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Dynamical study of a simple microfluidic device for mixing purposes ARNAUD GOULLET, New Jersey Institute of Technology, NADINE AUBRY, Carnegie Mellon — Many microfluidic applications require the mixing of reagents, but efficient mixing in these laminar systems is often challenging. In this presentation, we consider further the method of pulsed flow mixing which takes advantage of time dependency rather than spatial complexity. Previous works show that good mixing can be achieved by considering three channels forming a T-shape geomety, with sinusoidal fluxes at the two inlets. Flow visualizations from experiments, and numerical simulations, have indicated that the majority of the mixing takes place in the confluence region. We carefully study the dynamic of tracer particles at the confluence region by using computational fluid dynamics and dynamical systems theory. We explore the parameter space in terms of the Reynolds number, Strouhal number and phase difference between the two inlet flows and show that regular and chaotic dynamics can occur at the confluence region. Poincaré sections and concentration plot will be presented to illustrate the mixing. The chaotic regime exhibits stretching and folding of material lines at all (large and small) scales, and is thus promising as an effective mixing tool.

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