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Following analytically stages of transition in Couette flow MICHAEL KARP, JACOB COHEN, Faculty of Aerospace Engineering, Technion — A possible explanation for transition in Couette flow is the mechanism of transient growth (TG). Accordingly, a small disturbance can achieve a significant non-modal TG and trigger nonlinear mechanisms before its eventual decay owing to viscosity. The linear optimal disturbance achieving the maximal growth consists of a pair of streamwise independent counter-rotating vortices (CVPs) which create spanwise-varying streamwise streaks. These may become unstable with respect to infinitesimal disturbances. It is shown that four decaying normal modes, obtained analytically, are sufficient to follow the linear TG mechanism. A secondary linear stability analysis of the modified base-flow (Couette flow with streaks) is conducted using Floquet theory for the spanwise periodic base-flow. The predictions of the stability analysis are compared with direct numerical simulations using the "Channelflow" code. It is shown analytically that the inclusion of nonlinear interactions between the base-flow and the CVPs is required in order to predict instability. Furthermore, it is demonstrated that the generation of a 'strong' inflectional point is more important than obtaining maximal growth. The minimal number of modes enables us to follow analytically several key stages of the transition process.

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