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**Optimal perturbations in plane Poiseuille flow based on the optimization of the p-norm of the energy density** D.P.G. FOURES, C.P. CAULFIELD, DAMTP - University of Cambridge, P.J. SCHMID, LADHYX - Ecole Polytechnique — Over the last twenty years, much attention has been given to the consideration of transient non-modal growth of infinitesimal perturbations in shear flows. Indeed, it is now well-accepted that marked transient growth of the energy is possible for intermediate times even though all normal modes are linearly stable. It is often postulated that such amplification of an initial perturbation could trigger nonlinear behaviour within the flow and hence be responsible for the transition toward a turbulent state. Most of these studies have been based on the optimization of an initial perturbation in order to maximize the "gain," i.e. the amplification of the integrated kinetic energy over the flow domain. In many realistic circumstances, it is of more interest to identify initial perturbations which maximize flow quantities locally. Therefore, we investigate the implications of switching from the 1-norm of the energy density to a general p-norm which will approximate the infinity norm for large values of p. By considering a simple model problem of two-dimensional plane Poiseuille flow, we show that identifying "optimal" perturbations which maximize the p-norm of the energy density at some finite time horizon typically leads to enhanced localization, at the cost of reduction in the gain in the energy of the perturbation.

S.M.E. Rabin
DAMTP - Univertsity of Cambridge

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