DETAILS ON CHAOTIC ADVECTION IN PULSED FLOW

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Many microfluidic applications, like lab-on-chip, require the mixing of reagents, but efficient mixing in these laminar (i.e., low Reynolds number) systems is often difficult. In this presentation, we consider further the method of pulsed flow mixing which takes advantage of time dependency rather than spatial complexity.

In particular, using computational fluid dynamics (CFD) we analyze the dynamics of the flow in a channel comprising two inlets and one outlet, with a pulsing of 90 degrees out of phase between the two inlets. By performing extensive numerical simulations and following material lines, the details of the mixing mechanism at the confluence of the inlets are shown and analyzed using dynamical systems theory.

Depending on the values of the parameters of the problem, different dynamics are clearly identified and a bifurcation diagram is derived. Using the latter, we show that there exists a range of parameter values for which the chaotic advection and therefore the mixing is optimal.

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