

Chaotic Advection in a Mixer with Changing Geometry

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Chaotic advection is examined in a mixer consisting of a circular vat full of fluid, stirred by an arbitrary number of stirring rods. The fluid is assumed to be highly viscous, and the corresponding Stokes flow two-dimensional. A series solution for the velocity field permits an extremely precise computation of the paths of passive fluid particles under motion of the stirring rods. Of particular note is the case of three or more stirring rods, which allows the generation of 'topological chaos' provided the stirring rods move with appropriate topology. To date, the stirring rods have had circular cross-section; it is shown here how the series-solution approach can be modified to accommodate other cross-sectional profiles, and that stirring can be made more effective using elliptical paddles rather than circular ones.

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