shown to be unstable to infinitesimal perturbations for quite moderate Reynolds numbers. In this study, we apply the recently developed variational techniques to optimize the kinetic energy over finite time horizons of three-dimensional finite amplitude perturbations for a time-evolving background flow initially described by a hyperbolic tangent function, which flow is subject to KHI. Our objective is to determine what are the minimal energy perturbations which can trigger turbulence in this geometry, and what role is played by KHI in such "optimized" transition. This research was supported by EPSRC.

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