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Shape Morphing of an Elastic Cylinder via Time-Varying Internal Viscous Flows[1] SHAI ELBAZ, AMIR GAT, Technion - Israel Institute of Technology — Viscous flows in contact with an elastic body apply both pressure and shear stress on the solid-liquid interface and thus create internal stress- and deformation-fields within the solid structure. We study the interaction between elastic slender axi-symmetric structures and internal time-varying viscous flows as a tool to create controlled shape-morphing of such elastic cylindrical structures. We neglect inertia in the liquid and solid and focus on two cases. Case 1 is viscous flow through a hollow elastic cylinder and case 2 is axial flow in the shallow gap created by two concentric cylinders, where the internal cylinder is rigid and the external elastic. For case 1, we obtain a linear diffusion equation and for case 2 we obtain a non-linear diffusion equation governing the deformation. Solutions for both cases allowing control of the time varying deformation field by way of controlling the liquid pressure at the inlet and outlet are presented. This research is of interest to applications such as micro-swimmers and soft-robotics.

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