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**Dynamics of Viscous Back-Flow from a Network of Elastic Microfluidic Channels** ASAF DANA, Technion-Israel Institute of Technology, ZHONG ZHENG, GUNNAR G. PENG, University of Cambridge, HOWARD A. STONE, Princeton University, HERBERT E. HUPPERT, University of Cambridge, GUY Z. RAMON, Technion-Israel Institute of Technology — We present a model for investigating the dynamics of back-flows caused by the elastic relaxation of a pre-strained medium. Namely, a model network with n bifurcated channel generations modeled as fluid confined between two rigid plates. The model uses a combination of lubrication theory for the flow and the equations of linear elasticity for the boundaries. The model assumes elastic deformation occurs only in channel aperture while the channels length remains constant throughout the process. The asymptotic results show good agreement with numerical calculations in early and late times, when the aperture and back-flow rate tend to $t^( - 1/3)$ and $t^( - 4/3)$, respectively. This work presents a case where the pressure gradient along the network is steepest near the outlet while the bulk of the network serves as a 'reservoir. In addition, an asymptotic solution is derived for late times and large n. For a fixed total length, networks with larger n are less efficient at evicting fluids, manifested through a longer time required for evicting a given fractional reduction of the initial volume. The model can be used to investigate the back-flow dynamics of fractured rocks e.g., in hydraulic fracturing operations.

Asaf Dana
Technion-Israel Institute of Technology

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