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Unsteady regimes in a T-mixer MARIA VITTORIA SALVETTI, SIMONE CAMARRI, DICI, University of Pisa, ANDREA FANI, EPFL, Lausanne — Micro T-mixers are devices aimed at providing efficient mixing. Most of the studies in the literature focused on the steady engulfment regime, characterized by a loss of the flow symmetries in the outflow channel which leads to a considerable increase of the mixing efficiency. Unsteady regimes were recently observed for Reynolds numbers (Re) larger than the steady engulfment critical value. We investigated these regimes for a given T-mixer configuration through direct numerical simulations. A first unsteady regime appears, in which the flow remains asymmetric in the mean but becomes periodic in time. As Re is further increased, the flow remains time-periodic but it continuously switches between a symmetric configuration and an asymmetric one. Three-dimensional linear stability and sensitivity analyses are also used to characterize the instability leading to the unsteady asymmetric regime (UAR), which is interesting for applications due to its high mixing efficiency. The largest sensitivity was observed to base-flow modifications introduced close to the 3D vortical structures forming at the confluence between the inlet channels. Finally, it is found that for a flat inlet velocity profile the UAR onset is delayed at larger Re than for a fully developed profile.

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