Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

A Hybrid Computational and Analytical Model of Irrigation Drip emitters[1] JAYA NARAIN, AMOS WINTER, V, Massachusetts Inst of Tech-MIT — This paper details a hybrid computational and analytical model to predict the performance of inline pressure-compensating drip irrigation emitters, devices used to accurately meter water to crops. Flow rate is controlled in the emitter by directing the water through a tortuous path, and then through a variable resistor composed of a flexible membrane that deflects under changes in pressure, restricting the flow path. An experimentally validated computational fluid dynamics model was used to derive a resistance factor that characterizes flow behavior through a tortuous path. Expressions describing the bending mechanics of the membrane were combined with analytical fluid flow models to iteratively predict flow behavior through the variable resistor. The hybrid model reduces the computational time as compared to purely computational methods, lowering the time required to iterate and select optimal designs. The model was validated using three commercially available drip emitters, rated at 1.1, 2, and 3.8 L/hr. For each, the model accurately predicted flow rate versus pressure behavior within a 95% confidence interval of experimental data and accurately replicated the performance stated by the manufacturer.

[1]Jain Irrigation, NSF GRFP

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Date submitted: 01 Aug 2017 Electronic form version 1.4