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Coherent structures in 3D viscous time-periodic flow J.G. ZNAIEN, M.F.M. SPEETJENS, R.R. TRIELING, H.J.H. CLERCX, Dept. of Physics, Eindhoven University of Technology, P.O.Box 513, 5600MB Eindhoven, The Netherlands — Periodically driven laminar flows occur in many industrial processes from food-mixing devices to micro-mixer in lab-on-a-chip systems. The present study is motivated by better understanding fundamental transport phenomena in three-dimensional viscous time-periodic flows. Both numerical simulation and three-dimensional Particle Tracking Velocimetry measurements are performed to investigate the 3D advection of a passive scalar in a lid-driven cylindrical cavity flow. The flow is forced by a time-periodic in-plane motion of one endwall via a given forcing protocol. We concentrate on the formation and interaction of coherent structures due to fluid inertia, which play an important role in 3D mixing by geometrically determining the tracer transport. The disintegration of these structures by fluid inertia reflects an essentially 3D route to chaos. Data from tracking experiments of small particles will be compared with predictions from numerical simulations on transport of passive tracers.

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