Hyoung Suk Suh, Ph.D.

Assistant Professor
Department of Civil and Environmental Engineering
Case Western Reserve University

2104 Adelbert Road, Bingham 215, Cleveland, OH 44106, USA
Email: hssuh@case.edu
Web: https://www.porolab.org
Phone: +1 (216) 368-5762

Google Scholar | ResearchGate | ORCID | Scopus | LinkedIn

Education

2018 – 2022 | **Columbia University**, New York, NY, USA
Ph.D., Civil Engineering and Engineering Mechanics

2015 – 2017 | **Yonsei University**, Seoul, Korea
M.S., Civil and Environmental Engineering

2010 – 2015 | **Yonsei University**, Seoul, Korea
B.S. with High Honors, Civil and Environmental Engineering

Experience

2023 – | **Case Western Reserve University**, Cleveland, OH, USA
Assistant Professor (tenure-track)

2022 – 2023 | **Columbia University**, New York, NY, USA
Postdoctoral Research Scientist

2018 – 2022 | **Columbia University**, New York, NY, USA
Presidential Fellow | Research Assistant

Honors and Awards

Selected Awards Received by the PI

- UCITE Glennan Fellowship — Case Western Reserve University, 2024 – 2025
- The Dongju Lee '03 Memorial Award — Columbia University, 2022
- Finalist, Presidential Awards for Outstanding Teaching — Columbia University, 2021, 2022
- MMLDT-CSET Conference NSF Fellowship — National Science Foundation, 2021
- Presidential Fellowship — Columbia University, 2018 – 2022
- Brain Korea 21 Fellowship — Korea Research Foundation, 2015 – 2017

- B.S./M.S. Joint Program Full Scholarship — Yonsei University, 2015 – 2017
- High Honors Graduation Award — Yonsei University, 2015
- National Science and Technology Full Scholarship — Korea Student Aid Foundation, 2010 – 2015

Selected Awards Received by the PI's Group Members

- Sejong Science Fellowship (Yejin Kim) — National Research Foundation of Korea, 2024
- Swanger Graduate Fellowship (Zixi Zhang) — Case Western Reserve University, 2024

Publications

Journal Articles

[21] Kim, T., Yun, T.S., and **Suh, H.S.** (2025) Can ChatGPT implement finite element models for geotechnical engineering applications?, *International Journal for Numerical and Analytical Methods in Geomechanics*, accepted. https://doi.org/10.1002/nag.3956.

[20] **Suh, H.S.** (2024) Diffuse interface modeling of non-isothermal Stokes-Darcy flow with immersed transmissibility conditions, *International Journal for Numerical Methods in Engineering*, 125(24), e7589. https://doi.org/10.1002/nme.7589.

[19] **Suh, H.S.**, Na, S., and Choo, J. (2024) Pore-morphology-based estimation of the freezing characteristic curve of water-saturated porous media, *Water Resources Research*, 60(8), e2024WR037035. https://doi.org/10.1029/2024WR037035.

[18] **Suh, H.S.**, Song, J.Y., Kim, Y., Yu, X., and Choo, J. (2024) Data-driven discovery of interpretable water retention models for deformable porous media, *Acta Geotechnica*, 19, 3821-3835. https://doi.org/10.1007/s11440-024-02322-y.

[17] **Suh, H.S.** (2024) Evolution of anisotropic capillarity in unsaturated granular media within the pendular regime, *International Journal of Geo-Engineering*, 15(1), 10. https://doi.org/10.1186/s40703-024-00211-7.

[16] Bahmani, B., **Suh, H.S.**, and Sun, W. (2024) Discovering interpretable elastoplasticity models via the neural polynomial method enabled symbolic regressions, *Computer Methods in Applied Mechanics and Engineering*, 422, 116827. https://doi.org/10.1016/j.cma.2024.116827.

[15] **Suh, H.S.**, Kweon, C., Lester, B., Kramer, S., and Sun, W. (2023) A publicly available PyTorch-ABAQUS UMAT deep-learning framework for level-set plasticity, *Mechanics of Materials*, 184, 104682. https://doi.org/10.1016/j.mechmat.2023.104682.

[14] **Suh, H.S.** and Sun, W. (2022) Multi-phase-field microporomechanics model for simulating ice-lens growth in frozen soil, *International Journal for Numerical and Analytical Methods in Geomechanics*, 46(12), 2307-2336. https://doi.org/10.1002/nag.3408. (selected as the featured cover).

[13] **Suh, H.S.** and Sun, W. (2021) Asynchronous phase field fracture model for porous media with thermally non-equilibrated constituents, *Computer Methods in Applied Mechanics and Engineering*, 387, 114182. https://doi.org/10.1016/j.cma.2021.114182.

[12] Heider, Y., **Suh, H.S.**, and Sun, W. (2021) An offline multi-scale unsaturated poromechanics model enabled by self-designed/self-improved neural network, *International Journal for Numerical and Analytical Methods in Geomechanics*, 45(9), 1212-1237. https://doi.org/10.1002/nag.3196.

[11] **Suh, H.S.** and Sun, W. (2021) An immersed phase field fracture model for microporomechanics with Darcy-Stokes flow, *Physics of Fluids*, 33, 016603. http://doi.org/10.1063/5.0035602. (selected as the Editor's pick).

[10] **Suh, H.S.**, Sun, W., and O'Connor, D. (2020) A phase field model for cohesive fracture in micropolar continua, *Computer Methods in Applied Mechanics and Engineering*, 369, 113181. https://doi.org/10.1016/j.cma.2020.113181.

[9] **Suh, H.S.** and Sun, W. (2019) An open source FEniCS implementation of a phase field fracture model for micropolar continua, *International Journal of Multiscale Computational Engineering*, 17(6), 639-663. https://doi.org/10.1615/IntJMultCompEng.2020033422.

[8] Kim, Y., **Suh, H.S.**, and Yun, T.S. (2019) Reliability and applicability of the Krumbein-Sloss chart for estimating geomechanical properties in sands, *Engineering Geology*, 248, 117-123. https://doi.org/10.1016/j.enggeo.2018.11.001.

[7] **Suh, H.S.** and Yun, T.S. (2018) Modification of capillary pressure by considering pore throat geometry with the effects of particle shape and packing features on water retention curves for uniformly graded sands, *Computers and Geotechnics*, 95, 129-136. https://doi.org/10.1016/j.compgeo.2017.10.007.

[6] **Suh, H.S.**, Kang, D.H., Jang, J., Kim, K.Y., and Yun, T.S. (2017) Capillary pressure at irregularly shaped pore throats: Implications for water retention characteristics, *Advances in Water Resources*, 110, 51-58. https://doi.org/10.1016/j.advwatres.2017.09.025.

[5] Lee, C., **Suh, H.S.**, Yoon, B., and Yun, T.S. (2017) Particle shape effect on thermal conductivity and shear wave velocity in sands, *Acta Geotechnica*, 12, 615-625. https://doi.org/10.1007/s11440-017-0524-6.

[4] **Suh, H.S.**, Kim, K.Y., Lee, J., and Yun, T.S. (2017) Quantification of bulk form and angularity of particle with correlation of shear strength and packing density in sands, *Engineering Geology*, 220, 256-265. https://doi.org/10.1016/j.enggeo.2017.02.015.

[3] **Suh, H.S.**, Jo, Y., Yun, T.S., and Kim, K.Y. (2016) Shear resistance of sandy soils depending on particle shape, *Journal of the Korean Geotechnical Society*, 32(6), 41-48. https://doi.org/10.7843/kgs.2016.32.6.41.

[2] Kim, K.Y., **Suh, H.S.**, Yun, T.S., Moon, S.-W., and Seo, Y.-S. (2016) Effect of particle shape on the shear strength of fault gouge, *Geosciences Journal*, 20(3), 351-359. https://doi.org/10.1007/s12303-015-0051-0.

[1] **Suh, H.S.**, Yun, T.S., and Kim, K.Y. (2016) Prediction of soil-water characteristic curve and relative permeability of Jumunjin sand using pore network model, *Journal of the Korean Geotechnical Society*, 32(1), 55-62. https://doi.org/10.7843/kgs.2016.32.1.55.

Manuscript Under Review or In Preparation

– Kim, Y. and **Suh, H.S.**, GNPNM: A graph neural pore network model for predicting quasi-static drainage displacement patterns, under review.

Peer Reviewed Conference Proceedings and Book Chapters

[12] **Suh, H.S.**, Na, S., and Choo, J. (2025) An image-based framework for modeling the freezing process in water-saturated porous media, *17th International Conference of the International Association for Computer Methods and Advances in Geomechanics*, Kowloon, HKSAR.

[11] Kim, Y. and **Suh, H.S.** (2025) Geometric learning framework for predicting pore-scale drainage displacement patterns, *Engineering Mechanics Institute 2025 Conference*, Anaheim, CA, USA.

[10] Kim, T., Yun, T.S., Choo, J., and **Suh, H.S.** (2025) Assessment of ChatGPT's capability in implementing finite element models for poroelasticity problems, *Engineering Mechanics Institute 2025 Conference*, Anaheim, CA, USA.

[9] Jiang, Y., **Suh, H.S.** and Yu, X. (2025) Predicting the thermal properties of unsaturated soils with machine learning models, *TRB Annual Meeting 2025*, Washington, DC, USA.

[8] **Suh, H.S.** and Sun, W. (2023) A multi-phase-field model for simulating ice lens growth and thawing in frozen porous media, *Geo-Congress 2023*, Los Angeles, CA, USA.

[7] **Suh, H.S.** and Sun, W. (2022) Multi-phase-field approach for modeling ice lens growth and thaw in frozen soil, *2nd International Conference on Energy Geotechnics*, La Jolla, CA, USA.

[6] **Suh, H.S.** and Sun, W. (2022) An immersed phase field fracture model in fluid-infiltrating porous media with evolving Beavers-Joseph-Saffman condition, *2nd International Conference on Energy Geotechnics*, La Jolla, CA, USA.

[5] Yin, Q., **Suh, H.S.**, and Sun, W. (2021) Numerical investigation on freezing and thawing of saturated soil, *Engineering Mechanics Institute 2021 Conference*, New York, NY, USA.

[4] **Suh, H.S.** and Sun, W. (2021) An immersed phase field fracture model for fracture-induced Stokes-Darcy flow, *Engineering Mechanics Institute 2021 Conference*, New York, NY, USA.

[3] **Suh, H.S.**, Kang, D.H., Jang, J., Kim, K.Y., and Yun, T.S. (2018) Capillary pressure at irregularly shaped pore throat, *7th International Conference on Unsaturated Soils*, Kowloon, HKSAR.

[2] **Suh, H.S.**, Kang, D.H., and Yun, T.S. (2017) Capillary pressure correction in irregularly shaped pore channel, *19th International Conference on Soil Mechanics and Geotechnical Engineering*, Seoul, Korea.

[1] Kang, D.H., **Suh, H.S.**, Kim, K.Y., and Yun, T.S. (2016) Calibration of capillary pressure of pore network by lattice Boltzmann simulation, *1st International Conference on Energy Geotechnics*, Kiel, Germany.

Teaching and Supervision

Teaching Experience

- *Instructor*, Soil Mechanics (ECIV330) — CWRU, 2024 –
- *Instructor*, Elasticity and Data-driven Mechanics (ECIV435) — CWRU, 2024 –
- *Faculty Advisor*, Civil Engineering Senior Project (ECIV398) — CWRU, 2023 –
- *Guest Lecturer*, Data Analysis for Civ. and Env. Engr. (ECIV455) — CWRU, 2023
- *Teaching Assistant*, Soil Mechanics (CIEN3141) — Columbia University, 2020 – 2022
- *Teaching Assistant*, Soil Mechanics (CEE3403) — Yonsei University, 2017
- *Teaching Assistant*, Introduction to Engineering Design (ENG1107) — Yonsei University, 2016

Postdoctoral Scholar and Student Advising

Postdoctoral Fellows

- Yejin Kim, *Generative artificial intelligence for the inverse design of engineered geomaterials* 2024 –

Ph.D. Students

- Zixi Zhang, *Material point method for multi-phase porous materials* 2024 –
- Mohammad Rezanezhad, *Multi-physics in fractured/fracturing porous media* 2025 –

Undergraduate Students

- Mcangel Dougan (Capstone Design Project Advisee) 2023
- Amory Ling (Academic Advisee) 2024 –
- Trilok Stead (Academic Advisee) 2024 –

Grants and Contracts

Principal Investigator

- *Integrating mechanics and AI: data-driven material modeling through an interactive computing platform*, CWRU UCITE Glennan Fellowship (Amount: $6,500) 2024 – 2025

Service and Activities

Professional Affiliations

American Geophysical Union (AGU) | American Society of Civil Engineers (ASCE) | International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) | International Association of Computational Mechanics (IACM) | Korean Geotechnical Society (KGS) | Korean-American Scientists and Engineers Association (KSEA) | U.S. Association for Computational Mechanics (USACM) | United States Council on Geotechnical Education and Research (USUCGER)

Journal Reviewer

Advances in Water Resources | *Applied Thermal Engineering* | *Computers and Concrete* | *Computers and Geotechnics* | *European Journal of Mechanics / A Solids* | *Granular Matter* | *International Communications in Heat and Mass Transfer* | *International Journal for Numerical and Analytical Methods in Geomechanics* | *International Journal of Geo-Engineering* | *International Journal of Heat and Mass Transfer* | *International Journal of Mechanical Sciences* | *International Journal of Solids and Structures* | *Journal of Contaminant Hydrology* | *Journal of Engineering Mechanics* | *KSCE Journal of Civil Engineering* | *Proceedings of the Royal Society A* | *Results in Physics* | *Scientific Reports* | *Soils and Foundations* | *Steel and Composite Structures*

Invited Talks

- CWRU, Dept. of Earth, Environmental, and Planetary Sciences NOV. 2024
- CWRU, Computational Science Colloquium APR. 2024
- Yonsei University, Dept. of Civil and Environmental Engineering JUL. 2023
- KAIST, Dept. of Civil and Environmental Engineering JUN. 2023
- University at Buffalo, Dept. of Civil, Structural and Environmental Engineering FEB. 2023

- University of Hawai'i at Mānoa, Dept. of Civil and Environmental Engineering FEB. 2022
- University of Pittsburgh, Dept. of Civil and Environmental Engineering FEB. 2022

Conference Activities

- *Co-organizer*, Computational Geomechanics mini-symposium, EMI 2025, Anaheim, CA, USA (with Shabnam Semnani, Qiushi Chen, Xiaoyu Song, Jinhyun Choo, WaiChing Sun, Richard Regueiro, and Ronaldo Borja)

Dissertation Defense and Examination Committee

Ph.D. Defense

- Zeyu Xiong, Dept. of Civil Engineering and Engineering Mechanics, Columbia University JAN. 2025
- Yongfan Guo, Dept. of Civil Engineering, McMaster University SEP. 2024
- Mohammod Minhajur Rahman, Dept. of Civil and Environmental Engineering, CWRU AUG. 2024

Ph.D. Candidacy Examination

- Jiachun Sun, Dept. of Civil and Environmental Engineering, CWRU MAR. 2025
- Zhao Liu, Dept. of Civil and Environmental Engineering, CWRU DEC. 2024
- Shafi Ullah, Dept. of Civil and Environmental Engineering, CWRU APR. 2024

Honor Society Membership

- *Former President and Co-founder*, True Insight Yonsei University
- *Former Member*, Young Engineers Honor Society (YEHS) National Academy of Engineering Korea

Outreach Activity

- *Panelist*, "AI: Shaping the Future of Disciplines" Seminar Series Case Western Reserve University
- *Ambassador*, eCYBERMISSION Army Educational Outreach Program