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Validated Analytical Model of a Pressure Compensation Drip Irrigation Emitter PULKIT SHAMSHERY, Graduate Researcher at MIT, RUOQIAN WANG, Postdoctoral Researcher at MIT, KATHERINE TAYLOR, Graduate Researcher at MIT, DAVIS TRAN, Undergraduate at MIT, AMOS WINTER, Assistant Professor at MIT — This work is focused on analytically characterizing the behavior of pressure-compensating drip emitters in order to design low-cost, low-power irrigation solutions appropriate for off-grid communities in developing countries. There are 2.5 billion small acreage farmers worldwide who rely solely on their land for sustenance. Drip, compared to flood, irrigation leads to up to 70% reduction in water consumption while increasing yields by 90% – important in countries like India which are quickly running out of water. To design a low-power drip system, there is a need to decrease the pumping pressure requirement at the emitters, as pumping power is the product of pressure and flow rate. To efficiently design such an emitter, the relationship between the fluid-structure interactions that occur in an emitter need to be understood. In this study, a 2D analytical model that captures the behavior of a common drip emitter was developed and validated through experiments. The effects of independently changing the channel depth, channel width, channel length and land height on the performance were studied. The model and the key parametric insights presented have the potential to be optimized in order to guide the design of low-pressure, clog-resistant, pressure-compensating emitters.

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