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Evolution of turbulent kinetic energy in the presence of a uniform kinetic energy gradient without mean shear[1] ADRIEN THORMANN, CHARLES MENEVEAU, Johns Hopkins University — In this work we study grid turbulence with a initial uniform spatial gradient of kinetic energy of the form $k \sim \beta(y - y_0)$, where y is the spanwise position, while having no mean-velocity shear. Therefore, there is no production but only dissipation and spatial transverse diffusion of turbulent kinetic energy. The experiment is performed with the use of an active grid and screens mounted upstream of the wind-tunnel's test section, iteratively designed to produce a uniform gradient of turbulent kinetic energy without mean velocity shear. Data are acquired using X-wire thermal anemometry at different spanwise and downstream locations. Profile measurements are used to quantify the constancy of the mean velocity and the linearity of the initial profile of kinetic energy. Measurements show that at all spanwise locations the decay in the streamwise direction follows a power-law but with exponents $n(y)$ that depend upon the spanwise location. The results are consistent with a parameterization of decay of the form $k/\langle u \rangle^2 = \beta(x/x_{\text{ref}})^{-n(y)}(y - y_0)/M$. Results for the development of the integral length scale, and for velocity skewness and flatness factors, which show significant deviations from Gaussianity, are also presented.

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Adrien Thormann
Johns Hopkins University

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