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A coupled deformation-diffusion theory for fluid-saturated porous solids DAVID HENANN, KEN KAMRIN, LALLIT ANAND, Department of Mechanical Engineering, MIT — Fluid-saturated porous materials are important in several familiar applications, such as the response of soils in geomechanics, food processing, pharmaceuticals, and the biomechanics of living bone tissue. An appropriate constitutive theory describing the coupling of the mechanical behavior of the porous solid with the transport of the fluid is a crucial ingredient towards understanding the material behavior in these varied applications. In this work, we formulate and numerically implement in a finite-element framework a large-deformation theory for coupled deformation-diffusion in isotropic, fluid-saturated porous solids. The theory synthesizes the classical Biot theory of linear poroelasticity and the more-recent Coussy theory of poroplasticity in a large deformation framework. In this talk, we highlight several salient features of our theory and discuss representative examples of the application of our numerical simulation capability to problems of consolidation as well as deformation localization in granular materials.

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