Abstract Submitted
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Spectral analysis of structure functions and their scaling exponents in forced isotropic turbulence[1] MORITZ LINKMANN, University of Edinburgh, W. DAVID MCCOMB, Retired, SAMUEL YOFFE, University of Strathclyde, ARJUN BERERA, University of Edinburgh — The pseudospectral method, in conjunction with a new technique for obtaining scaling exponents ζ_n from the structure functions $S_n(r)$, is presented as an alternative to the extended self-similarity (ESS) method and the use of generalized structure functions. We propose plotting the ratio $|S_n(r)/S_3(r)|$ against the separation r in accordance with a standard technique for analysing experimental data. This method differs from the ESS technique, which plots the generalized structure functions $G_n(r)$ against $G_3(r)$, where $G_3(r) \sim r$. Using our method for the particular case of $S_2(r)$ we obtain the new result that the exponent ζ_2 decreases as the Taylor-Reynolds number increases, with $\zeta_2 \to 0.679 \pm 0.013$ as $R_\lambda \to \infty$. This supports the idea of finite-viscosity corrections to the K41 prediction for S_2, and is the opposite of the result obtained by ESS. The pseudospectral method permits the forcing to be taken into account exactly through the calculation of the energy input in real space from the work spectrum of the stirring forces. The combination of the viscous and the forcing corrections as calculated by the pseudospectral method is shown to account for the deviation of S_3 from Kolmogorov's "four-fifths"-law at all scales.

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