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Geometrical effects on helical flow in grooved microchannels¹ NICHOLAS S. LYNN JR., DAVID S. DANDY, Department of Chemical and Biological Engineering, Colorado State University — Due to the enhancement of surface effects on the microscale, patterned grooves on a microchannel floor remain a powerful method to induce helical flows within a pressure driven system. Although there have been many numerical studies on geometrical effects on the staggered herringbone mixer (SHM), all have mainly focused on the groove periodicity and depth, two factors that contribute greatly to the magnitude of helical flow. Here we present a new geometrical factor that more directly affects the generation of helical flow over patterned grooves. By varying the ratio of the length of the grooves to the neighboring ridges, helical flow can be optimized for a given groove depth and channel aspect ratio. Helical flow is characterized by the magnitude of transverse flow rate per unit axial length of channel, normalized by the bulk flow through the channel. A full numerical study details the magnitude of helical flow over uneven patterned grooves in a slanted groove micromixer (SGM), and the optimized parameters are shown to be equivalent to the SHM. These optimized systems are shown to have a 50% increase in helical flow over the previous geometries.

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Nicholas S. Lynn Jr. Department of Chemical and Biological Engineering, Colorado State University

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