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Initial conditions and symmetry breaking for linear energy amplification in eddy-viscosity models of turbulent channels[1] PABLO GARCÍA-RAMOS, U. Politécnica Madrid, JAVIER JIMÉNEZ, UPM and CTR Stanford — We study maximally-growing linear perturbations in a turbulent channel, using linearized Navier Stokes equations and an eddy viscosity that is generally lower than the one required to maintain the full velocity profile. The new viscosity depends on the wavenumber, and can be rationalized from spectral considerations. Significantly, fully nonlinear simulations using it, are able to self-sustain. We find that it is important to consider not only the optimal perturbation for a given wavenumber, but also those associated to the next few singular values. In general, these come in pairs. For short-wavelength modes localized near the wall, or in the sublayer, symmetric and antisymmetric eigenfunctions have essentially the same growth properties, showing that the two walls are decoupled. For larger wavelengths, whose optimal perturbations span the whole flow thickness, symmetry is broken, and the solution with an antisymmetric streamwise velocity becomes dominant. It corresponds to a fast streak in one wall opposite to a slow one in the other, and agrees with the structure of global modes obtained from correlations in full-channel DNSes.

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