Shupeng Chai

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Research interests

Earthquake Mechanics; Seismology; Rock Physics

- Role of fault roughness and contact conditions
- Laboratory shear tests and numerical simulations

Education

2023–Present **PhD** in Geotechnical Engineering HK **Hong Kong Polytechnic University**

- Thesis: Governing role of fault-geometry-dependent stress heterogeneity in laboratory earthquakes
- Chief supervisor: Professor Qi Zhao

2025–2026 **Visiting PhD** student SG **Nanyang Technological University**

- Project: Simulating the effects of asperity contacts on laboratory earthquakes with PyQuake3D
- Supervisor: Professor Luca Dal Zilio

2018–2020 **MASc** in Mineral Engineering CA **University of Montreal (Polytechnique Montréal)**

- Thesis: Analytical and numerical studies on the stresses in backfilled stopes and the stability of side-exposed backfill in inclined stopes (link).

2014–2018 **BEng** in Civil Engineering CN **Wuhan University**

- Thesis: Numerical analyses on the horizontal directional drilling under a railway (Outstanding Thesis).

Professional Experience

2023–2025 Teaching Assistant **Hong Kong Polytechnic University**

- 2025-2026 Semester 1, CSE 579 Advanced rock engineering: tutorial
- 2024-2025 Semester 1, CSE40411 Rock engineering: tutorial, laboratory, field trip, consultation
- Supervision of final year project

2021–2023 Lecturer **Zhengzhou University of Science and Technology**

- Teaching: Soil Mechanics, Subgrade and Pavement Engineering, Road Engineering
- Research: Slope stability analyses

2018 Road Design Intern **Three Gorges Geotechnical Consultants Co., Ltd (Wuhan)**

Publications

(To be) submitted

[1] **Chai S**, Su B, Zou Y, Dal Zilio L, Hatzor Y H, Zhao Q (2026). Fault roughness and contact evolution control the dilatancy and compaction during shear sliding. *To be submitted to Geophysical Research Letters*.

[2] **Chai S**, Dal Zilio L, Hatzor Y H, Zhao Q (2026). Staged coseismic behavior controlled by roughness-induced stress heterogeneity. *To be submitted to Geophysical Research Letters*.

[3] **Chai S**, Zhao Q (2026). Interplay between fault geometric roughness and mechanical properties in governing sliding instability. *To be submitted to Earth and Planetary Science Letters*.

[4] **Chai S**, Zou Y, Wu H, Akbariforouz M, Su B, Grasselli G, Elsworth D, Hatzor Y H, Zhao Q (2026). Unveiling stress heterogeneity in seismic slip: A review of fault shear experiments. *To be submitted*.

***Peer-reviewed* (selected,** see full publication list via Google Scholar**)**

[5] **Chai S**, Zou Y, Wu H, Akbariforouz M, Su B, Grasselli G, Elsworth D, Hatzor YH, Zhao Q* (2026). Influence of stress heterogeneity on shear behavior of rock discontinuities in laboratory experiments: New insights from numerical simulations. *International Journal of Rock Mechanics and Mining Sciences* 197:106358. (link)

[6] **Chai S**, Zheng J*, and Li L (2023). Kink effect on the stress distribution in 2D backfilled stopes. *Geotechnical and Geological Engineering*. (link)

[7] **Chai S*** (2023). Two-wedge slope stability analysis considering a nonvertical wedge interface. *Bulletin of Engineering Geology and the Environment*. 82:89. (link)

[8] **Chai S***, Fan L and Liang H (2022). Required jacking force for deviation rectification of inclined structures supported with rigid piles. *Frontiers in Earth Science*. 10:998798. (link)

Selected Conference Presentations

[1] **Chai S**, Su B, Zou Y, Zhao Q (2025). Dilation or compaction? Laboratory insights into the role of fault roughness. **Oral** presentation at *EGU General Assembly 2025*. (link).

[2] **Chai S**, Zou Y, Chen G, Zhao Q (2024). Possible moonquakes and tectonic activities inferred from crater landslides. **Poster** presentation at *AGU24*. (link)

[3] **Chai S**, and Zhao Q. (2024). New insights into stress conditions on rock discontinuities in laboratory shear tests. **Oral** presentation at *International Geomechanics Conference 2024*. Kuala Lumpur, Malaysia. (Won **Best Student Award,** link)

[4] **Chai S**, and Zhao Q. (2024). New insights for stress conditions of laboratory shear tests. **Poster** presentation at *ARMA 58th. US Rock Mechanics/Geomechanics Symposium*. (link)

Awards & Honors

2025 PolyU Research Student Attachment Program (Scholarship) for a 6-month exchange at NTU

2024 **Best Student Award** at 2024 International Geomechanics Conference

2024 Second Prize in the Student Contest at 2024 International Geomechanics Conference

2024 2024 International Geomechanics Conference Student Sponsorship

2023 **Best Poster Award** in 2023 ARMA East Asia Geomechanics Workshop

2020 RBC Royal Bank Excellence Scholarship (University of Montreal)

2020 Marianne-Mareschal Excellence Scholarship (University of Montreal)

2019 Quebec Government Exemption Scholarship Program (University of Montreal)

2017 National Encouragement Scholarship (Wuhan University)

2017 Third prize in 11th National Structure Design Competition

2017 First prize in 10th National Engineering Drawing and BIM Innovation Competition

2016 Scholarship for Excellence of Wuhan University (Twice)

2016 Outstanding Student Cadre of Wuhan University

2014 Excellent Volunteer, Advanced Individual (Wuhan University)

Skills

Experimental skills Laboratory shear tests, Acoustic emissions, Micro-CT scan, etc.

Simulation skills: FLAC(3D), PFC(3D), MATLAB, Python

Languages: English (Proficient), French (Beginner), Mandarin Chinese (Native)