Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

To leak or not to leak: elastic deformation induced by fluid loading in porous slender structures ELIZABETH STRONG, HUSSAIN KARIMI , PEDRO M. REIS, Massachusetts Institute of Technology — Fluid flow past thin, reticulated structures is common both in nature (e.g. spider webs, insect wings) and technology (e.g. fabric, wire fences). Whereas flow through porous media has been studied extensively, the problem of fluid loading of a porous, deformable structure with free boundaries has been much less explored. We use precision desktop experiments to investigate the specific, yet representative, fluid-structure interaction problem involving the deformation of a porous elastic plate towed in a fluid bath, across a range of low to moderate Reynolds numbers: $0.1 \leq \mathrm{Re} \leq 10$. In conjunction, we rationalize our observations and provide predictive guidelines for determining the drag force applied to porous plates using a reduced theoretical model. Specifically, we are interested in quantifying and understanding the effects that the porosity and the elasticity of the porous plate coupled with the fluid loading to dictate the equilibrium shapes of the deformed structure.

elizabeth strong
Massachusetts Institute of Technology

Date submitted: 11 Nov 2016 Electronic form version 1.4