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Control and Manipulation of Fluid Flow Using Elastic Deformations BEHROUZ TAVAKOL, DOUGLAS HOLMES, Virginia Tech, GUILLAUME FROEHLICHER, HOWARD STONE, Princeton University — In this work, we utilize elastic deformations within a flexible microfluidic device via mechanical actuation to control and direct fluid flow. The device consists of a microchannel with a flexible arch prepared by buckling a thin elastic film. The deflection of the arch can be predicted and controlled using the classical theory of Euler buckling. We controlled the fluid flow rate by coupling the elastic deformation of the arch to the gap within the microchannel, and matched these experimental results analytically with a perturbation of lubrication theory and with computational simulations. These results illustrate an experimental design paradigm for the preparation of portable microchannels for chemical mixing, self-healing, and in situ diagnostics.

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