FULLY COUPLED SIMULATIONS OF DYNAMICS OF POROUS MEDIA USING A FINITE ELEMENT FRAMEWORK

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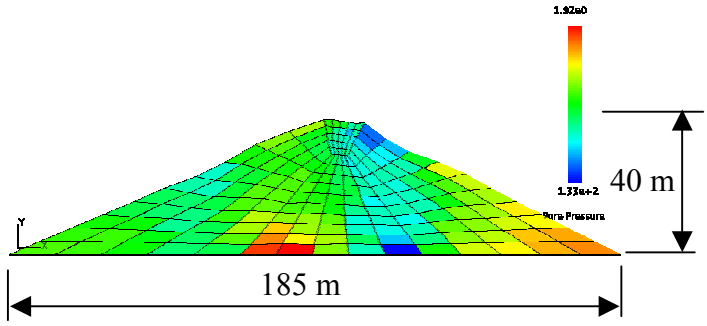
Simulating the behavior of porous media is important for many fields of engineering and science such as civil engineering, petroleum engineering, mechanical engineering, biomedical engineering, material science, and geophysics. A porous medium typically consists of a solid skeleton and a number of fluids occupying the pore space. When subjected to loads, the behavior of porous media is highly nonlinear and time dependent, and therefore is ideally suited for simulations using computational techniques. This paper will present simulations of the dynamic behavior of a porous medium obtained using a finite element framework. The example presented is the three-dimensional behavior of a saturated soil dam subjected to earthquake loads. The fully coupled differential equations governing the behavior of the soil skeleton and pore water [1] are solved using a finite element framework [2]. The nonlinear stress-strain behavior of the soil skeleton is modeled using elastoplastic constitutive models. Following a brief description of the theory, the framework will be described, the simulation results will be presented, and finally the scalability of the code will be discussed using results from single and multiple processor simulations.



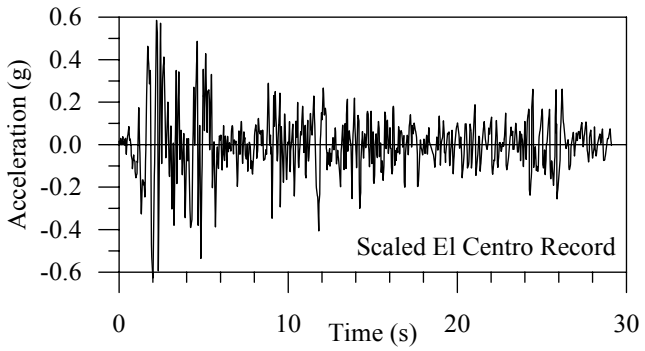


Fig. 1. Pore water pressure (in kPa) contours within a clay dam at t = 30.0 seconds following an earthquake.

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References

[1] K.K Muraleetharan, K.D. Mish, and K. Arulanandan, "A Fully Coupled Non-Linear Dynamic Analysis Procedure and Its Verification Using Centrifuge Test Results," *International Journal for Numerical and Analytical Methods in Geomechanics*, v. 18, p. 305-324, 1994.
[2] TeraScale Framework, www.terascale.net.