The Donald M. Burmister Lecture
Department of Civil Engineering and Engineering Mechanics
Columbia University

Geotechnical Engineering in the Age of Machine Learning and AI

Professor Youssef Hashash
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March 8, 2023 (13:15-14:15 EDT)

March 8, 2023					March 9, 2023			
Los Angeles 10:15 -	New York 13:15 -	London 18:15 -	Frankfurt/ Paris/Rome 19:15-	New Delhi 23:45 -	Nur-Sultan 0:15 -	Beijing/ Singapore 2:15 -	Tokyo 3:15 -	Sydney 5:15 -

Room 414, Schapiro CEPSR (Columbia University)

Zoom registration: http://www.columbia.edu/cu/civileng/ling/burmister

ABSTRACT Autonomous machines, AI chat bots and preference algorithms, coupled with ubiquitous computing and persistent connectivity, the stuff of science fiction a few decades ago, are all around us. We are interacting with them on a daily basis, while they accumulate more information, learn and become more capable. As (geotechnical) engineers we face interesting questions in this new reality. Are these developments relevant to our field? Can we use them in our engineering practice? Will AI and Machine learning replace geotechnical engineers? Will the uncertainty inherent in geologic materials insulate us from the intrusion of these tools, rendering them a passing fad? In this presentation I will explore the application of modern tools of machine learning and AI to Geotechnical Engineering. By taking a historical perspective I highlight the data intensive and data rich nature of our discipline. I explore the application of artificial neural networks, and self learning algorithms to selected applications in tunneling, seismic site response, excavations and material testing. I will then explore the use of Generative AI for geotechnical design and report writing.

About the Speaker Professor Youssef Hashash holds a B.S. (1987), an M.S. (1988) and a Ph.D. (1992) in civil engineering from the Massachusetts Institute of Technology. He began his career with the PB/MK TEAM in Dallas on the Superconducting Super Collider Project. In 1994 he joined Parsons Brinckerhoff in San Francisco and worked on a number of underground construction projects in the U.S. and Canada including the Boston Central Artery/Tunnel project.

Professor Hashash joined the faculty of the Department of Civil and Environmental Engineering at the University of Illinois at Urbana-Champaign in 1998. He teaches courses in Geotechnical Engineering, Numerical Modeling in Geomechanics, Geotechnical Earthquake Engineering, Tunneling in Soil and Rock, and Excavation and Support Systems. His research focus includes deep excavations and tunneling in urban areas, earthquake engineering, continuum and discrete element modeling and soil-structure interaction as well as resiliency and sustainability of the built infrastructure. He also works on geotechnical engineering applications of deep learning, artificial intelligence, visualization, augmented reality, imaging and drone technologies. He has published numerous journal articles and is co-inventor on four patents. His research group developed the software program DEEPSOIL that is used worldwide for evaluation of soil response to earthquake shaking. His work on seismic design of underground structures is extensively used in engineering practice. He is the geotechnical co-leader of the NIST (National Institute of Standards and Technology) led investigation into the Champlain Towers South Collapse in Surfside, Florida.

Professor Hashash is a Fellow of the American Society of Civil Engineers (ASCE), a past president of the Geo-institute of ASCE and has received a number of teaching, university and professional awards including the Presidential Early Career Award for Scientists and Engineers and the ASCE 2014 Peck medal. He was elected to the National Academy of Engineering in 2022.

The late Prof. Donald M. Burmister (1895-1981) is one of the pioneers in the field of Soil Mechanics and Geotechnical Engineering. He established the Soils Laboratory at Columbia University in 1933. He was a faculty member for 34 years before retiring in 1963. During his tenure at Columbia University, he investigated earthworks and foundations for over 400 projects. Most notably among these were the Brookhaven National Laboratory, the Throgs Neck, Tappan Zee and Verrazano Narrows Bridges, the First New York World Fairs at Flushing Meadows, and the reconstruction of the White House in 1950. He has developed several soil testing methods and his soil classification system is still widely used. He also contributed to the first use of digital computer in conjunction with his theory of the layered pavement system.