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**Chaotic advection using passive and active rigid particles in a two-dimensional serpentine channel flow** TAE GON KANG, MARTIEN A. HULSEN, PATRICK D. ANDERSON, JAAP M.J. DEN TOONDER, HAN E.H. MEIJER, Eindhoven University of Technology — We studied flow and mixing due to the presence and active manipulation of rigid particles in a two-dimensional serpentine channel. The motion of a freely suspended particle in this flow is time periodic and the streamlines from the perturbed velocity are hyperbolic in nature. From Poincaré sections we observe two chaotic mixing zones separated by Kolmogorov-Arnold-Moser (KAM) boundaries along the path of the particle. In the case of the time-periodic flow of two-particles, two interacting hyperbolic points are present which give rise to three chaotic mixing zones. The efficiency of the mixing process can be greatly enhanced by adding a time-periodic external force working on the particle(s). The larger the force, the larger the strength of the perturbation of the flow. The size and presence of global chaotic mixing zones is positively influenced, as demonstrated by Poincaré sections, while the enhanced rate of mixing is computed via the deformation of a material strip undergoing stretching and folding around the particle. Actuation indeed makes the separating KAM boundaries disappear leading to almost global chaotic advection.

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