Abstract Submitted
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Asymptotic analysis of homogeneous isotropic decaying turbulence with unknown initial conditions[1] PHILIP SCHAEFER, MARKUS GAMPERT, JENS HENRIK GOEBBERT, MICHAEL GAUDING, PETERS NORBERT, Institute for Combustion Technology, RWTH Aachen — In decaying grid turbulence there is a transition from the initial state immediately behind the grid to the state of fully developed turbulence downstream which is believed to become self-similar and is characterized by a power law decay of the turbulent kinetic energy with a decay exponent n. The value of this exponent however depends on the initial distribution of the velocity moments. In the non-dimensionalized form of the von Kármán-Howarth equation a decay exponent dependant term occurs whose coefficient will be called δ. We exploit the fact that δ vanishes for $n = 2$ to formulate a singular perturbation problem, where another small number in the equation, namely $1/4$, is assumed to be of the same order as of magnitude as δ. In the limit of infinitely large Reynolds numbers, we obtain an outer layer as well as an inner layer of the thickness of the order $\mathcal{O}(\delta^{\frac{3}{2}})$, where the Kolmogorov scaling is valid. To leading order, we obtain in the outer layer an algebraic balance between the two-point correlation and the third order structure function.

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