Fluid-structure interactions in a soft-walled Hele-Shaw cell

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University of Oxford — The interaction of viscous and interfacial flows with soft
materials has recently attracted substantial interest from a variety of different per-
spectives. Here, we study these interactions in the context of a model problem: Flow
in a deformable Hele-Shaw cell, where one wall is rigid and the other is soft. Com-
bining experiments with mathematical modelling, we consider the coupling of flow
and deformation during (a) the initial injection of viscous fluid into the empty cell
(the filling problem), (b) the subsequent steady state during continued injection of
the same fluid (the steady state), and (c) the relaxation of the cell after injection is
stopped (the relaxation problem). We then discuss the implications of these results
for hydrodynamic instabilities such as viscous fingering.

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