Department of Civil and Environmental Engineering
Seminar Announcement

"Soil Structure Interaction Studies Related to Energy Geomechanics, Infrastructure, and Resilience"

Presented by
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Abstract:

Soil structure interaction is an integral part of geotechnical engineering and is important for building resilience in civil infrastructure. This seminar focuses on two different soil structure interaction studies – development of an analytical framework with applications in offshore wind turbine monopiles, pile foundations, moving load problems, and other similar geo-structures; and a high-rate finite element analysis framework with applications in blast analysis of geo-structures. Further, development of a resilience assessment framework for civil infrastructure subject to geo-hazards is briefly described.

A generalized soil structure interaction framework is developed based on energy and variational principles of mechanics that takes into account different beam and plate theories for modeling the structure, different linear and nonlinear constitutive models for simulating the soil behavior, and a variety of static and dynamic applied loads. The analysis framework is as accurate as equivalent finite element analysis but is computationally more efficient. The framework can be easily adopted in practice for analysis and design of a variety of geo-structures.

The high-rate finite element framework involves development of a critical-state based visco-plastic constitutive model for simulating the high strain-rate behavior of sands and incorporating it in a finite element analysis framework for analysis of blast in tunnels and other geo-structures. This framework was developed as part of an effort to increase resilience in geo-infrastructure against man-made hazards like terror attacks.

A quantitative framework for the assessment of resilience and sustainability of geo-infrastructure is at its initial stage of development, and is conceptually based on the Driver–Pressure–State–Impact–Response (DPSIR) framework. This framework is briefly described through an example problem based on a selected road network in the province of Ontario, Canada.

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2310 Newmark
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