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Lifetimes of the large-scale motions in channels up to $Re_\tau \approx 5000$[1]
MIGUEL ENCINAR, ALBERTO VELA-MARTIN, JAVIER JIMENEZ, Universidad Politecnica de Madrid — The energy spectra of (wall-bounded) turbulent flows is unmistakeably one of the most important tools in turbulent research. Due to past limitations of computational resources, direct numerical simulations have traditionally focused on the computation of the spatial spectra, neglecting its temporal counterpart. We compute the spatio-temporal spectra of the large scales (larger than one fifth of the channel half-height) of channels up to $Re_\tau \approx 5000$. Using the spectra, it is possible to extend the definition of 'correlation time' to provide a meaningful estimation of the lifetime for every spatial wavelength, and at every height. We find the lifetimes to increase with the distance to the wall and with the stream and spanwise wavelengths. There is almost no difference between in the lifetime of a given wavelength between velocity components. Nevertheless, the expected lifetime of each component is different due to the difference in their energy spectra, i.e. the streamwise component lives longer because has more energy in long wavelengths. We also found that the lifetimes scale across Reynolds numbers with the channel half-height and the bulk velocity, instead of the friction velocity.

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