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Puch Card Programmable Microfluidics GEORGE KORIR, MANU PRAKASH, Stanford University — Microfluidic technology has emerged as a powerful means of manipulating fluids at the micro-scale with many promising applications, but universal programmability is still dependent on external control systems. With a focus on global-health and field applications, external control and pumps significantly hamper the use of microfluidic devices in harsh conditions. Punch Cards (simple tapes of paper) have been used to program early computers before the advent of electronic memory. With this analogy, we present a novel universal programming scheme for microfluidics using paper Punch Card tapes. We further characterize our devices as a function of readout speed, bit-error rate for a given operating conditions (Capillary and Reynolds number). A lumped element model was built to characterize the flow and serve as a predictive template for future designs. Operated by hand, the system requires no external sources of electricity or pumps. We demonstrate that Punch Cards provide an innumerable number of ways to program fluids including running complex protocols in the field with minimal training.

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