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Fluid Mixing using Braids on a Lattice SIERRA DUNN, SPENCER SMITH, Mount Holyoke College — Fluid mixing has many important applications, from predicting the behavior of microfluidic devices on the small scale to mitigating the spread of pollutants in the ocean on a larger scale. We often want to maximize mixing, such as when designing an efficient mixer for industrial use. We consider a specific model of mixing in two dimensions, in which stirring rods move the fluid around. To measure mixing, we track the stretching of material lines in the fluid. The exponential stretching rate of these lines over time quantifies the strength of mixing. We start with stirring rods arranged in a lattice, pairs of which execute either clockwise or counterclockwise switches. Collections of these braid generators which can be executed on the lattice simultaneously constitute a braid operator, and a time ordered set of braid operators constitutes a lattice braid. We have a novel algorithm that uses a topological characterization of material lines to find their evolution under the action of lattice braids. We are interested in what patterns of lattice braids maximize the mixing. We also explore the mixing produced through randomly chosen braids.

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