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Formation of coherent structures in 3D laminar mixing flows
MICHEL SPEETJENS, Energy Technology Laboratory, Mechanical Engineering Department, Eindhoven University of Technology, P.O. Box 513, 5600 MB, Eindhoven, The Netherlands, HERMAN CLERCX, Fluid Dynamics Laboratory, Applied Physics Department, Eindhoven University of Technology, P.O. Box 513, 5600 MB Eindhoven, The Netherlands — Mixing under laminar flow conditions is key to a wide variety of industrial systems of size extending from microns to meters. Examples range from the traditional (and still very relevant) mixing of viscous fluids via compact processing equipment down to emerging micro-fluidics applications. Profound insight into laminar mixing mechanisms is imperative for further advancement of mixing technology (particularly for complex micro-fluidics systems) yet remains limited to date. The present study concentrates on a fundamental transport phenomenon of potential relevance to laminar mixing: the formation of coherent structures in the web of 3D fluid trajectories due to fluid inertia. Such coherent structures geometrically determine the transport properties of the flow and better understanding of their formation and characteristics may offer ways to control and manipulate the mixing properties of laminar flows. The formation of coherent structures and its impact upon 3D transport properties is demonstrated by way of examples.

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