The Geo-Institute Earthquake Engineering and Soil Dynamics Technical Committee will livestream the session **"Site-specific Ground Motion Hazard Analysis" on Thursday, December 5, at 11 AM EST**. The topics include:

"The ASCE 7-22 Chapter 21 Site-specific MCER and MCEG Ground Motion Hazard Analysis Procedures" **Nico Luco**

The most recent 2022 edition of the ASCE 7 Standard (Minimum Design Loads and Associated Criteria for Buildings and Other Structures), ASCE/SEI 7-22, includes changes to the site-specific ground motion procedures of its Chapter 21. For example, the deterministic ground motions that cap the otherwise probabilistic values are now calculated via "scenario earthquakes" from hazard disaggregation. In a particular manner, the USGS applied these procedures with the 2018 USGS National Seismic Hazard Model to develop the ASCE/SEI 7-22 Chapter 22 ground motion maps and online databases of Risk-targeted Maximum Considered Earthquake (MCER) spectral response accelerations and Maximum Considered Earthquake Geometric Mean (MCEG) peak ground accelerations.

"USGS software tools for these site-specific ground motion hazard analyses" **Peter Powers**

The 2022 edition of the ASCE 7 Standard (Minimum Design Loads and Associated Criteria for Buildings and Other Structures) includes changes to the site-specific ground motion procedures of Chapter 21. For example, the deterministic ground motions that cap the otherwise probabilistic (risk-targeted) values are now calculated via "scenario earthquakes" from hazard disaggregation. Here we review and provide examples of how to perform such analyses using the latest USGS online web applications and other tools available in the USGS Earthquake Hazard Toolbox: https://earthquake.usgs.gov/nshmp/. The new site-specific procedures are expected to be part of the 2025 California Building Code. Many of the USGS software tools are also useful for the AASHTO bridge design specifications.

A data-driven ground motion synthesis framework, with physics-informed input motions and nonlinear site response **(by Y Shi, F Xia, G Lavrentiadis, D Asimaki*)**

The proliferation of recorded and simulated ground motion repositories are inspiring a new generation of data-driven models for ground-motion synthesis that can account for complex site effects. Data-driven models directly learn the governing laws of physics from sufficiently rich training data, while avoiding the use of simplified assumptions that limit the realism of models developed with traditional statistical tools. In this study, we demonstrate this new paradigm of learning and quantifying the sources of ground motion epistemic uncertainty by coupling: (i) a Generative Adversarial Neural Operator (GANO), which synthesizes broadband three-component acceleration time histories at reference outcrop conditions, with (ii) a Fourier Neural Operator (FNO), which modifies the outcrop ground motions to account for the full nonlinear response of the near-surface soil layers. GANO was trained on a synthetic ground motion dataset for strike-slip and reverse events developed using the Southern California Earthquake Center (SCEC) Broadband Platform (BBP), while FNO was trained on non-linear one-dimensional wave propagation through smooth Bay Area velocity profiles using the site-response software, PySeismoSoil. A key advantage of the neural operator architectures in GANO and FNO compared to traditional neural networks, is their resolution invariance: training can include input signals of different sampling frequencies without loss of information or generation of artifacts, while prediction can be performed on sampling frequencies independent of training. Verification analyses through residual and goodness of fit evaluations demonstrate that GANO can learn the magnitude and distance scaling, while FNO can correctly estimate the non-linear amplification for ground motions and profiles not included in the training dataset for 0.1 to 30hz frequency range. By appropriately conditioning data-driven algorithms, or combinations thereof like in this case, our work demonstrates the potential of using these methods to learn increasingly complex physics and their uncertainty over the entire frequency range of engineering interest, and to generate on demand time-histories appropriate for engineering design with high degree of realism.