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Optimal Blinking-Flow Microfluidic Mixers[1] DAVID MOTT, Naval Research Laboratory, KEVIN MCILHANY, United States Naval Academy, ELAINE ORAN, Naval Research Laboratory, STEPHEN WIGGINS, University of Bristol — The performance of blinking-flow microfluidic mixers is explored in order to identify optimal mixer designs. A two-dimensional lid-driven flow model is defined that approximates the cross-channel flow in three-dimensional grooved mixers. On either side of a specified separatrix location on the channel floor, the model imposes two different transverse velocities that generate a pair of counter-rotating vorticies of differing sizes. Blinking-flow mixers are then defined by alternating two such fields with the separatrix location for each field chosen independently. An exhaustive search of this design space demonstrates that the best blinking flow mixers are not symmetric, i.e., the second velocity field is not the mirror image of the first. The best mixers combine a field with the separatrix near the channel centerline with a field with separatrix near one of the side walls. Results are compared to comparable three-dimensional grooved channel mixers, and implications of these results for optimizing general mixer designs are discussed.

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