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Energy amplification in turbulent channels[1] JUAN C. DEL ALAMO, School of Aeronautics Madrid, JAVIER JIMENEZ, School of Aeronautics Madrid and CTR Stanford, PAULO ZANDONADE, U. Illinois Urbana-Champaign, ROBERT D. MOSER, U. Texas Austin — We study the temporal stability of the Orr-Sommerfeld and Squire equations in channels with turbulent mean velocity profiles and turbulent eddy viscosities. All the eigensolutions of this problem are damped, but initial perturbations with wavelengths $\lambda_x > \lambda_z$ can grow temporarily before decaying. For each wavelength, the structure of the most amplified solution agrees with that of the most energetic POD eigenfunction obtained from the available direct numerical simulations ($180 \leq Re_\tau \leq 1900$). The transient growth has two local maxima at $\lambda_z^+ = 100$ and $\lambda_z/h = 3$, which coincide with the widths of the near-wall streaks and of the largest structures of the outer layer. The dynamics of both the near-wall and the outer solutions are similar. They start with a wall-normal v event which does not grow but which forces streamwise velocity fluctuations by stirring the mean shear ($uv < 0$). The resulting u fluctuations grow significantly and last longer than the v ones, containing nearly all the kinetic energy at the instant of maximum amplification.

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