Verification and Validation of Numerical Methods in Geotechnical Earthquake Engineering

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Abstract

Recent advances in constitutive modeling of materials and the emergence of highly efficient numerical solution techniques fueled by the power of modern computing capabilities has provided an unprecedented opportunity for detailed and sophisticated analysis of complex civil infrastructure system. Many of these systems involve geomaterials that exhibit highly complex stress-strain-strength behavior in monotonic and cyclic loading conditions. A growing number of commercial software packages are now available to practicing engineers for fully-coupled nonlinear analysis of geostructures and soil-structure interaction problems under seismic loading. To be useful in engineering practice, however, these solution tools must be validated against carefully conducted and reliable experimental observations. This lecture will provide an overview of a major international research program, known as Liquefaction Experiments and Analysis Project (LEAP), that has been assessing the validity of a large number of advanced constitutive and numerical modeling techniques for simulation of earthquake-induced soil liquefaction and its consequences. A summary of the results of two recent projects, in which a large number of experimenters and numerical modelers from around the world participated, is presented, and the main lessons learned are highlighted.

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