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Spectral energetics of a quasilinear approximation in uniform shear turbulence[1] CARLOS GONZALEZ HERNANDEZ, YONGYUN HWANG, Imperial College London — The spectral energetics of a quasilinear (QL) model is studied in uniform shear turbulence. For the QL approximation, the velocity is decomposed into a mean averaged in the streamwise direction and the remaining fluctuation. The equations for the mean are fully considered, while the equations for the fluctuation are linearised around the mean. The QL model exhibits an energy cascade in the spanwise direction, but this is mediated by highly anisotropic small-scale motions unlike that in direct numerical simulation mediated by isotropic motions. In the streamwise direction, the energy cascade is shown to be completely inhibited in the QL model, resulting in highly elevated spectral energy intensity residing only at the streamwise integral length scales. It is also found that the streamwise wavenumber spectra of turbulent transport, obtained with the classical Reynolds decomposition, statistically characterizes the instability of the linearised fluctuation equations. Further supporting evidence of this claim is presented by carrying out a numerical experiment, in which the QL model with single streamwise Fourier mode is found to generate the strongest turbulence for $L_x/L_z = 1 \sim 3$, consistent with previous findings.

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