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Non-linear dynamics of annular creeping flow enclosed by an elastic membrane SHAI ELBAZ, AMIR GAT, Technion Israel Institute of Technology — This study deals with the fluid-structure-interaction problem of longitudinal annular flow about a varying cross-section centre-body enclosed by an elastic membrane. The gap between the centre-body and membrane wall may be initially filled with a thin fluid layer or devoid of it. We employ elastic shell theory and the lubrication approximation and obtain a forced nonlinear diffusion equation governing the problem. In the case of an advancing liquid front in an initially unpenetrated interface (viscous peeling) the governing equation degenerates into a forced porous medium equation, for which several closed-form solutions can be obtained. Based on self-similarity we define propagation laws for the fluid-elastic interaction which in turn provide the basis for numerical investigation of compound solutions such as pulse trains and other waveforms. The presented interaction between viscosity and elasticity may be applied to fields such as soft-robotics and micro-scale or larger swimmers by allowing for the time-dependent control of a compliant boundary.

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