

THE ROLE OF UNSATURATED SOILS: FROM SEISMIC SFSI TO LIQUEFACTION ASSESSMENT AND MITIGATION

Speaker

Prof. Majid Ghayoomi

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Abstract

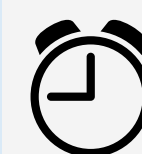
Soil-Foundation-Structure Interaction (SFSI) evaluates the collective seismic response of a system containing the superstructure, foundation, and surrounding soil given the earthquake motion at the ground surface. The dynamic characteristics of soils not only affect the seismic ground response, but also greatly influence SFSI. The behavior of unsaturated soil is complex and differs from dry and saturated soil deposits, because inter-particle suction stresses increase the effective stress and change dynamic characteristics of soils. Although the water table level prior to a seismic event may not be known, understanding the potential impact of moisture variability and the extent of this uncertainty would be extremely critical in improving SFSI analysis procedures and predicting and mitigating detrimental earthquake effects. Also, soil moisture can be used as an effective liquefaction monitoring parameter both in terms of pre-event moisture and the seismically induced moisture changes. This has led to a growing interest in liquefaction mitigation through partial saturation. This presentation reviews applications of unsaturated soil and ground water level on seismic site response, soil-structure interaction, foundation settlement, the response of rocking foundations for bridge systems, and liquefaction mitigation. Further, the role of soil moisture on liquefaction assessment using spaceborne data will be discussed.

Biography

Dr. Majid Ghayoomi is a Professor in the Department of Civil and Environmental Engineering at University of New Hampshire. In the last 20 years, he has worked on several projects involving the application of unsaturated soil mechanics and hydro-geo-mechanics of soils in different geotechnical applications including soil-structure interaction, seismic response of geotechnical systems, flooded roads, and coastal infrastructure. His recent projects deal with climate and seismic resilience and adaptation of coastal and Arctic infrastructure and social systems. Dr. Ghayoomi currently serves as the chair of the ASCE Unsaturated Soils committee and also the chair of the upcoming 9th ISSMGE International Conference on Unsaturated Soils to be held in Boston, MA, in June 2027. He received 2014 ISSMGE TC106 Award for the best paper in application of unsaturated soils, 2018 ISSMGE Unsaturated Soils Spark Bright Lecture Award, 2021 ACS PRF New Direction Award, and 2022 UNH CEPS Excellence in Research Award. In addition, he recently received 2026 UNH Faculty Scholar Award and 2026 US Fulbright Scholar Award. Dr. Ghayoomi is a licensed professional engineer in the state of New Hampshire.



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