Abstract Submitted
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On the entrainment dynamics of inergodic, non-stationary flows[1]

GIUSEPPE ROSI, DAVID RIVAL, Queen's University — Entrainment is typically studied through the conditional averaging along the turbulent non-turbulent interface (TNTI) of ergodic flows. However, this method is unsuitable for inergodic, non-stationary flows, as the TNTI is non-similar at different points in space and time. To understand how a TNTI's mean time dependence effects entrainment, the current study investigates the transport of irrotational fluid into a vortex forming behind an accelerating plate. The plate accelerates to a final velocity within a full-, half- and quarter-chord tow. Phase-averaged, planar, particle tracking velocimetry data is acquired and the forward finite-time Lyapunov exponent and vorticity fields are used to identify the TNTI. The TNTI is then represented by a contour, which is used to approximate the entrainment rate and investigate the transport mechanisms across the TNTI. Early results show that increasing acceleration suppresses vortex growth and entrainment. We hypothesize that shear-layer structure is integral to entrainment by altering the feeding rate of rotational fluid and the TNTI's convexity. The hypothesis is tested by altering plate-edge geometry and by varying the final chord-based Reynolds number from 5000 to 20 000.

[1]Natural Sciences and Engineering Council of Canada

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