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Unsteady engulfment regime in a three dimensional T-mixer: stability and sensitivity analyses SIMONE CAMARRI, DICI, University of Pisa, ANDREA FANI, University of Nice, MARIA VITTORIA SALVETTI, DICI, University of Pisa — Micro T-mixers are important devices in microfluidics; for instance, they are often used as junction elements in complex micro-systems. Most of the studies in the literature focused their attention on the steady engulfment regime, characterized by a loss of the flow symmetries in the outflow channel which in turn leads to a considerable increase of the mixing efficiency. It has been recently observed that if the Reynolds number is increased beyond the steady engulfment critical value, the flow may become unsteady with a periodic pulsating behavior and this regime corresponds to a significant further increase of mixing compared to the steady one. We consider a given T-mixer geometry and we combine direct numerical simulations with fully 3D linear stability and sensitivity analyses to characterize the unsteady engulfment regime in terms of critical Reynolds number, characteristic time frequencies and flow dynamics. The unsteadiness seems to be triggered by a critical value for the intensity and orientation of vortices at the confluence in the mixing channel; the instability core is indeed located in the center of these vortices. The sensitivity to a generic modification of the base-flow is investigated, to obtain indications on possible control strategies.

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