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WITHDRAWN: Valveless Pumping: Theory and Experimental Validation THOMAS BRINGLEY, STEPHEN CHILDRESS, NICHOLAS VANDENBERGHE, JUN ZHANG, Courant Institute, NYU — An elastic tube connected in a ring to a rigid tube, filled with water, and squeezed periodically off-center produces a net flow around the tubes. This phenomenon, known as valveless pumping, is thought to have applications to the biology of blood circulation as well as to the design of practical pumps, particularly at the micro-scale. At the 2004 DFD meeting, we described an experimental study and a simple model of such a system. The experimental system successfully pumped fluid, and we also observed flow reversals and resonances. Since, we have made improvements to our (still simple) model, and its results now better match those of the experiment. We have also made significant advances in our mathematical understanding of the model, including deriving an asymptotic expression for the average flux in the pump that reveals the effects of changing any of the physical parameters. We find several surprising results about the roles of wave propagation, nonlinear advection, and the stiffness of the elastic tube in valveless pumping. Also, we are able to explain the flow reversals observed in the experiment. Our conclusions from the model are confirmed by experimental results.

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