

## Seunghee Kim, Ph.D., P.E.

Assistant Professor, Dept. of Civil & Environmental Engineering, Univ. of Nebraska-Lincoln  
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Google Scholar: <https://scholar.google.com/citations?user=yIbmHbsAAAAJ&hl=en>

### I. RESEARCH AREAS

- Fundamental study: Multi-phase/reactive fluid flow in porous media; Poro-thermo-elasticity; Mineral dissolution/precipitation; Hydro-chemo-thermo-mechanically coupled analysis.
- Applicational study – Energy geotechnics: CO<sub>2</sub> geologic storage & utilization; Large- and small-scale compressed air energy storage (CAES); Geologic nuclear waste disposal; Geologic hydrogen storage; Gas hydrate-bearing sediments.
- Geotechnics for resilient bridge/road infrastructures: Soil-pile interactions; Geosynthetics-reinforced soils; Integral/semi-integral abutment systems; Settlement of bridge approaches.

### II. EARNED DEGREES

- Ph.D., Geotechnical Engineering, School of Civil and Environmental Engineering  
Georgia Institute of Technology, Atlanta, Georgia, USA (Dec. 2012)  
Minor: Physical and chemical properties of geo-materials
- M.S., Geotechnical Engineering, School of Civil and Environmental Engineering  
Georgia Institute of Technology, Atlanta, Georgia, USA (May 2011)
- M.S., Geotechnical Engineering, Department of Civil and Environmental Engineering  
Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea (Feb. 2005)
- B.S., Department of Civil and Environmental Engineering, KAIST, Daejeon, Korea (Feb. 2003)  
Minor: Management engineering

### III. EMPLOYMENT

- Assistant Professor, University of Nebraska-Lincoln, Lincoln, Nebraska (Aug. 2016~Present)
- Assistant Professor, Western New England University, Springfield, Massachusetts (Aug. 2014~Aug. 2016)
- Postdoctoral Fellow, Bureau of Economic Geology, The University of Texas at Austin, Austin, Texas (Mar. 2013~Aug. 2014)
- Instructor, Georgia Institute of Technology, Atlanta, Georgia (Aug. 2012~Dec. 2012)
- Researcher, Korea Institute of Civil Engineering and Building Technology (KICT), Gyeonggi, Korea (Feb. 2007~June 2008)
- Assistant Manager, Dongho Co., Ltd., Gyeonggi, Korea (Jan. 2005~Jan. 2007)

### IV. PUBLICATIONS

#### Journal Papers

##### Published

28. Zhang, J., Zhang, H., Lee, D., Ryu, S., and **Kim, S.** (2021). "Study on the effect of pore-scale heterogeneity and flow rate during repetitive two-phase fluid flow in microfluidic porous media." *Petroleum Geoscience*, In print. DOI: 10.1144/petgeo2020-062.

27. Zhang, J., Hosseini Zadeh, A., and **Kim, S.** (2021). "Geomechanical and energy analysis on the small- and medium-scale CAES in salt domes." *Energy*, 221, 119861. DOI: 10.1016/j.energy.2021.119861.
26. Kim, S., **Kim, S.**, Zhang, J., Druszkowski, E., and Sweidan, A. (2021). "Experiment and numerical studies on thermally-induced slip ratcheting on a slope." *Infrastructures*, 6, 5. DOI: 10.3390/infrastructures6010005.
25. Hosseini Zadeh, A., Mamirov, M., **Kim, S.**, and Hu, J. (2021). "CO<sub>2</sub>-treatment of recycled concrete aggregates for improving mechanical and environmental properties." *Construction and Building Materials*, 275, 122180. DOI: 10.1016/j.conbuildmat.2020.122180.
24. Hosseini Zadeh, A., Kim, I., and **Kim, S.** (2021). "Characteristics of formation and dissociation of CO<sub>2</sub> hydrates at different CO<sub>2</sub>-water ratios in a bulk condition." *Journal of Petroleum Science and Engineering*, 196, 108027. DOI: 10.1016/j.petrol.2020.108027.
23. Jeon, M.-K., **Kim, S.**, Hosseini Zadeh, A., and Kwon, T.-H. (2020). "Study on the viscous fluid flow in disordered-deformable porous media using hydro-mechanically coupled pore-network modeling." *Transport in Porous Media*, 133(2), 207-227. DOI: 10.1007/s11242-020-01419-8.
22. Pulatsu, B., **Kim, S.**, Erdogmus, E., and Lourenço, P.B. (2020). "Advanced numerical analysis of masonry retaining walls using mixed discrete-continuum approach." *Proceedings of the Institution of Civil Engineers - Geotechnical Engineering (ICE)*, 173(1). DOI: 10.1680/jgeen.19.00225.
21. Ko, J., **Kim, S.**, Kim, S., and Seo, H. (2020). "Utilizing building foundations as micro-scale compressed air energy vessel: Numerical study for mechanical feasibility." *Journal of Energy Storage*, 28, 101225. DOI: 10.1016/j.est.2020.101225.
20. Zhang, J., Zhang, H., Lee, D., Ryu, S., and **Kim, S.** (2020). "Microfluidic study on the two-phase fluid flow in porous media during repetitive drainage-imbibition cycles and implications to the CAES operation." *Transport in Porous Media*, 131(2), 449-472.
19. Kim, I., Caroline, B., and **Kim, S.** (2019). "Feasibility study: Electromagnetic heating of soils using magnetic nanoparticle-coated geotextiles." *Géotechnique Letters*, 10(2), DOI: 10.1680/jgele.19.00098.
18. Park, Y.-C., **Kim, S.**, Lee, J. H., and Shinn, Y. J. (2019). "Effect of reducing irreducible water saturation in a near-well region on CO<sub>2</sub> injectivity and storage capacity." *International Journal of Greenhouse Gas Control*, 86, 134-145.
17. Bachus, R.C., Terzariol, M., Pasten, C., Chong, S.H., Dai, S., Cha, M.S., **Kim, S.**, Jang, J., Papadopoulos, E., Roshankhah, S., Lei, L., Garcia, A., Park, J., Sivaram, A., Santamarina, F., Ren, X. and Santamarina, J.C. (2019). "Characterization and engineering properties of dry and ponded class-F fly ash." *Journal of Geotechnical and Geoenvironmental Engineering*, 145(3), 04019003.
16. Park, T., Joo, H.-W., Kim, G.-Y., **Kim, S.**, Yoon, S., and Kwon, T.-H. (2017). "Biosurfactant as an enhancer of geologic carbon storage: Microbial modification of interfacial tension and contact angle in carbon dioxide/water/quartz systems." *Frontiers in Microbiology*, 8:1285, doi: 10.3389/fmicb.2017.01285.
15. **Kim, S.** and Hosseini, S.A. (2016). "Study on the ratio of stress-pore pressure changes during fluid injection and its implications for CO<sub>2</sub> geologic storage." *Journal of Petroleum Science and Engineering*, 149, 138-150.
14. **Kim, S.** and Santamarina, J.C. (2016). "Geometry-coupled reactive fluid transport at the fracture scale: application to CO<sub>2</sub> geologic storage" *Geofluids*, 16, 329-341.

13. **Kim, S.** and Hosseini, S.A. (2015). "Hydro-thermo-mechanical analysis during injection of cold fluid into a geologic formation." *International Journal of Rock Mechanics and Mining Sciences*, 77, 220-236.
  12. **Kim, S.** and Santamarina, J.C. (2015) "Reactive fluid flow in CO<sub>2</sub> storage reservoirs – Pore network model study." *Greenhouse Gases: Science and Technology*, 5, 462-473.
  11. **Kim, S.** and Hosseini, S. A. (2014) "Geological CO<sub>2</sub> storage: Incorporation of pore pressure/stress coupling and thermal effect to determine maximum sustainable pressure limit." *Energy Procedia*, 63, 3339-3346.
  10. Hosseini, S. A., **Kim, S.**, and Zeidouni, M. (2014) "Application of multi-well analytical models to maximize geological CO<sub>2</sub> storage in brine formations." *Energy Procedia*, 63, 3563-3567.
  9. **Kim, S.** and Santamarina, J. C. (2014). "CO<sub>2</sub> geological storage: Hydro-chemo-mechanical analyses and implications." *Greenhouse Gases: Science and Technology*, 4, 528-543.
  8. **Kim, S.** and Hosseini, S.A. (2014). "Above-zone pressure monitoring and geomechanical analyses for a field-scale CO<sub>2</sub> injection project, Cranfield, MS." *Greenhouse Gases: Science and Technology*, 4, 81-98.
  7. **Kim, S.** and Santamarina, J. C. (2014). "Engineered CO<sub>2</sub> injection: The use of surfactants for enhanced sweep efficiency." *International Journal of Greenhouse Gas Control*, 20, 324-332.
  6. **Kim, S.** and Santamarina, J. C. (2013). "CO<sub>2</sub> breakthrough and leak - sealing experiments on shale and cement." *International Journal of Greenhouse Gas Control*, 19, 471-477.
  5. Espinoza, D. N., **Kim, S.**, and Santamarina, J. C. (2011). "CO<sub>2</sub> geological storage – Geotechnical implications." *KSCE Journal of Civil Engineering*, 15(4), 707-719.
  4. Fragaszy, R. J., Santamarina, J. C., Amekudzi, A., Assimaki, D., Bachus, D., Burns, S. E., Cha, M. S., Cho, G. C., Cortes, D. D., Dai, S., Espinoza, D. N., Garrow, L., Huang, H., Jung, J. W., **Kim, S.**, Kurtis, K., Lee, C. H., Pasten, C. P., Phadnis, H., Rix, G. J., Shin, H. S., Torres, M. C., and Tsouris, C. (2011). "Sustainable development and energy geotechnology – Potential roles of geotechnical engineering." *KSCE Journal of Civil Engineering*, 15(4), 611-622.
  3. Lee, J.H., Koo, H.B., Kim, S.H., and **Kim, S.** (2011). "A case study of road upheaval caused by slope movement and verification of reinforcement using real-time monitoring." *The Journal of Engineering Geology*, 21(3), 221-230.
  2. Kim, S. H., Koo, H. B., and **Kim, S.** (2009). "A case study on the field investigation and stability analysis of the collapsed cut-slope in tunnel portal, Danyang." *The Journal of Engineering Geology*, 19(3), 401-408.
  1. Koo, H. B., **Kim, S.**, Kim, S. H., and Lee, J. Y. (2008). "Study on jointed rock mass properties and analysis model of numerical simulation on collapsed slope." *Journal of Korean Geotechnical Society*, 24(5), 65-78.
- Under Review or In Preparation Based on Completed Research**
3. **Kim, S.**, Hosseini Zadeh, A., Nole, M., Daigle, H., Huh, C., and Kim, I. "Spontaneous generation of stable CO<sub>2</sub> emulsions via the dissociation of nanoparticle-aided CO<sub>2</sub> hydrate." In preparation.
  2. Prasun, S., **Kim, S.**, and Hosseini, S.A. "Effect of gas cap on injection-induced poroelastic stresses in the base layer faults: Numerical study." In preparation.
  1. **Kim, S.** and Santamarina, J. C. "Energy efficiency in rock crushing: Optimal thermo-mechanical comminution." In preparation.

## Books, Book Chapters, and Other Publications

3. **Kim, S.** (2019). "Benchmark Portfolio: CIVE 334 - Introduction to Geotechnical Engineering," University of Nebraska-Lincoln, 26pg.

2. **Kim, S.**, Espinoza, D.N., Jung, J., Cha, M., and Santamarina, J.C. (2019). "Ch. 17: Carbon Geological Storage: Coupled Processes, Engineering and Monitoring" Science of Carbon Storage in Deep Saline Formations: Process Coupling Across Time and Spatial Scales, Edited by Newell, P. and Ilgen, A., Elsevier, pp. 287-304. DOI: <https://doi.org/10.1016/B978-0-12-812752-0.00017-4>.

1. Santamarina, J. C., Al-Ghoul, M., Alonso, E., Birkle, P., Calo, V. M., Cha, M., Fratta, D., Gale, J. F. W., Kaka, S. I., Kaszuba, J., **Kim, S.**, Lu, P., Mahmoud, M., McDougall, J., Patzek, T.W., Radke, C., Tarragona, A. R., Renard, F., Sanchez, M., Shin, H., Sultan, A. S., van Cappallen, P., van Dijk, C., Viggianim G., and Wuttke, I. F. (2016). "Dissolution and Precipitation: Implications for Energy Geo-Engineering" King Abdullah University of Science and Technology, 295pg.

## Theses

2. Ph.D. Thesis (2012). "CO<sub>2</sub> geological storage: hydro-chemo-mechanically coupled phenomena and engineered injection." Georgia Institute of Technology, 188 pgs., Atlanta, Georgia.

1. M.Sc. Thesis (2005). "Subsurface Stiffness Imaging using HWAW (Harmonic Wavelet Analysis of Wave) method." Korea Advanced Institute of Science and Technology, 105 pgs., Daejeon, Korea.

## Conference Papers

### In English

27. Hosseini Zadeh, A., Kim, I., and **Kim, S.** "Experimental study on the characteristics of formation and dissociation of CO<sub>2</sub> hydrates in porous media" 2<sup>nd</sup> International Conference on Energy Geotechnics (ICEGT 2020), E3S Web of Conferences, 205, 02004, <https://doi.org/10.1051/e3sconf/202020502004>.

26. Zhang, J., Zhang, H., Lee, D., Ryu, S., and **Kim, S.** "Experimental study: Effect of pore geometry and structural heterogeneity on the repetitive two-phase fluid flow in porous media and its implications to PM-CAES" ICEGT 2020, E3S Web of Conferences, 205, 07010, <https://doi.org/10.1051/e3sconf/202020507010>.

25. Zhang, J., Seo, H., Kim, S., Ko, J., and **Kim, S.** "Experimental study of pipe-pile-based micro-scale compressed air energy storage (PPMS-CAES) for a building" ICEGT 2020, E3S Web of Conferences, 205, 07012, <https://doi.org/10.1051/e3sconf/202020507012>.

24. Jeon, M.-K., Hosseini Zadeh, A., **Kim, S.**, and Kwon, T.-H. "Fluid-driven mechanical responses of deformable porous media during two-phase flows: Hele-Shaw experiments and hydro-mechanically coupled pore network modeling" ICEGT 2020, E3S Web of Conferences, 205, 08009, <https://doi.org/10.1051/e3sconf/202020508009>.

23. Zhang, H., Palmon, T., **Kim, S.**, and Ryu, S. "Fabrication of a microchannel device with a three-dimensional pore network using a sacrificial sugar template" FEDSM 2020, July 12-16, 2020, Orlando, FL.

22. Zhang, J., Zhang, H., Lee, D., Ryu, S., and **Kim, S.** "Experimental study on the two-phase fluid flow in porous media during repetitive drainage-imbibition cycles using microfluidics technique." Geotechnical Engineering in the XXI Century: Lessons learned and future challenges, Proceedings of the XVI Pan-American Conference on Soil Mechanics and Geotechnical Engineering (XVI PCSMG), N.P. Lopez-Acosta et al. (Eds.), November 17-20, 2019, Cancun, Mexico, 2458-2465, doi: 10.3233/STAL190315.

21. Demuro, J., **Kim, S.**, and Zhu, C. "Influences of damage- and healing-induced microstructure changes on the permeability of 3D printed rock masses." 53<sup>rd</sup> U.S. Rock Mechanics / Geomechanics Symposium, June 23-26, 2019, Brooklyn, NY.
20. Hosseini Zadeh, A., Jeon, M.-K., Kwon, T.-K., and **Kim, S.** "Study of poroelastic deformation in soft elastic granular materials during repetitive fluid injection." 53<sup>rd</sup> U.S. Rock Mechanics / Geomechanics Symposium, June 23-26, 2019, Brooklyn, NY.
19. Kim, S., Druszkowski, E., Zhang, J., and **Kim, S.** "Numerical study on thermally-induced displacement ratcheting of a thin rock slab." Geo-Congress 2019: Geotechnical Materials, Modeling, and Testing, March 24-27, 2019, Philadelphia, PA, GSP 310, 506-513.
18. Kim, I., Best, C., and **Kim, S.** "Electromagnetic soil heating using magnetic nanoparticle-coated geotextiles." Geo-Congress 2019: Earth Retaining Structures and Geosynthetics, March 24-27, 2019, Philadelphia, PA, GSP 306, 376-382.
17. Prasun, S., **Kim, S.**, and Hosseini, S. A. "Geologic carbon storage: Implications of two-phase flow on injection-induced stress on faults." COMSOL Conference, October 3-5, 2018, Boston, MA, 14pg.
16. Kim, S., Fiedler, B. J., and **Kim, S.** "A landslide model with the shear band propagation: modification for unsaturated condition." International Foundations Congress and Equipment Expo, March 5-10, 2018, Orlando, FL, GSP 297, 314-323.
15. Ko, J., Seo, H., Kim, S., and **Kim, S.** "Numerical analysis: Mechanical behavior of pipe-pile used for micro-scale compressed air energy storage (CAES)." International Foundations Congress and Equipment Expo, March 5-10, 2018, Orlando, FL, GSP 294, 715-723.
14. **Kim, S.** and Hosseini, S. A. "Hydro-mechanical analysis during fluid injection into a geologic formation and implications for CO<sub>2</sub> geologic storage." 19<sup>th</sup> International Conference on Soil Mechanics and Geotechnical Engineering, Seoul, Korea, 2017, 3451-3454.
13. Kim, S., Ko, J., **Kim, S.**, Seo, H. and Tummalapudi, M. "Investigation of small-scale CAES (compressed air energy storage) pile as a foundation system." Geotechnical Frontiers 2017, 103-112.
12. **Kim, S.** and Santamarina, J. C. "Rock crushing using microwave pre-treatment." Geo-Chicago 2016: Sustainable Materials and Resource Conservation, 720-729.
11. Kim, S., **Kim S.**, Seo, H., and Jung, J. W. "Mechanical behavior of a pile used for small-scale compressed air energy storage." Geo-Chicago 2016: Geotechnics for Sustainable Energy, 135-143.
10. **Kim, S.** and Hosseini, S. A. "Effect of pore pressure/stress coupling on geological CO<sub>2</sub> storage." 13<sup>th</sup> Annual Carbon Capture, Utilization & Storage Conference, 2014, Pittsburgh.
9. Hosseini, S. A. and **Kim, S.** "Optimization of injection rates for geological CO<sub>2</sub> storage in brine formations." 13<sup>th</sup> Annual Carbon Capture, Utilization & Storage Conference, 2014, Pittsburgh.
8. **Kim, S.** and Santamarina, J. C. "Geological CO<sub>2</sub> storage: Reactive fluid transport - Pore-scale study -." Geo-Congress 2014, Atlanta.
7. **Kim, S.**, Hosseini, S. A., and Hovorka, S. D. "Numerical simulation: Field scale fluid injection to a porous layer in relevance to CO<sub>2</sub> geological storage." COMSOL Conference, Oct. 9-11, 2013, Boston.

6. Koo, H. B., **Kim, S.**, Kim, S. H., and Rhee, J. H. "A case study on safety analysis for uneven pressure at tunnel portal site." The 12<sup>th</sup> International Conference of IACMAG (International Association for Computer Methods and Advances in Geomechanics), Oct. 1-6, 2008, Goa, India.
5. Koo, H. B., Kim, S. H., **Kim, S.**, and Lee, J. Y. "A case study on the stability and numerical analysis of the collapsed cut-slope in Danyang, Korea." The 12<sup>th</sup> International Conference of IACMAG (International Association for Computer Methods and Advances in Geomechanics), Oct. 1-6, 2008, Goa, India.
4. **Kim, S.**, Kim, S. H., Rhee, J. H., and Koo, H. B. "Estimates of rock mass properties using the RMR and GSI system." Proceedings of the GSK (The Geological Society of Korea) 2007 Fall Conference 2007, Oct. 25-26, Chuncheon, Korea.
3. **Kim, S.**, Kim, D. S., Park, H. C., and Lee, J. S. "Subsurface Stiffness Imaging using Harmonic Wavelet Analysis of Waves (HWAW) Method." Proceedings of 17<sup>th</sup> KKCNN Symposium on Civil Engineering, Dec. 13-15, 2004, Ayutthaya, Thailand, 531-537.
2. Kim, D. S., Bang, E. S., **Kim, S.**, and Park, H. C. "Subsurface stiffness imaging with SPT-uphole and HWAW methods." Proceedings of Advanced in Structural Engineering and Mechanics (ASEM'04), Sept. 2-4, 2004, Seoul, Korea, 2070-2080.
1. Kim, D. S., **Kim, S.**, and Park, H. C. "Seismic site characterization using harmonic wavelet analysis of wave (HWAW) method." Proceedings of US-Korea Joint Seminar/Workshop on Smart Structure Technologies, Sept. 2-3, 2004, Seoul, Korea, 335-346.

#### *In Korean - Selected*

6. Rhee, J. H., **Kim, S.**, Kim, S. H., and Koo, H. B. "A study on inventory of cut-slope using the mobile PC." KGS (Korean Geotechnical Society) Spring National Conference 2008, Mar. 28-29, 2008, Seoul, Korea, 813-820.
5. **Kim, S.**, Rhee, J. H., and Koo, H. B. "Numerical simulation and countermeasure on upheaval generation in the road caused by sliding of a slope." KGS Spring National Conference 2008, Mar. 28-29, 2008, Seoul, Korea, 833-841.
4. Kim, S. H., Koo, H. B., Lee, J. Y., Rhee, J. H., and **Kim, S.** "Geotechnical characteristics of the collapsed 00 tunnel slope in Yeosu-Suncheon area." KGS Spring National Conference 2008, Mar. 28-29, 2008, Seoul, Korea, 848-857.
3. Lee, J. Y., Koo, H. B., Kim, S. H., and **Kim, S.** "A stability evaluation according to inclination of upper natural slope in soil slope." 2008 Spring Conference, Korean Society of Hazard Mitigation, Feb. 28, 2008, Seoul, Korea, 577-580.
2. Kim, S. H., Koo, H. B., Rhee, J. H., and **Kim, S.** "Geotechnical characteristics of road cut slope in national highway 24 at Suknam pass, Eonyang-Milyang area." 2008 Spring Conference, Korean Society of Hazard Mitigation, Feb. 28, 2008, Seoul, Korea, 589-592.
1. Son, Y. J., Koo, H. B., Kim, S. H., and **Kim, S.** "Stability analysis and countermeasures on cut slopes within national road construction between Giseong and Wonnam." Proceedings of the KSEG 2007 Spring Conference 2007, Apr. 25-27, Gyeongju, 637-639.

## V. RESEARCH PROJECTS and CONSULTING EXPERIENCES

### At University of Nebraska-Lincoln, Lincoln, Nebraska (Aug. 2016~Present)

- Assessment of greenhouse gas sequestration resources in Districts 5, 6, and 7 to improve carbon management opportunities in Nebraska.
- Application of biochar as carbon sequestering and beneficial additive in concrete, Nebraska Center for Energy Sciences Research.
- Crashworthy foundations for soil-embedded roadside safety hardware, Mid-America Transportation Center.
- Assessing performance of geosynthetic reinforced pavement with a large-scale track wheel test and nondestructive testing tools, Mid-America Transportation Center.
- Multiscale and multiphysical testing-modeling of inorganic microfiber-reinforced engineered barrier materials (IMEBM) for enhancing repository performance, U.S. Department of Energy NEUP.
- Improvement on the treatment of recycled concrete aggregates (RCA) using CO<sub>2</sub> for its commercial application, NE Department of Economic Development and Hawkins Construction Company.
- Characterization of hydro-mechanically coupled fluid transport in deformable porous media and application to convection-enhanced drug delivery, Nebraska Collaboration Initiative.
- Evaluation of light pole foundation embedment, Alaska Dept. of Transportation & Public Facilities.
- REU Site: Sustainability of horizontal civil networks in rural areas, National Science Foundation.
- Development of guideline for the use of geosynthetics in different roadway layered system in Nebraska, Nebraska Department of Transportation (NDOT).
- Injection optimization via implementation of mechanically-coupled numerical simulations, Korea Advanced Institute of Science and Technology (KAIST).
- Pipe-pile-based micro-scale compressed air energy storage for buildings with intermittent renewable energy resources, Nebraska Collaboration Initiative.
- Feasibility study: Alternatives to prevent settlements and bumps at bridge approaches in Nebraska, NDOT.
- Design optimization and monitoring of joint-less integral and semi-integral abutment bridges in Nebraska, NDOT.
- CPT based pile design, Nebraska Department of Roads.
- Utilization of CO<sub>2</sub> to improve recycled concrete aggregate (RCA), Layman Seed Funding.
- Development of advanced computational/experimental models to elucidate multiphase fluid transport in disordered-deformable porous media, UNL Research Council: Interdisciplinary Research Grants.
- Consulting: Heliwalls shoring system (Omaha, NE, USA).

### At Bureau of Economic Geology, The University of Texas at Austin, Austin, Texas (Mar. 2013~Aug. 2014)

- Enhanced Analytical Simulation Tool (EASiTool) for CO<sub>2</sub> Storage Capacity Estimation and Uncertainty Quantification, U.S. Department of Energy.
- The Southeast Regional Carbon Sequestration Partnership (SECARB), U.S. Department of Energy.

### At Georgia Tech, Atlanta, Georgia (Aug. 2008~Dec. 2012)

- CO<sub>2</sub> Geological Storage: Coupled Hydro-Chemo-Thermo-Mechanical Phenomena – From the pore-scale process to macro-scale implications, U.S. Department of Energy.
- Identification of Honeycombs in Fresh Concrete, Electric Power Research Institute.
- Fly Ash Characterization, Electric Power Research Institute.
- Rock Crushing, Georgia Mining Association.

#### **At KICT, Gyeonggi, Korea (Feb. 2007~June 2008)**

- 2007 National Road Cut Slopes Management System (CSMS) Administration Affair, Ministry of Construction and Transportation (MOCT).
- 2006 CSMS Administration Affair, MOCT.
- Evaluation of Stability and Solution on Cut Slopes for National Road Construction between Bupjeon and Socheon, Ssangyong Engineering Construction.
- Stability Analysis and Solution Proposal for Cut Slopes of Manyang #1 Tunnel Portal, Hanshin Construction.
- Study on Stability Analysis and Solution Proposal for Cut Slopes of Deokcheon Tunnel Portal, Keangnam Enterprises.

#### **At Dongho Co. Ltd., Gyeonggi, Korea (Jan. 2005~Jan. 2007)**

- Design of a Full-Scale Structure Laboratory, Expressway & Transportation Research Institute.
- Design and Construction of Automated Waste Collection System at New Towns.
  - Incheon Song-do, Seongnam Pan-gyo, Gim-po Janggi, Gwang-myeong Soha New Towns.

#### **At KAIST, Daejeon, Korea (Mar. 2003~Feb. 2005)**

- Two-Dimensional Image Processing of Soil Stiffness Profiles Using SPT-Uphole and HWAW Methods, Korea Institute of Construction & Transportation Technology Evaluation and Planning (KICTEP), MOCT.
- Development of NDT Equipment Using Stress Wave Propagation, KICTEP, MOCT.
- Smart Assessment of Ground and Earth Structures Using Stress Wave Propagation, SISTeC (Smart Infrastructure Technology Center), Korea Science and Engineering Foundation.

## **VI. ACADEMIC REVIEWS and SERVICES**

### **Journal Reviews**

- Computational Geosciences (1)
- Computers and Geosciences (1)
- Journal of Structural Geology (1)
- Géotechnique Letters (2)
- Frontiers (1)
- Engineering Structures (1)
- Geofluids (1)
- Journal of Geotechnical and Geoenvironmental Engineering (2)
- Engineering Geology (1)
- Fuel (1)
- KSCE Journal of Civil Engineering (2)



- Advances in Water Resources (2)
- JGR - Solid Earth (2)
- Greenhouse Gases: Science and Technology (1)
- AGU Water Resources Research (1)
- Geomechanics and Engineering (1)
- AAPG Bulletin (1)
- Earth-Science Reviews (1)
- Marine and Petroleum Geology (1)
- Geomechanics for Energy and the Environment (2)
- International Journal of Greenhouse Gas Control (9)

### Book Reviews

- “Science of Carbon Storage in Deep Saline Formations: Process Coupling Across Time and Spatial Scales”, Chapter 16 “Hydrologic, Mechanical, Thermal, and Chemical Process Coupling Triggered by the Injection of CO<sub>2</sub>”, 2017.

### Conference Proceedings Reviews

- Topic V/Rock Mechanics, Geo-Congress 2020, 2019.
- 52<sup>nd</sup> US Rock Mechanics/Geomechanics Symposium, “Coupled Processes, Fluid-Driven Fracture” and “Numerical Modeling of Civil Rock Engineering Projects”, 2018.
- Geotechnical Frontiers 2017/Sinkhole Detection, Characterization and Engineering, 2016.
- Geo-Chicago 2016 A03/Carbon Sequestration, 2015.
- 13<sup>th</sup> Annual Carbon Capture, Utilization & Storage Conference, Geomechanics Session, 2014.

### Proposal Reviews

- Proposal review: New Direction (ND) program for *ACS Petroleum Research Fund*, 2021.
- Proposal review: Doctoral New Investigator (DNI) program for *ACS Petroleum Research Fund*, 2015.

### Leaderships in International and National Organizations

- Organizing Chair of the session “Subsurface Storage and Sequestration”, Interdisciplinary Track, 55<sup>th</sup> U.S. Rock Mechanics / Geomechanics Symposium, June 20 - 23, 2021, Houston, TX, USA.
- Organizing Chair of the session “Subsurface Storage and Sequestration”, Interdisciplinary Track, 54<sup>th</sup> U.S. Rock Mechanics / Geomechanics Symposium, June 28 - July 1, 2020, Golden, CO, USA.
- Chair of the ARMA Future Leaders Selection Committee, 2019-2020.
- Organizing Chair on mini-symposium “Solid-Fluid Interactions in Emerging Energy Geosystems”, 2<sup>nd</sup> International Conference on Energy Geotechnics (ICEGT), Sept. 2020, La Jolla, CA, USA.
- International Advisory Board for the “2<sup>nd</sup> International Conference on Energy Geotechnics”, Sept. 20-23, 2020, La Jolla, CA, USA.
- Secretary of the “Rock Mechanics Committee”, Geo-Institute, ASCE, 2019 - Present.
- Organizing Chair on “Numerical Modeling of Civil Rock Engineering Projects”, 52<sup>nd</sup> US Rock Mechanics/Geomechanics Symposium, June 2018, Seattle, Washington, USA.
- Chair on “Energy Geotechnics and Sustainability”, The 6<sup>th</sup> International Young Geotechnical Engineer’s Conference, Sept. 2017, Seoul National University, Seoul, Korea.
- Chair on “Excavation”, The 6<sup>th</sup> International Young Geotechnical Engineer’s Conference, Sept. 2017, Seoul National University, Seoul, Korea.
- Organizing Chair on “CEA Joint Session: Carbon Capture, Storage, and Utilization”, US-Korea Conference 2017: Engagement Opportunities for Global Challenge, August 9-12, Washington D.C., USA.

### Leaderships in Regional and Local Organizations

- A member of the planning committee of Geo-Omaha, Omaha, NE, 2017 - Present.

## VII. TEACHING EXPERIENCES

### Assistant Professor at University of Nebraska-Lincoln, Lincoln, Nebraska

CIVE 898 Special Topics: Rock and Poromechanics	(Spring 2017, 2021, Fall 2018)
CIVE 898 Special Topics: Analytical and Numerical Methods on Multiphysical Coupling	(Spring 2018)
CIVE 436/836 Foundation Engineering	(Fall 2016, 2017, 2020)
CIVE 434/834 Soil Mechanics II	(Fall 2019)
CIVE 334 Introduction to Geotechnical Engineering	(Spring 2019, 2020)

### Assistant Professor at Western New England University, Springfield, Massachusetts

CEE 412 Petrophysics and Reservoir Geomechanics	(Spring Semester 2016)
CEE 330 Soil Mechanics & CEE 332 Soil Mechanics Lab	(Spring Semester 2016, 2015)
CEE 430 Geotechnical Engineering	(Fall Semester 2015)
CEE 411 Petroleum Fluids & Reservoir Engineering	(Fall Semester 2015)
ME 202 Statics	(Fall Semester 2015, 2014)
CEE 324 Groundwater Engineering	(Spring Semester 2015)
CEE 361 Engineering Fluid Mechanics	(Fall Semester 2014)

### Teaching Assistant & Instructor at Georgia Tech, Atlanta, Georgia

Instructor, COE 2001 Statics	(Fall Semester 2012)
Teaching Assistant, CEE 6402 Soil Mechanics	(Fall Semester 2011)
Teaching Assistant, CEE 4405 Introduction to Geotechnical Engineering	(Fall Semester 2009)

### Teaching Assistant at KAIST, Daejeon, Korea

Teaching Assistant, Soil Dynamics and Earthquake Engineering	(Spring Semester 2004)
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## VIII. Research Supports

- Assessment of greenhouse gas sequestration resources in Districts 5, 6 and 7 to improve carbon management opportunities in Nebraska, Sponsor: Nebraska Environmental Trust (July 1, 2021 – June 30, 2023, \$394,165), Seunghee Kim (PI) and Caroline Burberry (Co-PI).
- Application of biochar as carbon sequestering and beneficial additive in concrete, Sponsor: Nebraska Center for Energy Sciences Research (January 1, 2021 - December 31, 2022, \$170,000), Jiong Hu (PI), Adam Smith (Co-PI), and Seunghee Kim (Co-PI).
- Crashworthy foundations for soil-embedded roadside safety hardware, Mid-America Transportation Center (September 1, 2020 - February 28, 2022, \$351,788.49), Joshua S. Steelman (PI), Mojdeh Asadollahipajouh (Co-PI), Chung R. Song (Co-PI), Seunghee Kim (Co-PI), and Jongwan Eun (Co-PI).
- Assessing performance of geosynthetic reinforced pavement with a large-scale track wheel test and nondestructive testing tools, Mid-America Transportation Center (September 1, 2020 - February 28, 2022, \$270,000), Jongwan Eun (PI), Seunghee Kim (Co-PI), Chung R. Song (Co-PI), and Jinying Zhu (Co-PI).
- Multiscale and multiphysical testing-modeling of inorganic microfiber-reinforced engineered barrier materials (IMEBM) for enhancing repository performance, U.S. Department of Energy NEUP (September 1, 2020 - August 31, 2023, \$800,000), Jongwan Eun (PI), Seunghee Kim (Co-PI), Yong-Rak Kim (Co-PI, Texas A&M), Yifeng Wang (Co-PI, Sandia National Lab), and Carlos F. Jove-Colon (Co-PI, Sandia National Lab).
- Improvement on the treatment of recycled concrete aggregates (RCA) using CO<sub>2</sub> for its commercial application, Nebraska Department of Economic Development and Hawkins Construction Company (1:1 Match) (August 1, 2020 - July 31, 2021, \$100,000), Seunghee Kim (PI) and Jiong Hu (Co-PI).

- Characterization of hydro-mechanically coupled fluid transport in deformable porous media and application to convection-enhanced drug delivery, Nebraska Collaboration Initiative (July 1, 2020 - June 30, 2022, \$150,000), Seunghee Kim (PI), Sangjin Ryu (Co-PI), and Chi (Kevin) Zhang (Co-PI).
- Development of guideline for the use of geosynthetics in different roadway layered system in Nebraska, Nebraska Department of Transportation (July 1, 2020 - December 31, 2021, \$106,536), Jongwan Eun (PI) and Seunghee Kim (Co-PI).
- Evaluation of light pole foundation embedment, Alaska Dept. of Transportation & Public Facilities (March 1, 2020 - February 28, 2022, \$248,261), Joshua Steelman (PI), Mojdeh Asadollahipajouh (Co-PI), Seunghee Kim (Co-PI), Jongwan Eun (Co-PI), Chung Song (Co-PI), and Cody Stolle (Co-PI).
- REU Site: Sustainability of horizontal civil networks in rural areas, National Science Foundation (March 1, 2020 - February 28, 2023, \$448,597), Shannon Bartelt-Hunt (PI), Christine Wittich (Co-PI), and other collaborators (Yusong Li, Richard Wood, Daniel Linzell, Libby Jones, Joshua Steelman, Xu Li, Seunghee Kim, Jongwan Eun, and Tiffany Messer).
- Pipe-pile-based micro-scale compressed air energy storage for buildings with intermittent renewable energy resources, Nebraska Collaboration Initiative (July 1, 2019 - June 30, 2021, \$147,753), Seunghee Kim (PI), Wei Qiao (Co-PI), and Youngki Jang (Co-PI).
- Injection optimization via implementation of mechanically-coupled numerical simulations, Korea Advanced Institute of Science and Technology (July 17, 2019 - August 14, 2019, \$5,005), Seunghee Kim (PI).
- Feasibility study: Alternatives to prevent settlements and bumps at bridge approaches in Nebraska, Nebraska Department of Transportation (July 1, 2019 - December 31, 2020, \$99,469), Seunghee Kim (PI) and Jongwan Eun (Co-PI).
- Design optimization and monitoring of joint-less integral and semi-integral abutment bridges in Nebraska, Nebraska Department of Transportation (July 1, 2018 - December 31, 2019, \$142,312), Chungwook Sim (PI), Seunghee Kim (Co-PI), Jongwan Eun (Co-PI), and Chung R. Song (Co-PI).
- Utilization of CO<sub>2</sub> to improve recycled concrete aggregate (RCA), Layman Seed Funding (May 1, 2018 - April 30, 2019, \$10,000), Seunghee Kim (PI) and Jiong Hu (Co-PI).
- CPT based pile design, Nebraska Department of Roads (July 1, 2017 - December 31, 2018, \$105,846), Chung R. Song (PI) and Seunghee Kim (Co-PI).
- Development of advanced computational/experimental models to elucidate multiphase fluid transport in disordered-deformable porous media, UNL Research Council: Interdisciplinary Research Grants (January 2017 - December 2017, \$20,000), Seunghee Kim (PI) and Sangjin Ryu (Co-PI).
- Experimental study of thermophysical responses of CO<sub>2</sub> dissolution and CH<sub>4</sub> outgassing and the reaction rates during multiphase flow, Undergraduate New Investigator Grant, American Chemical Society Petroleum Research Fund (September 2016 - August 2018, \$55,000), Seunghee Kim (PI). Grant awarded but canceled due to the transition to UNL.
- Curriculum and course development grant for the Reservoir Engineering concentration within the Civil Engineering Department, Western New England University (May 2015 - August 2015, \$2,000), Seunghee Kim (PI).
  - The total budget of research projects at University of Nebraska-Lincoln (UNL): \$2,436,306.
  - Seunghee Kim's portion from the total research budget at UNL: \$1,005,368.

## IX. PATENT

- Barry, K.F., Biagini, M.S.G., Santamarina, J.C., Wall, J.J., Le Pape, Y.M.R., Lindberg, J.T., Cha, M. Dai, S., and Kim, S., Void Detection System, US 2013/0192375 A1, Georgia Institute of Technology.

## X. HONORS AND AWARDS

- ARMA (The American Rock Mechanics Association) Future Leaders, 53<sup>rd</sup> U.S. Rock Mechanics / Geomechanics Symposium, Brooklyn, NY, USA (June, 2019).
- Author Achievement Award, Bureau of Economic Geology, Austin, TX, USA (Apr. 2014).
- Best Paper Award, COMSOL Conference 2013, Boston, MA, USA (Oct. 2013).
- KKCNN Adachi Award (Best research presentation in geotechnical engineering), 17<sup>th</sup> KKCNN Symposium on Civil Engineering, Ayutthaya, Thailand (Dec. 2004).
- Korean Government Full Scholarships, Korea Advanced Institute of Science and Technology (2003-2004).

## XI. Presentations and Posters

### Oral Presentations

18. Pipe-Pile-Based Micro-Scale Compressed Air Energy Storage (PPMS-CAES) for a Building, 2<sup>nd</sup> US-Korea Geotech Workshop, University of Nebraska-Lincoln, NE, USA (October 2020).
17. Energy-Geotechnics and Pore-Scale Study on Fluid Flow in Porous Media, US-Korea Geotechnical Workshop, Athens, GA, USA (July 2019).
16. Fluid Flow in Porous Media and Application to Energy-Geotechnology, NE Microfluidics Symposium, Creighton University, Omaha, NE, USA (Oct. 2018).
15. Pore-Network Simulation and Experiments for CO<sub>2</sub> Geo-Storage, NE Fluid Dynamics Research Initiative, Lincoln, NE, USA (Dec. 2017).
14. Microfluidics: Experiments and Simulations for Energy Applications, NE Microfluidics Symposium, Lincoln, NE, USA (Oct. 2017).
13. Pore-Network Simulations for CO<sub>2</sub> Geologic Sequestration: Findings and Future Directions, US-Korea Conference 2017: Engagement Opportunities for Global Challenge, D.C. USA (Aug. 2017).
12. Hydro-Chemo-Thermo-Mechanically Coupled Analyses for CO<sub>2</sub> Geologic Storage, Invited Talk, The University of Central Florida, Orlando, FL (Jan. 2016).
11. Reactive Fluid Flow in CO<sub>2</sub> Storage Reservoirs, KAUST Athenaeum: Dissolution and Precipitation – Implications of Energy Geo-Engineering, Thuwal, Saudi Arabia (Feb. 2016).
10. Hydro-Chemo-Thermo-Mechanically Coupled Analyses for CO<sub>2</sub> Geologic Storage, Invited Talk, The Korea University, Seoul, Korea (Jan. 2016).
9. Multi-Physics and Multi-Scale Analyses for CO<sub>2</sub> Geologic Storage, Invited Talk, The University of Hong Kong, Hong Kong (Dec. 2015).
8. Multi-Physics and Multi-Scale Analyses for CO<sub>2</sub> Geologic Storage, Invited Seminar, University of Massachusetts at Amherst, Amherst, MA (Nov. 2014).
7. Geomechanics at Cranfield, 9<sup>th</sup> SECARB Briefing, Atlanta, GA (Mar. 2014).
6. Pore Pressure/Stress Coupling during Fluid Injection and Its Implications on CO<sub>2</sub> Geologic Storage, UTCCS-2, Austin, TX (Jan. 2014).

5. CO<sub>2</sub> Geologic Storage: Multi-Physic and Multi-Scale Analyses, at KAIST, KICT and KIGAM, Korea (Dec. 2013).
4. Geomechanical Analysis for DAS - Cranfield CO<sub>2</sub> Injection Site, GCCC Meeting, Houston, TX (July 2013).
3. New Results – Geomechanical Analysis for DAS, Cranfield, Joint SECARB Meeting, Austin, TX (June 2013).
2. Identification of Honeycombs in Fresh Concrete, to EPRI, Atlanta, GA (July 2011).
1. Thermo-Mechanical Crushing, Sustainability and CO<sub>2</sub> Issues, GT-ENPC Workshop, Atlanta, GA (May 2009).

### Poster Presentations

9. Hydro-Thermo-Mechanical Analysis during the Injection of Cold CO<sub>2</sub> into a Geologic Formation and the Determination of Maximum Pressure Limit, Gordon Research Conference: Carbon Capture, Utilization & Storage, Colby-Sawyer College, NH, USA (June 2017).
8. CO<sub>2</sub> Geologic Storage: Pore- and Core-Scale Study, Gordon Research Conference: Carbon Capture, Utilization & Storage, Colby-Sawyer College, NH, USA (June 2017).
7. Constant Rate or Stepwise Injection of Cold Fluid into a Geologic Formation: A Hydro-Thermo-Mechanical Analysis, 2015 AGU Fall Meeting (Dec. 2015).
6. Pore Pressure/Stress Coupling and Implications on CO<sub>2</sub> Geological Storage, BEG Symposium (Sept. 2013)
5. Engineered CO<sub>2</sub> Injection for Carbon Sequestration in Saline Aquifers, GTRIC, Georgia Tech (Feb. 2012).
4. CO<sub>2</sub> Geological Storage - Reactive Fluid Transport, 14<sup>th</sup> Sowers Symposium, Georgia Tech (May 2011).
3. CO<sub>2</sub> Geological Storage and Implications, 13<sup>th</sup> Sowers Symposium, Georgia Tech (May 2010).
2. CO<sub>2</sub> Geological Storage and Implications, 2010 Methane Hydrate Meeting, DOE (Jan. 2010).
1. Optimal Thermo-Mechanical Crushing, 12<sup>th</sup> Sowers Symposium, Georgia Tech (May 2009).

## XII. PROFESSIONAL ACTIVITIES

### Professional Certification

- PE - Nebraska, USA, 2020
- EIT - Nebraska, USA, 2017
- Registered Engineer, #: 032021301371, Korea, 2003

### Professional Affiliations

- Sigma Xi, The Scientific Research Society, Associate Member
- American Society of Civil Engineers (ASCE), Member
- The American Rock Mechanics Association (ARMA), Member
- Association of Environmental & Engineering Geologists (AEG), Member
- United States Universities Council on Geotechnical Education and Research (USUCGER), Contact Member
- American Geophysical Union (AGU), Member
- The North American Geosynthetics Society (NAGS), Member

### Professional Training

- ADSC 2016 Foundation Engineering Faculty Workshop, Chattanooga, Tennessee, June 5-10, 2016.

- Educate the Educators: A Geosynthetics Training Program for University Professors, Austin, Texas, July 28-29, 2015.
- 2015 PDCA Professor's Driven Pile Institute, Logan, Utah, June 22-26, 2015.
- Writing & Designing NSF Proposals Workshop, Boston, Massachusetts, April 9, 2015.

### **Educational Training**

- Learning by Design, University of Nebraska-Lincoln, Omaha, Nebraska, September 2019 – December 2019. Instructor: Tareq Daher.
- 2018 - 2019 Peer Review of Teaching Project, University of Nebraska-Lincoln, Lincoln, Nebraska, August 2018 – May 2019. Product: Kim, Seunghee. "Benchmark Portfolio: CIVE 334 - Introduction to Geotechnical Engineering" (2019). UNL Faculty Portfolios, 131. <https://digitalcommons.unl.edu/prtunl/131>.