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Consolidation by lubrication at sedimentary jamming fronts DOUGLAS DURIAN, CARLOS ORTIZ, TED BRZINSKI, University of Pennsylvania — We formulate a nonlinear partial differential equation to describe changes in packing fraction for sedimenting particles at low Reynolds number. It is based on two key fluid-mediated forces. One is the viscous interaction of a particle with the surrounding suspension, which causes the settling speed to decrease with increasing packing fraction according to a hindered settling function; we constrain its form by a comprehensive data compilation. The other ingredient is a lubrication force that resists change in separation between neighboring particles; it diverges at contact and hence captures the accumulation of a close-packed sediment. These forces, plus gravity and mass conservation, lead to a new "sedimentation equation" that we propose for the evolution of packing fraction versus position and time. Asymptotic and numerical solutions are presented, and compared with experiment, for the shape of the stationary jamming front between sediment and suspension that moves upwards at constant shape and speed.

Douglas Durian
University of Pennsylvania

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