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Capillary Machines for Manipulating Small Objects AHMED SHERIF, J. MILES FAABORG, CHENG ZENG, MING XIAO, Harvard University, MARTIN FALK, University of Chicago, ROZHIN HAJIAN, Harvard University, YOHAI BAR-SINAI, Google Research, MICHAEL BRENNER, VINOTHAN MANOHARAN, Harvard University — Machines that can operate on small objects in a programmable, scalable, and simple way are an attractive solution to many problems. To make such machines, we take advantage of the repulsive capillary interactions between millimeter-scale polymer "floats" pinned at an interface and the wetting walls of a decimeter-scale 3D-printed device. In this talk, we discuss the experimental techniques necessary to use these repulsive interactions in conjunction with the vertical motion of the device to guide objects along complex 3D paths. These techniques include defining serializable operations to programmably manipulate floats and using device geometry and contact angle hysteresis to simplify complicated motions. We then apply these techniques to the problems of twisting and braiding micrometer-scale wires, which are difficult to manipulate with typical braiding machines.

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