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Rayleigh-Bénard-Poiseuille flow: Optimal growth of streamwise-uniform disturbances J JOHN SOUNDAR JEROME, JEAN-MARC CHOMAZ, PATRICK HUERRE, Ecole Polytechnique — An investigation of the dominant transient growth mechanisms in plane Poiseuille flow subjected to a destabilizing cross-stream temperature gradient is presented. It was pointed out by the same authors in DFD meeting 2009 that only the streamwise-uniform and nearly-streamwise-uniform disturbances are highly influenced by the Rayleigh number $\boldsymbol{Ra}$ and Prandtl number $\boldsymbol{Pr}$. Here, it is demonstrated that the *short-time* behavior is governed by the classical inviscid lift-up mechanism and the optimal input for the largest *long-time* response is given by the adjoint of the dominant eigenmode with respect to the energy scalar product: the Rayleigh-Bénard eigenmode without its streamwise velocity component. These short and long-time responses are then shown to depict, up to leading order, the optimal transient growth $\boldsymbol{G(t)}$. It is thereby brought out that, at moderately large $\boldsymbol{Ra}$ (or small $\boldsymbol{Pr}$ at a fixed $\boldsymbol{Ra}$), the dominant adjoint mode is a good approximation to the optimal initial condition for all time. The results remain qualitatively similar over a general class of norms that can be considered as growth functions. For instance, the dominant adjoint eigenmode still approximates the maximum optimal response.

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