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Inter-scale energy budget in a von Kármán mixing tank ANNA N. KNUTSEN[1], PAWEL BAJ, NICHOLAS A. WORTH, JAMES R. DAWSON, Norwegian University of Science and Technology, JOHN M. LAWSON, University of Southampton, EBERHARD BODENSCHATZ, Max Planck Institute of Dynamics and Self-Organisation — The inter-scale energy budget in the center region of a von Kármán mixing tank has been investigated based on fully resolved measurement data from volumetric and stereo PIV experiments at Re_λ =199. The Kármán-Howarth equation generalized for non-isotropic, inhomogeneous turbulence (sometimes referred to as the Kármán-Howarth-Monin-Hill equation) is used to map the full energy transfer, and determine the importance of the different mechanisms transporting energy. The results show that the mean flow, despite its small magnitude relative to the turbulent fluctuations, plays a significant role in the local inter-scale energy transfer. This result stands out from similar investigations of other types of flows, where the mean flow has been found to have a negligible role in transporting energy across scales. This large contribution is caused by the strong gradients in all directions of the mean flow, which is a special feature of the von Kármán flow. The isotropy of the various terms is also evaluated, and strong local variations of the different terms in scale space are observed even down to very small separations, highlighting the importance of using planar or volumetric data when energy transfer is studied.

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Anna N. Knutsen
Norwegian University of Science and Technology

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