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Optimal linear amplification of partial energy norms in turbulent channels[1] JAVIER JIMENEZ, U. Poltecnica de Madrid and CTR — When comparing "optimally-amplified" linearized porturbations in modeled turbulent channels to the observed structures in real multiscale flows, it is often useful to redefine the norm used in the comparison. For example, to study the kinetic energy at a given wall distance, it is useful to examine which initial perturbations amplify optimally the energy at that level, rather than the total one. The same is true of individual velocity components. Unfortunately, such norms are singular, vanishing for some nonzero perturbations, and require modifying the standard optimum-growth algorithm, We present such a modification, using a nonsingular norm to normalize the initial condition, and a possibly singular one to monitor growth, and apply it to model the energy spectra in a linearized eddy-viscosity approximation to turbulent channels. Using a norm that measures the buffer-layer energy leads to maximum amplification in the spectral region characteristic of near-wall streaks, while using energy windows farther from the wall isolates spectra similar to those in the log or outer layers. The results are used to investigate the likely origin of the different turbulent structures.

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