

International Congress on **AI AND MACHINE LEARNING**

August 02, 2021 | Webinar

Investigating the micromechanics of granular materials using machine learning methods**Jianfeng Wang, Wu Mengmeng***City University of Hong Kong, Kowloon, Hong Kong*

There is a dearth of machine-learning investigations of the micro-mechanics of granular soils. The micro-mechanics deals with the mechanics of granular materials at the micro-scale (often particle scale) or meso-scale and is contrasted with the macro-mechanics which focuses on the macro-scale behavior measured at the laboratory sample scale or field scale. In this talk, a pioneering investigation of the contact force chains (CFC) in quasi-statically sheared granular materials using machine learning methods is conducted. An artificial neural network (ANN) based on discrete element method (DEM) simulation data is developed and applied to predict the anisotropy of CFC in an assembly of spherical grains undergoing a biaxial test. Five particle-scale features including particle size, coordination number, x- and y-velocity (i.e., x and y-components of the particle velocity), and spin which all contain predictive information of the CFC are used to establish the ANN. The results of model prediction show that the combined features of particle size and coordination number have a dominating influence on the CFC estimation. An excellent model performance manifested in a close match between the rose diagrams of CFC from the ANN predictions and DEM simulations is obtained. In addition, some preliminary results of the prediction of the constitutive response of granular materials using the machine learning method are also presented.

Biography

Dr. Jianfeng Wang received his BSc and MSc degrees from Tongji University, China and his PhD degree from Virginia Tech, USA. Dr. Wang is internationally well known for his works in the field of micromechanical characterization and modeling of granular soils. Dr. Wang's work has been awarded the prestigious international prizes of 2011 Geotechnical Research Medal (UK Institution of Civil Engineers) and 2010 Higher Education Institutions Outstanding Research Award - Natural Science Award (the Ministry of Education of China). His research has attracted over 7 million HKD of external grants including the Research Grant Council (RGC) of Hong Kong SAR and National Science Foundation of China (NSFC). Dr. Wang currently serves as a Scientific Editor of Journal of Rock Mechanics and Geotechnical Engineering (The Chinese Academy of Science), and an Editorial Board Member of Soils and Foundations (The Japanese Geotechnical Society). So far Dr. Wang has published 80 SCI journal papers with a Google Scholar H-index of 26.

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