1157-76-130 **Vishal Anand** and **Ivan C. Christov*** (christov@purdue.edu), School of Mechanical Engineering, 585 Purdue Mall, WEST LAFAYETTE, IN 47907-2088, and **Tanmay C. Shidhore** and **Xiaojia Wang**. *Mathematical modeling of viscous flows in deformable conduits.*

The pressure-driven flow profile through a channel of arbitrary cross-section can be calculated from exact unidirectional solutions of the steady Stokes equations, via classical methods of mathematical physics. Recently, however, experiments on internal flows in rectangular channels with a soft boundary have shown that coupling between the wall deformation and the pressure gradient driving the flow lead to a flow profile that is not described by the classical solutions. To address this knowledge gap, we take a perturbative approach to solving the coupled problem of viscous flow and elastic deformation. Specifically, for a long and slender geometry, the flow problem is reduced to unidirectional Stokes flow in a slowly-varying geometry. In parallel, the deformation problem is reduced to a two-dimensional linear elasticity boundary value problem in each flow-wise cross-section. Importantly, this mathematical approach yields closed-form solutions for the flow and deformation profiles, which, under the assumption of steady flow, predict the hydraulic resistance (i.e., pressure drop required to maintain a given volumetric flow rate). Our mathematical model compares favorably to microfludic experiments.

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