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Capillary rise of a liquid into a deformable porous material[1]
JAVED SIDDIQUE, DANIEL ANDERSON, George Mason University — We examine the effects of gravity in a model of one-dimensional imbibition of an incompressible liquid into an initially dry and deformable porous material. We obtain analytic results for steady state positions of the wet porous material–dry porous material interface as well as the liquid–wet material interface. The time-dependent free-boundary problem is solved numerically and the results compared to the steady state predictions. In the absence of gravity, the liquid rises to an infinite height and the porous material deforms to an infinite depth, following square-root in time scaling. In contrast, in the presence of gravity, the liquid rises to a finite height and porous material deforms to a finite depth. Dependence on model parameters such as the solid liquid density ratio is also explored.

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