Dear Sir/Mdm

You are cordially invited to attend the **CUS Online Seminar: Learning to Move Through Soil: Bioinspired Mechanics and Burrowing Robots** on 2 September 2026 (Wednesday) via Microsoft Teams.
Please refer to the attached PDF for more details of the online seminar. Thank you.

CUS Online Seminar: Learning to Move Through Soil: Bioinspired Mechanics and Burrowing Robots
Speaker: Dr Junliang (Julian) TAO, Associate Professor, Arizona State University
Date: 02 Sep 2026 (Wednesday)
Time: 10:30 am to 12:00 pm (Singapore Time)
Platform: MS TEAMS (The meeting link will be sent to the registrants one day before the online seminar.)
Organised By: Centre for Urban Solutions (CUS), School of Civil and Environmental Engineering (CEE), Nanyang Technological University (NTU), Singapore
Supported By: Biogeotechnics (IF = 15.9)
Registration (Free): Please click the link below to register.
https://events.teams.microsoft.com/event/5b5b4237-18b8-451b-baff-adf3d15b8d62@15ce9348-be2a-462b-8fc0-e1765a9b204a

NANYANG TECHNOLOGICAL UNIVERSITY

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About the Seminar

Burrowing robots represent an emerging class of mobile systems with potential applications in subsurface exploration, search and rescue, sensor deployment, inspection, monitoring, and construction. Moving through soil, however, is fundamentally different from moving through air or water. A burrowing robot must create or enlarge its own path while overcoming high penetration resistance and frictional drag. It must also contend with depth-dependent stress and strength, spatial heterogeneity, and a medium whose structure and state are continuously altered by the robot's movement. Effective underground mobility therefore requires more than propulsion: a robot must actively manage soil resistance, establish anchorage, and adapt its motion to evolving ground conditions. Soil-dwelling organisms offer remarkably diverse solutions to these challenges. Razor clams and earthworms coordinate body expansion and contraction to anchor and advance; burrowing snakes and worm lizards use undulatory motion; mole crabs locally fluidize granular media; plant roots and seed awns exploit growth, shape change, and environmental cycles. Beyond their biological diversity, these organisms reveal transferable mechanical principles, including symmetry breaking, reciprocal motion, localized soil weakening, and strategic control of anchorage and drag. This talk presents lessons from our studies of razor clams, self-burrowing seed awns, and worm lizards, and describes how these lessons have informed the design and development of bioinspired burrowing robots. More broadly, it explores how biological observation, geomechanics, experimentation, and robotic design can be integrated to help engineered systems learn to move effectively through soil.

About the Speaker

Dr Junliang (Julian) TAO is an Associate Professor in the School of Sustainable Engineering and the Built Environment at Arizona State University (ASU). Before joining ASU, he was an Assistant Professor at The University of Akron. He earned his bachelor's degree from China University of Geosciences (Wuhan), master's degree from Tongji University, and Ph.D. from Case Western Reserve University. Dr Tao's research focuses on bioinspired geotechnics. His work investigates interactions between living organisms and geological materials, abstracts the underlying mechanisms into sustainable, and intelligent geotechnical systems. His current research interests include bioinspired self-burrowing robots, underground sensing and communication, and sustainable countermeasures for natural hazards. He is a recipient of the NSF CAREER Award and was named Young Engineer of the Year by his local ASCE section.

Regards
Professor CHU Jian
Director, Centre for Urban Solutions (CUS)
School of Civil and Environmental Engineering (CEE)
Nanyang Technological University, Singapore
