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The alignment of vortical structures in turbulent flow through a contraction VIVEK MUGUNDHAN, PUGAZENTHI RAMAKRISHNAN, NATHAN SPEIRS, RAVI SAMTANEY, SIGURDUR THORODDSEN, King Abdullah University of Science and Technology (KAUST) — Contracting turbulent streams occur in many industrial applications, such as flows in ducts and nozzles. Herein we use Tomo-PIV to study the alignment of turbulent vortical structures advecting through a 2-D contraction, with a contraction ratio of 2.5:1. The turbulence is generated with an active grid inside a water tunnel, attaining Re_λ of 250. Volumetric and time-resolved Tomo-PIV and Shake-The-Box velocity measurements are used to characterize the streamwise evolution of coherent vortical structures at three locations, upstream of and two within the contraction. We confirm the conceptual picture of coherent large-scale vortical structures being stretched and aligned with the mean strain rate. We also find that the local vorticity vector aligns with the mean strain, while remaining preferentially aligned with the intermediate eigenvector of the local instantaneous strain-rate tensor. The observed behavior of alignments are unaffected by the grid-rotation protocols and the modest transverse inhomogeneity.

Vivek Mugundhan
King Abdullah University of Science and Technology (KAUST)

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