

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**

- 2023–2026 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](#))
- [9] **Chai S*** (2022). Maximum height estimation for mine waste dumps. *Journal of the Southern African Institute of Mining and Metallurgy*. 122(10):579-586. ([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.

Computational skills FLAC(3D), PFC(3D), MATLAB, Python

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