

Abstract Submitted
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Calculation of minimal seeds in stabilised pipe flows¹ ELENA MARENSEI, ASHLEY P. WILLIS, School of Mathematics and Statistics, The University of Sheffield, PROFESSOR RICHARD KERSEWELL, THE UNIVERSITY OF BRISTOL COLLABORATION — The minimal seed is the initial perturbation of lowest energy that triggers transition to turbulence. Variational methods are used to construct fully nonlinear optimisation problems that seek the minimal seed in stabilised pipe flows. By introducing a body force that flattens the mean streamwise velocity profile, the minimal seed is shown to move towards higher values of the critical initial energy E_c . In the unforced case, we apply a spectral filter to the minimal seed at $Re=2000$. The structure of the minimal seed is found to be robust to quite severe spectral filtering as well as to changes in the base flow. To clarify the relevance and realisability of the minimal seed in experiments, a statistical study is performed, where energy is scattered randomly over the allowed wavenumbers and the probability of transition calculated as a function of the initial energy $E_0 > E_c$. The initial conditions generated with this analysis are fed into direct numerical simulations with a localised forcing introduced to mimic the presence of a baffle in the core of the flow. The resulting curve $E_c = E_c(Re)$ is compared to the one obtained in the uncontrolled case.

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