

# Chao Zhang, Ph.D.

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## EDUCATION

- **Doctor of Philosophy** (Ph.D.), with the highest honor, in Civil Engineering, Michigan Technological University, Houghton, MI, U.S.A., 2014-2017
- **Master of Engineering** (M.E.), with the highest honor, in Civil Engineering, Hunan University, Changsha, China, 2012-2014
- **Bachelor of Science** (B.S.), with the highest honor, in Civil Engineering, Hunan University, Changsha, China, 2008-2012

## ACADEMIC APPOINTMENTS

- **Vice Dean for Research**, College of Civil Engineering, Hunan University, 2022-present
- **Professor**, College of Civil Engineering, Hunan University, 2019-present
- **Visiting Professor**, Swiss Federal Institute of Technology in Zürich, 2019.11
- **Postdoctoral Fellow**, Dept. of Civil & Environ. Eng., Colorado School of Mines, 2017-2019

## RESEARCH INTERESTS

- Coupled Hydraulic, Mechanical, and Thermal Processes in Unsaturated Soils
- Nanoscale Numerical and Experimental Techniques in Understanding Soil Behavior
- Urban Underground Space Development Techniques

## SELECTED PUBLICATIONS

**Publications in Refereed Journals** (\* Corresponding author; † Graduate student advisee)

- [1] Gou, L.<sup>†</sup>, **Zhang, C.**<sup>\*</sup>, Lu, N., & Hu, S.<sup>†</sup> (2023). A Soil Hydraulic Conductivity Equation Incorporating Adsorption and Capillarity. *Journal of Geotechnical and Geoenvironmental Engineering*, 149(8), 04023056.
- [2] Zhao, N.<sup>†</sup>, Hu, S.<sup>†</sup>, **Zhang, C.**<sup>\*</sup>, Li, F.<sup>\*</sup>, & Chen, R. (2023). Physical Origins of Freezing and Melting Temperature Depressions of Water in Millimeter-Sized Pores. *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 131851.
- [3] Chen, R., Lang, Z.<sup>†\*</sup>, **Zhang, C.**<sup>\*</sup>, Zhao, N.<sup>†</sup>, & Deng, P. (2023). A paradigm for seismic resilience assessment of subway system. *Tunnelling and Underground Space Technology*, 135, 105061.
- [4] Ren, Y.<sup>†</sup>, **Zhang, C.**<sup>\*</sup>, Zhu, M.<sup>†</sup>, Chen, R., & Wang, J.<sup>†</sup> (2023). Significance and formulation of ground loss in tunneling-induced settlement prediction: a data-driven study. *Acta Geotechnica*, 1-16.
- [5] Gou, L.<sup>†</sup>, **Zhang, C.**<sup>\*</sup>, Hu, S.<sup>†</sup>, Chen, R., & Dong, Y. (2023). Semi-analytical solutions for soil consolidation induced by drying. *Acta Geotechnica*, 18(2), 739-755.

- [6] Hu, S.<sup>†</sup>, & **Zhang, C.**<sup>\*</sup> (2023). A sorption isotherm model for soil incorporating external and internal surface adsorption, and capillarity. *Canadian Geotechnical Journal*.
- [7] Hu, S.<sup>†</sup>, **Zhang, C.**<sup>\*</sup>, & Lu, N. (2023). Quantifying Coupling Effects Between Soil Matric Potential and Osmotic Potential. *Water Resources Research*, 59(2), e2022WR033779.
- [8] **Zhang, C.**, Hu, S.<sup>†</sup>, Qiu, Z.<sup>†</sup>, & Lu, N.<sup>\*</sup> (2022). A poroelasticity theory for soil incorporating adsorption and capillarity. *Géotechnique*, 1-18.
- [9] **Zhang, C.**, Gou, L.<sup>†</sup>, Hu, S.<sup>†\*</sup>, & Lu, N. (2022). A thermodynamic formulation of water potential in soil. *Water Resources Research*, 58(9), e2022WR032369.
- [10] Luo, S., Lu, N.<sup>\*</sup>, **Zhang, C.**, & Likos, W. (2022). Soil water potential: A historical perspective and recent breakthroughs. *Vadose Zone Journal*, 21(4), e20203.
- [11] Wang, J.<sup>†</sup>, Qiu, Z.<sup>†</sup>, **Zhang, C.**<sup>\*</sup>, & Chen, R. (2022). Assessing temperature dependence of soil water adsorption strength by molecular simulation. *Géotechnique Letters*, 12(2), 125-130.
- [12] **Zhang, C.**<sup>\*</sup>, Hu, S.<sup>†</sup>, & Lu, N. (2022). Unified elastic modulus characteristic curve equation for variably saturated soils. *Journal of Geotechnical and Geoenvironmental Engineering*, 148(1), 04021171.
- [13] **Zhang, C.**, Wang, J.<sup>†</sup>, & Chen, R.<sup>\*</sup> (2021). Water adsorption isotherms on soil external particle surface by molecular simulation. *Computers and Geotechnics*, 139, 104432.
- [14] **Zhang, C.**<sup>\*</sup>, & Lu, N. (2021). Soil sorptive potential–based paradigm for soil freezing curves. *Journal of Geotechnical and Geoenvironmental Engineering*, 147(9), 04021086.
- [15] **Zhang, C.**, & Lu, N.<sup>\*</sup> (2020). Unified effective stress equation for soil. *Journal of Engineering Mechanics*, 146(2), 04019135.
- [16] Lu, N., & **Zhang, C.**<sup>\*</sup> (2020). Separating external and internal surface areas of soil particles. *Journal of Geotechnical and Geoenvironmental Engineering*, 146(2), 04019126.
- [17] **Zhang, C.**, & Lu, N.<sup>\*</sup>. (2020) Soil sorptive potential: Its determination and predicting soil water density. *Journal of Geotechnical and Geoenvironmental Engineering*. 146 (1), 04019118.
- [18] Lu, N., & **Zhang, C.**<sup>\*</sup>. (2019) Soil sorptive potential: Concept, theory, and verification. *Journal of Geotechnical and Geoenvironmental Engineering*, 145 (4), 04019006.
- [19] **Zhang, C.**, & Lu, N.<sup>\*</sup>. (2019) Unitary definition of matric suction. *Journal of Geotechnical and Geoenvironmental Engineering*, 145 (2), 02818004.
- [20] **Zhang, C.**, & Lu, N.<sup>\*</sup>. (2019) Augmented Brunauer–Emmett–Teller Equation for Water Adsorption on Soils. *Vadose Zone Journal*. 18 (1), 1-12.
- [21] **Zhang, C.**, & Lu, N.<sup>\*</sup>. (2018) What is the range of soil water density: Critical review with a unified model. *Reviews of Geophysics*, 56.
- [22] **Zhang, C.**, & Lu, N.<sup>\*</sup>. (2018) Measuring soil water density by helium pycnometer. *Journal of Geotechnical and Geoenvironmental Engineering*, 144(9): 02818002.
- [23] **Zhang, C.**, & Liu, Z.<sup>\*</sup>. (2018). Freezing of water confined in porous materials: Role of adsorption and unfreezable threshold. *Acta Geotechnica*, 13 (5), 1203–1213.
- [24] **Zhang, C.**, Liu, Z.<sup>\*</sup>, & Deng, P. (2018). Using molecular dynamics to unravel the phase composition behavior of nano- size pores in frozen soils: Does Young-Laplace equation apply in the low temperature range. *Canadian Geotechnical Journal*, 55 (8), 1144–1153.
- [25] **Zhang, C.**, Deng, P.<sup>\*</sup>, & Ke, W. (2018). Kinematic response of rectangular piles under S waves. *Computers and Geotechnics*, 102, 229-237.
- [26] **Zhang, C.**, Deng, P.<sup>\*</sup>, & Ke, W. (2018). Assessing physical mechanisms related to kinematic soil-pile interaction. *Soil Dynamics and Earthquake Engineering*, 114, 22-26.

- [27] **Zhang, C.**, Dong, Y. \*, & Liu, Z. (2017). Lowest matrix potential in quartz: Metadynamics evidence. *Geophysical Research Letters*, 44(4), 1706-1713.
- [28] **Zhang, C.**, Liu, Z. \*, & Dong, Y. (2017). Effects of adsorptive water on the rupture of nanoscale liquid bridges. *Applied Clay Science*, 146, 487-494.
- [29] **Zhang, C.**, Liu, Q. \*, & Deng, P. (2017). Surface motion of a half space with a semi-cylindrical canyon under P, SV and Rayleigh waves. *Bulletin of the Seismological Society of America* 107(3).
- [30] Ke, W., & **Zhang, C.** \* (2017). A closed-form solution for kinematic bending of end-bearing piles. *Soil Dynamics and Earthquake Engineering*, 103, 15-20.
- [31] **Zhang, C.**, Liu, Z. \*, & Deng, P. (2016). Atomistic - scale investigation of effective stress principle of saturated porous materials by molecular dynamics. *Geophysical Research Letters*, 1944-8007.
- [32] **Zhang, C.**, Liu, Z. \*, & Deng, P. (2016). Contact angle of soil minerals: A molecular dynamics study. *Computers and Geotechnics*, 75, 48-56.
- [33] **Zhang, C.**, Liu, Q. \*, & Deng, P. (2015). Antiplane scattering of SH waves by a trapezoidal valley with a circular-arc alluvium in an elastic half space. *Journal of Earthquake and Tsunami*, 9(03), 1550008.

### **Book chapters**

- [1] Lu, N., **Zhang, C.**, & Hillel, D. (2023). Water properties. In *Reference Module in Earth Systems and Environmental Sciences*. Elsevier.

### **FUNDING RESEARCH PROJECTS**

- National Natural Science Foundation of China: Unravelling the multiscale physicochemical mechanisms underlying hydration processes of expansive soils. 2021.01-2024.12. Award amount: ¥580,000.
- National Natural Science Foundation of China: Disturbance-disaster mechanism and safety control of construction of deep underground space in megacities. 2021.01-2025.12. Award amount: ¥830,000
- National Key Research and Development Program of China: Research on the typical application technologies of ecological building materials in the sponge cities of the middle reaches of the Yangtze River. 2020.01-2023.03. Award amount: ¥1230,000.
- National Key Research and Development Program of China: Whole-machine Digital Prototype Integrating Service Environment of Underground Engineering Equipment. 2019.12-2022.11. Award amount: ¥666,100.

### **COURSE INSTRUCTION**

- Spring 2023, Introduction to Environmental and Energy Geotechnics, 11 students.
- Spring 2023, Design of Underground Structures, Undergraduate Proficiency, 48 students.
- Fall 2022, Fundamentals of Soil Behavior, Graduate Elective, 14 students.
- Spring 2022, Introduction to Environmental and Energy Geotechnics, 13 students.
- Spring 2022, Design of Underground Structures, Undergraduate Proficiency, 45 students.
- Fall 2021, Fundamentals of Soil Behavior, Graduate Elective, 15 students.
- Spring 2021, Introduction to Environmental and Energy Geotechnics, 27 students.
- Spring 2021, Design of Underground Structures, Undergraduate Proficiency, 53 students.
- Fall 2020, Fundamentals of Soil Behavior, Graduate Elective, 13 students.
- Spring 2020, Design of Underground Structures, Undergraduate Proficiency, 47 students.
- Spring 2020, Introduction to Civil Engineering, Undergraduate Proficiency, 59 students.

- Fall 2019, Soil Mechanics, Undergraduate Proficiency, 44 students.

## **PROFESSIONAL ACTIVITIES**

- Technical committee member, Unsaturated Soils, Geo-Institute, ASCE.
- Technical committee member, Engineering Geology and Site Characterization, Geo-Institute, ASCE.
- Technical committee affiliate member, Poromechanics Committee, Engineering Mechanics Institute, ASCE.
- Member, American Geophysical Union (AGU).
- Associate member, American Society of Civil Engineers (ASCE).

## **JOURNAL AND CONFERENCE REVIEWER**

- Water Resources Research
- Journal of Mechanics and Physics of Solids
- Journal of Geotechnical and Geoenvironmental Engineering – ASCE
- Geotechnique
- Canadian Geotechnical Journal
- Geotechnique Letters
- Soil Dynamics and Earthquake Engineering,
- Vadose Zone Journal
- Journal of Hydrology
- Journal of Engineering Mechanics – ASCE
- Journal of Materials in Civil Engineering – ASCE
- Journal of Cold Regions Engineering – ASCE
- Geotechnical Testing Journal – ASTM International
- Engineering Analysis with Boundary Elements
- Applied Clay Science
- Engineering
- International Journal of Geomechanics – ASCE
- Construction and Building Materials

## **SELECTED AWARDS AND HONORS**

- **Norman Medal**, ASCE, 2021.
- Ministry of Education **First Prize in Science and Technology Progress Award**, 2021.
- The **Outstanding New Teacher Award** of Hunan University, 2021.
- **Editor's Choice paper**, ASCE Journal of Engineering Mechanics, 2020
- **Editor's Choice paper**, ASCE Journal of Geotechnical and Geoenvironmental Engineering, 2020
- **Wilbur Haas Graduate Research Excellence Award**, Michigan Tech, 2017.
- **Dean's Award** for Outstanding Scholarship, Michigan Tech, 2017.
- The **Hugo Shong** Scholarship, 2012.