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Leveraging viscous peeling in soft actuators and reconfigurable microchannel networks LIOR SALEM, Technion Autonomous Systems Program, Technion, BENNY GAMUS, Faculty of Mechanical Engineering, Technion - Israel Institute of Technology, YIZHAR OR, AMIR GAT, Faculty of Mechanical Engineering, Technion — The research fields of microfluidics and soft robotics both involve complex small-scale internal channel networks, embedded within a solid structure. This work examines leveraging viscous peeling as a mechanism to create soft actuators and microchannel networks, including complex elements such as valves, without the need for fabrication of structures with micron-scale internal cavities. We consider configurations composed of an internal slender structure embedded within another elastic solid. Pressurized viscous fluid is introduced into the interface between the two solids, thus peeling the two elastic structures and creating internal cavities. Since the gap between the solids is determined by the externally applied pressure, the characteristic size of the fluidic network may vary in time and be much smaller than the resolution of the fabrication method. This work presents a model for the highly nonlinear elastic-viscous dynamics governing the flow and deformation of such configurations. Experimental demonstrations of micron-scale valves and channel-networks created from millimeter scale structures are presented, as well as the transient dynamics of viscous peeling based soft actuators. The experimental data is compared with the suggested model, showing very good agreement.

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