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Energy transfer and dissipation in forced isotropic turbulence[1]
MORITZ LINKMANN, University of Edinburgh, W. DAVID MCCOMB, Retired, ARJUN BERERA, University of Edinburgh, SAMUEL YOFFE, University of Strathclyde — A model for the Reynolds number dependence of the dimensionless dissipation rate C_ε is derived from the dimensionless Kármán-Howarth equation, resulting in $C_\varepsilon = C_{\varepsilon,\infty} + C/R_L$, where R_L is the integral scale Reynolds number. The coefficients C and $C_{\varepsilon,\infty}$ arise from asymptotic expansions of the dimensionless second- and third-order structure functions. The model equation is fitted to data from direct numerical simulations (DNS) of forced isotropic turbulence for integral scale Reynolds numbers up to $R_L = 5875$ ($R_\lambda = 435$), which results in an asymptote for C_ε in the infinite Reynolds number limit $C_{\varepsilon,\infty} = 0.47 \pm 0.01$. Since the coefficients in the model equation are scale-dependent while the dimensionless dissipation rate is not, we modelled the scale dependences of the coefficients by an *ad hoc* profile function such that they cancel out, leaving the model equation scale-independent, as it must be. The profile function was compared to DNS data to very good agreement, provided we restrict the comparison to scales small enough to be well resolved in our simulations.

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