



The Risk Assessment and Management Committee will live-stream the session “**Managing Risk, Uncertainty, and Decision Making in Geotechnical Practice**” on Thursday, December 5, 2024 from 2pm - 4pm EST. The topics include:

“The Interpretability Dilemma: White Box vs Black Box Models for Geotechnical Decision-Making”

Sara Khoshnevisan

This presentation explores the trade-offs between transparent (white box) and non-interpretable (black box) machine learning models in geotechnical engineering. The challenge lies in balancing model interpretability with performance. White box models, such as decision trees, offer transparency, enabling engineers to understand and trust the predictions. However, they often lack the high accuracy of black box models like neural networks, which can better capture complex patterns but are difficult to interpret. Geotechnical engineers require models that not only perform well but also provide insight into how predictions are made. This presentation discusses potential solutions, such as using hybrid models that incorporate both approaches, explainable AI techniques to make black box models more interpretable, and frameworks for selecting the appropriate model depending on the project's needs for accuracy, interpretability, and safety.

“Bio-Inspired Drilling into Lunar Regolith for Space Exploration” **Lei Wang**

In recent years, many nations have launched lunar exploration missions. Characterization of the lunar regolith is critical for the extraction and utilization of in-situ resources to build a permanent base on the Moon. However, due to many challenges for drilling operations on the Moon, higher demands have been placed on the drilling tool design. This presentation introduces a discrete element modeling and multi-objective optimization design framework for the bio-inspired drill design into the lunar regolith based on the geotechnical characterization of the lunar highlands simulants. The proposed discrete element modeling and optimization framework provide an efficient solution for the design of a bio-inspired drill into the lunar regolith, which can serve as a guide for the design of bio-inspired tools and technologies for other extraterrestrial bodies.

"From Expert-driven to Data-Driven Risk Modeling" **Zenon Medina-Cetina**

This presentation introduces a comparative analysis between an expert-driven model and a data-driven model when predicting the state of risk of a given system. This includes the definition of a risk framework to guide a decision-making process when a threat is posed to a system, and when the threat causes some damage or impact in the system. It also covers a case where a model includes multiple threats, multiple systems, and multiple impacts, and a specific scenario when there is missing data to inform a model.

"Reliability-Based Design with Geotechnical Numerical Models" **Shadi Najjar**

Geotechnical engineering design is affected by varying sources of uncertainties that dictate the level of risk associated with the design. The main goal of reliability-based design (RBD) is to facilitate and improve decision-making in the presence of uncertainty. Despite the fact that several design codes have adopted RBD principles in geotechnical practice, it remains challenging for geotechnical engineers in general, and numerical engineers in particular, to embrace RBD in daily design practice. This presentation aims at breaking the barrier between the practicing numerical engineer and reliability-based design to encourage practitioners to use RBD tools to quantify risk and inform decision-making.