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Experimental Investigation of Scalar Patterns in a Spatially Periodic Flow Field HADI RAJAEI, OZGE BASKAN, MICHEL SPEETJENS , HERMAN CLERCX , Eindhoven University of Technology — Spatially persisting patterns that form during the downstream evolution of passive scalars in three-dimensional (3D) spatially periodic flow fields is a fundamental aspect of industrial mixing processes that rely on the static mixing principle. Despite many numerical studies on 3D spatially periodic flow fields, a comprehensive experimental research on the periodic flow field is still scarce. This research focuses on a comparative analysis between laboratory experiments and numerical simulations on the evolution of the periodic flow field and coherent flow structures and concerns the effect of boundary (i.e. inlet) conditions on the periodicity of the flow field in a representative inline mixer consisting of spatially periodic internal elements. The experimental setup is composed of an optically accessible vertical test section with transparent internal elements which is fed by a pressure-driven pipe flow containing tracer particles. The 3D streamlines, hence, the flow field, are measured by 3D Particle-Tracking Velocimetry technique. The streamwise development of the periodicity within few internal elements regardless of the inlet conditions has been proven by preliminary studies.

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