Contribution ID: **677** Type: **Oral Presentation**

Photoporomechanics: Visualizing and quantifying the evolving effective stress in 3D fluid-filled granular media

Wednesday, 24 May 2023 09:30 (15 minutes)

Granular media constitute the most abundant form of solid matter on Earth and other astronomical objects. When external forces are applied to granular media, the forces are transmitted in the media through a network of contacts—force chains. Understanding the temporal evolution and spatial structure of these force chains constitutes a fundamental goal of granular mechanics. For decades, our understanding of force chains has been derived from 2D experiments, using quasi-2D photoelastic particles with various shapes. Here, we introduce a new experimental technique, which integrates photoporomechanics [Li et al., PR Applied 2021; Meng et al., PR Applied 2022] into tomography, to observe the temporal evolution of 3D force chains under isotropic compression, triaxial shear and rotary shear. Our experimental study visualizes the alignment and intensification of 3D force chains as the external load changes from isotropic to triaxial shear and rotary shear. We also show that the fluctuation of the continuum-scale shear stresses can be pinpointed to the grain-scale buckling and healing of force chains. This work paves the way for understanding the grain-scale underpinning of localized failure of 3D granular media, such as shear banding of concrete structures and stick-slip frictional motion in tectonic and induced earthquakes.

Participation

In-Person

References

[1] Li, W., Meng, Y., Primkulov, B. K., & Juanes, R. (2021). Photoporomechanics: An experimental method to visualize the effective stress field in fluid-filled granular media. Physical Review Applied, 16(2), 024043.
[2] Meng, Y., Li, W., & Juanes, R. (2022). Fracturing in Wet Granular Media Illuminated by Photoporomechanics. Physical Review Applied, 18(6), 064081.

MDPI Energies Student Poster Award

No, do not submit my presenation for the student posters award.

Country

USA

Acceptance of the Terms & Conditions

Click here to agree

Primary authors: Prof. LI, Wei (Stonybrook University); Dr MENG, Yue (Princeton University); JUANES, Ruben (MIT)

Presenter: JUANES, Ruben (MIT)

Session Classification: MS12

Track Classification: (MS12) Advances in computational and experimental poromechanics