The Geo-Institute Earthquake Engineering and Soil Dynamics Technical Committee will live-stream the *session* "AI applications and uses on Geotechnical Earthquake Engineering" on Friday, December 11, at 2 PM EST. The talks include:

Talk #1: Accounting of Uncertainty in Seismic Site Response (presented by Andres Rodriguez-Marek, Ph.D., P.E., Virginia Tech)

Estimates of site response are an important component in the estimation of earthquake induced ground motions. These estimates can be made via proxy methods, such as the use of VS30 in ground motion prediction equations, or via analytical approaches, such as one-dimensional (1D) site response. The latter require the knowledge of a shear-wave velocity profile and the dynamic properties of the soils that make up the profile. These data carry measurement uncertainty, which is propagated to the uncertainty in site effects estimates. In addition, the methods used for analytical estimates of site response have their own modeling uncertainty. This presentation discusses approaches to estimate the uncertainty in site response estimates, as well as efforts made to quantify the modeling uncertainty for 1D site response analyses. The focus is on approaches used in seismic hazard analyses for nuclear sites, but the lessons learned have application in every-day engineering practice.

Talk #2: Machine Learning-Based Assessment of the Seismic Performance of Geotechnical Systems

(Presented by Jorge Maceso, Ph.D., P.E., GEOCAL)

In assessing the seismic performance of geotechnical systems, engineers often use analytical models to estimate the amount of seismically-induced displacements. These models consider system properties, earthquake parameters, and ground motion intensity measures (IMs) as inputs and have been typically formulated using "traditional" statistical techniques. This study discusses a new set of machine learning (ML) based models to estimate seismically-induced slope displacements in subduction and shallow crustal earthquake zones and liquefaction-induced building settlements in shallow crustal earthquake zones. Machine learning is used to select efficient features that explain seismically-induced displacements and settlements. The feature selection suggests no significant gain in accuracy beyond a small subset of features. Based on the selected features, a set models is developed considering several ML-based techniques with varying flexibility, interpretability, and bias-variance trade-offs. The developed models are assessed by evaluating test errors, their scaling compared to existing models, and their performance in case histories. The developed ML-based models contribute to performance-based assessments and also

enhance the treatment of epistemic uncertainties in estimating seismically-induced displacements. Lastly, as discussed in the paper, caution should be exercised when assessing ML models as they could be perceived as a "black box" without proper context and extrapolate inappropriately.

Talk #3: TBD