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ReStructure 2.0 Webinar Series

5:00pm November 17, 2022 (Time Zone: Europe/Rome)

TOWARDS NONLINEAR DYNAMIC ANALYSES OF BIO-CEMENTED GEOSYSTEMS AND APPLICATIONS IN LIQUEFACTION MITIGATION

Abstract: Earthquake-induced soil liquefaction has repeatedly been the cause of extensive infrastructure damage documented over multiple earthquake events across the world. Research developments have ranged from focusing on the fundamental understanding of the liquefaction phenomenon, to experimentally and numerically capturing its effects on soil-structure systems, and ultimately to either preventing or at a minimum mitigating its impacts. Amongst various ground improvement methods, Microbially-Induced Calcite Precipitation (MICP) has gained increased interest over the last decade as an alternative environmentally conscious artificial cementation technique analogous to natural cementation in the field. Research efforts over the last decades have led to new understandings of the effect of bio-cementation on sand behavior and accelerated the deployment of this technology to the field. Upscaling to the field will be even more successful with the availability of constitutive and numerical models capable of capturing the responses of treated deposits at the element and system scale respectively, such that treatment campaigns can be better planned and refined.

This webinar will present a newly formulated bounding surface plasticity model for bio-cemented sands (PM4SandC) which was developed to capture the stress-strain response of bio-cemented sands subject to earthquake loads. The model's formulation will be presented alongside with its validation and calibration against single-element simulations of monotonic and cyclic direct simple shear tests. Results from nonlinear site response analyses (SRA) will also be compared against centrifuge model test results. It will be shown that, with a minimal calibration effort and practically attainable input parameters, PM4SandC has the ability to capture the dynamic response of the bio-cemented sands at the system level. Ultimately, this work aims to enable the simulation of the response of artificially cemented sands in the field, which remains a critical knowledge gap in geotechnical practice, and will provide an important tool needed to design ground improvement treatment programs for liquefaction mitigation applications.

Presenter Bio-Sketch: Katerina Ziotopoulou is an Associate Professor in Civil and Environmental Engineering at the University of California at Davis since August of 2016. She received her PhD and MS degrees in Civil Engineering from UC Davis, and her undergraduate 5-year diploma degree in Civil Engineering from the National Technical University of Athens, Greece. Currently, her research focuses on numerically and experimentally studying ground failure due to earthquake-induced liquefaction and its mitigation, developing numerical tools that advance predictive capabilities, and exploring data-driven approaches for geotechnical earthquake engineering applications. She is the recipient of the 2021 Arthur Casagrande Professional Development Award of ASCE, the National Science Foundation CAREER Award, and the 2017 Greek International Woman in Science Award.

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