222a Extracting and Mixing by Using Integrated Actuators in a Microfluidic System

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Since the early days of microfluidics, it was recognized that miniaturization, by imposing flows to be laminar, considerably facilitates the handling of liquids in microsystems. Most of the micro-devices made in the last ten years took advantage of this capability. The objective of the present work is to make progress in the same direction by producing, under full control, and by using integrated actuators, different interface patterns and exploit them to achieve tasks of practical interest. The present work qualitatively confirms a recently published theoretical work which predicted that chaotic mixing can be achieved, in a cross-channel intersection, under certain conditions, but that also, if "resonance" conditions are satisfied, reversible stretching of the interface is obtained. We made use of actuators integrated in PDMS (PolyDimethylSiloxane) microsystems. The present study demonstrates experimentally the two effects, and exploits them to realize a micro-device that is based on a simple geometry, and is able to both mix or extract.