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Dynamic 3D velocity control with microfluidic device JEREMIAS GONZALEZ, BIN LIU, UC Merced — Many innovative techniques for microscopic manipulation have been developed due to the growing need for precise experimental probes into the world of microorganisms. Here we present a technique rooted deeply in the symmetry granted by the low Reynolds number regime, coupled with a well-chosen device geometry which exploits that symmetry. We show that the use of this pairing allows for the finely-controlled application of pressure to generate microscale 3D flows with symmetry-induced qualities that are purely directional and strain-free, or stationary and purely strainful. Further, we demonstrate that this set of flow modes can be dynamically used to control the velocity for any prescribed motion of microobjects through a fluid. Thus, our apparatus fills a unique need to control microobjects that are sensitive to the mechanical properties of the medium in which they are swimming, and to stimulate them only as experimentally desired.

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