# Faculty Personnel Record


***WaiChing Sun***
Assistant Professor
Department: Civil Engineering and Engineering Mechanics
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***Date:*** February 10th, 2020

***Education:***

| School | Degree | | Date |
|---|---|---|---|
| University of California, Davis | Civil Engineering | B.S. | 2005 |
| Stanford University | Civil Engineering | M.S. | 2007 |
| Princeton University | Civil Engineering | M.A. | 2008 |
| Northwestern University | Applied Mechanics | Ph.D. | 2011 |
| Sandia National Laboratories | Mechanics of Materials | Post-doc | 2013 |

***Title of Ph.D. Thesis***:

A multi-scale framework for modeling instabilities in fluid-infiltrating porous solids, PhD Dissertation, Northwestern University, June 2011.

***Field of Specialization:***

Computational Mechanics, Computational Geomechanics, Computational Poromechanics, Multiscale Modeling of Fracture, Damage, and Plasticity

***Career History:*** (list in reverse chronological order)

| Employer | Position | Beginning | Ending |
|---|---|---|---|
| Columbia University | Assistant Professor | 2014 | Present |
| Sandia National Laboratories | Sr Member of Technical Staff | 2013 | 2014 |
| Sandia National Laboratories | Postdoctoral Appointee | 2011 | 2013 |
| Caltech | Visiting Scholar | 2010 | 2011 |

***Awards/Honors Received:***

Internal (Department, School, University):

- **Provost's Diversity Award**, Columbia University, 2015.

External:

Selected individual awards received by the PI

- **John Argyris Award for Young Scientists**, the International Association for Computational Mechanics, 2020. The IACM recognizes outstanding accomplishments, particularly outstanding published papers, by researchers 40 or younger. Eligibility requires that the nominee not turn 41 in the year the award is presented. The IACM John Argyris Award for Young Scientists is sponsored by Elsevier to honor Professor John Argyris' significant contributions in the field.
- **NSF CAREER Award**, National Science Foundation (Mechanics of Materials and Structures Program, Civil, Mechanics, and Manufacturing Innovation Division), 2019. The NSF's most prestigious award in support of junior faculty who exemplify the role of teacher-scholar through outstanding research and excellent education.
- **EMI Leonardo Da Vinci Award**, the Engineering Mechanics Institute of American Society of Civil Engineers, 2018. The purpose of the award is to recognize outstanding young investigators early in their careers for promising ground-breaking developments in the field of Engineering Mechanics and Mechanical Sciences as relevant to Civil Engineering, understood in the broadest sense. The award is given annually to a young investigator, generally under 35 years of age or who has worked no more than 7 years since receiving their doctoral degree, and whose contributions show the promise of defining new directions in theory and application of Engineering Mechanics, in the vein of Leonardo da Vinci (1452-1519), a man of unquenchable curiosity and feverishly inventive imagination. The EMI of ASCE selected the PI "*for his fundamental contributions to computational multiscale poromechanics*".
- **Zienkiewicz Numerical Methods in Engineering Prize**, Institution of Civil Engineers (ICE) and John Wiley & Sons, 2017. Instituted following a donation by John Wiley & Sons Ltd to commemorate the work of Professor Olgierd Cecil Zienkiewicz CBE. DSc FRS FREng of the Institute for Numerical Methods in Engineering, University of Wales, Swansea. The medal is awarded biennially by the Institution of Civil Engineers (ICE) to a researcher under 40 for the paper which contributes most to research in numerical methods in engineering, among 8 prime peer-reviewed journals published by ICE or Wiley, i.e., Géothechnique, Géothechnique Letters, International Journal for Numerical Methods in Engineering, International Journal for Numerical Methods in Biomedical Engineering, International Journal for Numerical Methods in Fluids, International Journal for Numerical and Analytical Methods in Geomechanics, International Journal of Numerical Modelling: Electronic Networks, Devices and Fields, and ICE Proceedings.
- **AFOSR Young Investigator Program Award**, Air Force Office of Scientific Research, US Air Force, 2017. The Air Force's Young Investigator Program (YIP) award is one of the most prestigious honors bestowed by the US Air Force to outstanding scientists

beginning their independent careers. The program is designed to identify and support talented scientists and engineers who show exceptional promise for doing creative research in order to encourage their teaching and research careers.

- **ARO Young Investigator Program Award**, Army Research Office, US Army, 2015. The Army's Young Investigator Program (YIP) award is one of the most prestigious honors bestowed by the US Army to outstanding scientists beginning their independent careers. The program is designed to identify and support talented scientists and engineers who show exceptional promise for doing creative research in order to encourage their teaching and research careers.
- **Caterpillar Best Paper Prize**, Springer-Verlag Berlin Heidelberg, 2013. Selected annually among all journal articles published in *Acta Geotechnica* in 2013. Awardees include Yannis Dafalias (2014) and Franz-Josef Ulm (2012).

Other individual awards received by the PI

- **UPS Foundation Visiting Professorship**, Department of Civil and Environmental Engineering, Stanford University, 2020-2021 (offered, pending approval from Columbia University).
- **Dresden Fellowship,** Technische Universität Dresden, 2016.
- **Recognition Award,** for original work and authorship of Albany, Sandia National Laboratories, Department of Energy, 2016.
- **DURIP award**, Army Research Office and Department of Defense, 2015.
- **IUTAM Travel Fellowship**, International Union of Theoretical and Applied Mechanics, 2014.
- **USNCTAM Travel Fellowship**, 16th US National Congress of Theoretical & Applied Mechanics, 2010.
- **USACM Travel Fellowship**, 9th World Congress of Computational Mechanics, 2010.
- **NSF Travel Fellowship**, International Workshop on Multiscale and Multiphysics Processes in Geomechanics, 2010.
- **Tuition Scholarship**, Summer School on Accelerators for Science and Engineering, National Science Foundation, 2008
- **Graduate Fellowship**, Northwestern University, 2008, Princeton University, 2007, Stanford University, 2005
- **John W. and Ernestine L. Heinrich Scholarship**, University of California, Davis, 2004.
- **American Public Works Associations Scholarship**, American Public Works Associations, 2004.
- **PEER Scholarship**, Pacific Earthquake Engineering Research Center, 2004.
- **MORE Undergraduate Research Fellowship**, University of California, Davis, 2004.

Awards received by PI's students and group members since joining the research group

- **Mindlin award** (Kun Wang), Department of Civil Engineering and Engineering Mechanics, Columbia University, 2019.
- **Finalist of the Director's Postdoctoral Fellowship** (Kun Wang), Los Alamos National Laboratory, Department of Energy, 2019.

- Travel Scholarship (Kun Wang), 20th International Conference on Finite Elements in Flow Problems, Northwestern University, Evanston, 2019.
- Travel Scholarship (Kun Wang and Chuanqi Liu), Workshop on Meshfree and Particle Mechanics: Application and Theory, Santa Fe, 2018.
- **Mindlin award** (SeonHong Na), Department of Civil Engineering and Engineering Mechanics, Columbia University, 2018.
- Travel Scholarship (Eric Bryant), 3rd Biennial CO2 for EOR as CCUS conference, Petroleum Research School of Norway, 2017.
- **Dongju Lee Memorial Award** (SeonHong Na), Department of Civil Engineering and Engineering Mechanics, Columbia University, 2017.
- 2nd Place in Best Paper Student Competition (SeonHong Na), Engineering Mechanics Institute, Modeling Inelasticity and Multiscale Behavior Committee, EMI 2016 & PMC 2016, Vanderbilt University, Nashville, TN, 2016.
- Best Poster Presentation Award (Yang Liu), USNCCM San Diego, San Diego, CA, 2015.
- Travel Scholarship (Kun Wang), Society of Engineering Science Meeting at Texas A&M
- University, 2015.
- Travel Scholarship (Yang Liu), USNCCM San Diego, 2015.
- Travel Scholarship (SeonHong Na), EMI Stanford, 2015.
- Travel Scholarship (SeonHong Na), deal.ii Workshop, Texas A&M University, 2015.

***Publications***

Underline indicates supervised students and postdocs, † indicates visiting scholars, ♦ indicates corresponding author. Citation is based on google scholar data obtained on January 10th, 2020. Authorship policies include descending order of contribution (for multi-team collaborations), and placing the most experienced contributor last (for contributions solely completed by the PI's own research group).

***Papers in Refereed Journals:*** (List in Chronological Order)

2012 and earlier

J1. R.I. Borja♦, **W.C. Sun**, Estimating inelastic sediment deformation from local site response simulations, *Acta Geotechnica*, 2(3):183-195, doi: 10.10072Fs11440-007-0044-x, 2007. [PDF] (Impact factor = 3.247, number of citations=14.)

J2. R.I. Borja♦, **W.C. Sun**, Co-seismic sediment deformation during the 1989 Loma Prieta Earthquake, *Journal of Geophysical Research: Solid Earth*, Vol.113, B08314, doi:10.1029/2007JB005265, 2008. [PDF] (Impact factor = 3.59, number of citations=7.)

J3. **W.C. Sun**, J.E. Andrade♦, J.W. Rudnicki, A multiscale method for characterization of porous microstructures and their impact on macroscopic effective permeability, *International Journal for Numerical Methods in Engineering*, 88(12), 1260-1279, doi:10.1002/nme.3220, 2011. [PDF] (Impact factor = 2.746, number of citations=80.)

J4. **W.C. Sun**, J.E. Andrade♦, J.W. Rudnicki, P. Eichhubl, Connecting microstructural attributes and permeability from 3-D tomographic images of in situ compaction bands using multi-scale computation, *Geophysical Research Letter*, 38(10), L1032, doi:10.1029/2011GL047683, 2011 (featured in **EARTH magazine** September 2011 issue). [PDF] (Impact factor =4.58, number of citations=84.)

2013

J5. **W.C. Sun♦**, An unified method to predict diffuse and localized instabilities in sands, *Geomechanics and Geoengineering*, 8(22):65-75, doi:10.1080/17486025.2012.695403, 2013. [PDF] (Impact factor not available, number of citations=28.)

J6. A. Mota♦, **W.C. Sun**, J.T.Ostein, J.W. Foulk III, K.N. Long, Lie-Group interpolation and variational recovery for internal variables, *Computational Mechanics*, 52:1281-1299, doi:10.1007/s00466-013-0876-1, 2013. [PDF] (Impact factor = 3.159, number of citations=39.)

J7. **W.C. Sun♦**, J.T. Ostien, A.G. Salinger, A stabilized assumed deformation gradient finite element formulation for strongly coupled poromechanical simulations at finite strain, *International Journal for Numerical and Analytical Methods in Geomechanics*, 37(16):2755-2788, doi:10.1002/nag.2161, 2013. [PDF] (Impact factor = 2.48, number of citations= 92.)

J8. **W.C. Sun♦**, M.R. Kuhn and J.W.Rudnicki, A multiscale DEM-LBM analysis on permeability evolutions inside a dilatant shear band, *Acta Geotechnica*, 8(5):465-480, doi:10.1007/s11440-013-0210-2, 2013. (The authors received the **Caterpillar Best paper prize** in the year of 2013) [PDF] (Impact factor = 3.247, number of citations=74.)

2014

J9. **W.C. Sun♦**, Q. Chen, J.T. Ostien, Modeling hydro-mechanical responses of strip and circular footings on saturated collapsible geomaterials, *Acta Geotechnica*, 9(5):903-934, doi:10.1007/s11440-013-0276-x, 2014. [PDF] (Impact factor = 3.247, number of citations=50.)

J10. **W.C. Sun♦**, A. Mota, A multiscale overlapped coupling formulation for large deformation strain localization, *Computational Mechanics*, 54(3):803-820, doi: 10.1007/s00466-014-1034-0, 2014. [PDF] [Bibtex] [Erratum] (Impact factor = 3.159, number of citations=30.)

2015

J11. **W.C. Sun♦**, A stabilized finite element formulation for monolithic thermo-hydro-mechanical simulations at finite strain, *International Journal for Numerical Methods in Engineering*, 103(11):798-839, doi:10.1002/nme.4910, 2015. [PDF] (Impact factor = 2.746, number of citations=54.)

J12. M.R. Kuhn♦, **W.C. Sun**, Q. Wang, Stress-induced anisotropy in granular materials: fabric, stiffness, and permeability, *Acta Geotechnica*, 10(4)399-419, doi:10.1007/s11440-015-0397-5, 2015. [PDF] (Impact factor = 3.247, number of citations=56.)

J13. K. Wang, **W.C. Sun♦**, Anisotropy of a tensorial Bishop's coefficient for wetted granular materials, *Journal of Engineering Mechanics*, 143(3), B4015004, doi:10.1061/(ASCE)EM.1943-7889.0001005, 2015. [DRAFT] (Impact factor = 2.264, number of citations=26.)

J14. Y. Liu, **W.C. Sun♦**, J. Fish, Determining material parameters for critical state plasticity models based on multilevel extended digital database, *Journal of Applied Mechanics*, 88(1), 011003, doi: 10.1115/1.4031619, 2015. [PDF] (Impact factor = 2.772, number of citations=29.)

J15. Y. Liu, **W.C. Sun♦**, Z-F. Yuan, J. Fish, A nonlocal multiscale discrete-continuum model for predicting mechanical behavior of granular materials, *International Journal for Numerical Methods in Engineering*, 106(2):129-160, doi: 10.1002/nme.5139, 2015. [PDF] (Impact factor = 2.746, number of citations=61.)

2016

J16. N. Guo, J. Zhao♦, **W.C. Sun**, Multiscale analysis of shear failure of thick-walled hollow cylinder in dry sand, *Géotechnique Letters*, 6(1), 77-82, doi:10.1680/jgele.15.00149, 2016. [PDF] (Impact factor = 1.699, number of citations=17.)

J17. S. Na, **W.C. Sun♦**, Wave propagation and strain localization in a fully saturated softening porous medium under the non-isothermal conditions, *International Journal for Numerical and Analytical Methods in Geomechanics*, 40(10):1485-1510, doi:10.1002/nag.2505, 2016. [PDF] (Impact factor = 2.48, number of citations=13.)

J18. Z. Zheng,†, **W.C. Sun♦**, J. Fish, Micropolar effect on the cataclastic flow and brittle-ductile transition in high-porosity rocks, *Journal of Geophysical Research: Solid Earth*, doi:10.1002/2015JB012179, 2016. (Impact factor = 3.59, number of citations=8.)

J19. K. Wang, **W.C. Sun♦**, A semi-implicit discrete-continuum coupling method for porous media based on the effective stress principle at finite strain, *Computer Methods in Applied Mechanics and Engineering*, 304(1):546-583, doi:10.1016/j.cma.2016.02.020, 2016. [PDF] (Impact factor = 4.821, number of citations=56.)

J20. K. Wang, **W.C. Sun♦**, S. Salager, S. Na, G. Khaddour, Identifying material parameters for a micro-polar plasticity model via X-ray micro-CT images: lessons learned from the curve-fitting exercises, *International Journal of Multiscale Computational Engineering*, 14(4):389-413, doi:10.1615/IntJMultCompEng.2016016841, 2016. [PDF][Bibtex] (Impact factor = 1.016, number of citations=18.)

J21. A.G. Salinger♦, R.P. Pawlowski, Eric T. Phipps, R.A. Bartlett, G.A. Hansen, I. Kalashnikova, J.T. Ostien, **W.C. Sun**, Q. Chen, A. Mota, R.A. Muller, E. Nielsen, X. Gao. Albany: A Component-Based Partial Differential Equation Code Build on Trilinos, *International Journal of Multiscale Computational Engineering*, 14(4):415-438, doi:10.1615/IntJMultCompEng.2016017040, 2016. [PDF][Bibtex] (Impact factor = 1.016, number of citations=41.)

J22. **W.C. Sun♦**, Foreword: computational poromechanics, *International Journal of Multiscale Computational Engineering*, doi:10.1615/IntJMultCompEng.2016018596, 2016. [PDF][Bibtex] (Impact factor = 1.016, number of citations=0.)

2017

J23. K. Wang, **W.C. Sun♦**, A unified variational eigen-erosion framework for interacting fractures and compaction bands in brittle porous media, *Computer Methods in Applied Mechanics and Engineering*, 318:1-32 doi:10.1016/j.cma.2017.01.017, 2017. [PDF][Bibtex] (Impact factor = 4.821, number of citations=25.)

J24. S. Na, **W.C. Sun♦**, Computational thermo-hydro-mechanics for multiphase freezing and thawing porous media in the finite deformation range, *Computer Methods in Applied Mechanics and Engineering*, 318:667-700, doi:10.1016/j.cma.2017.01.028, 2017. (PhD Student SeonHong Na selected as runner-up for the 2017 best paper competition at EMI Nashville) [PDF] (Impact factor = 4.821, number of citations=40.)

J25. **W.C. Sun♦**, Z. Cai, J. Choo, Mixed Arlequin method for multiscale poromechanics problems, *International Journal for Numerical Methods in Engineering*, 111:624-659, doi:10.1002/nme.5476, 2017. [PDF] (Impact factor = 2.746, number of citations=20.)

J26. I. Wollny, **W.C. Sun**, M. Kaliske♦, A hierarchical sequential ALE poromechanics model for tire-water-road interaction on fluid-infiltrating roads, *International Journal for Numerical Methods in Engineering*, 112(8):909-938, doi:10.1002/nme.5537, 2017. [PDF] (Impact factor = 2.746, number of citations=9.)

J27. S. Na, **W.C. Sun♦**, H. Yoon, M. Ingraham, Effects of elastic heterogeneity on the fracture pattern and macroscopic effective toughness of Mancos Shale in Brazilian tests, *Journal of Geophysical Research: Solid Earth*, B013374, 122(8):6202-6230, doi:10.1002/2016JB013374, 2017. [URL] (Impact factor = 3.59, number of citations=26.)

J28. H. Xin†, **W.C. Sun♦**, J. Fish, a surrogate modeling approach for additive-manufactured materials, *International Journal of Multiscale Computational Engineering*, 15:525-543, doi: 10.1615/IntJMultCompEng.2017024632, 2017. (Impact factor = 1.016, number of citations=3.)

J29. H. Xin†, **W.C. Sun♦**, J. Fish, Thermo-mechanical discrete element simulations on Powder-Bed Sintering-based Additive Manufacturing, *International Journal of Mechanical*

*Sciences*, 149:373-392, doi:10.1016/j.ijmecsci.2017.11.028, 2018. [URL] (Impact factor = 4.134, number of citations=18.)

J30. O.I. Ulven†♦, **W.C. Sun**, Capturing the two-way hydro-mechanical coupling effect on fluid-driven fracture in a dual-graph lattice beam model, *International Journal for Numerical and Analytical Methods in Geomechanics*, 42(5):736-767, doi:10.1002/nag.2763, 2018. [URL] (Impact factor = 2.48, number of citations=0.)

2018

J31. K. Wang, **W.C. Sun♦**, A multiscale multi-permeability poroplasticity model linked by recursive homogenizations and deep learning, *Computer Methods in Applied Mechanics and Engineering*, 334(1):337-379, doi.org/10.1016/j.cma.2018.01.036, 2018. [URL] (Impact factor = 4.821, number of citations=39.)

J32. S. Na, **W.C. Sun♦**, Computational thermomerchanics of crystalline rock salt Part I: a combined phase field/crystal plasticity approach for single grain simulations, *Computer Methods in Applied Mechanics and Engineering*, doi:10.1016/j.cma.2017.12.022, 2018. [URL] (Impact factor = 4.821, number of citations=18.)

J33. J. Choo♦, **W.C. Sun**, Coupled phase-field and plasticity modeling of geological materials: from brit- tle fracture to ductile flow, *Computer Methods in Applied Mechanics and Engineering*, 330:1-32, doi:10.1016/j.cma.2017.10.009, 2018. [URL] (Impact factor = 4.821, number of citations=43.)

J34. J. Choo♦, **W.C. Sun**, Cracking and damage from crystallization in pores: Coupled chemo-poro-mechanics and phase-field modeling, *Computer Methods in Applied Mechanics and Engineering*, 335:347-379, doi:10.1016/j.cma.2018.01.044, 2018. [URL] (Impact factor = 4.821, number of citations=23..)

J35. **W.C. Sun♦**, T-F. Wong, Prediction of permeability and formation factors of sandstone with multiscale lattice Boltzmann/finite element simulation on microtomographic images, *International Journal of Rock Mechanics and Mining Sciences*, 106:269-277, doi:10.1016/j.ijrmms.2018.04.020, 2018. (Impact factor =3.78, number of citations=12)

J36. R. Gupta, S. Salager, **W.C. Sun♦**, K. Wang, Open-source support toward validating and falsifying discrete mechanics models using synthetic granular materials Part I: Experimental tests with particles manufactured by a 3D printer, *Acta Geotechnica*, doi:10.1007/s11440-018-0703-0, 2018. [URL] (Impact factor = 3.247, number of citations=3.)

J37. E. C.Bryant, **W.C. Sun**♦, A mixed-mode phase field fracture for secondary cracks in anisotropic brittle rocks with consistent kinematics, *Computer Methods in Applied Mechanics and Engineering*, 342:561-584, doi:10.1016/j.cma.2018.08.008, 2018. [URL] (Impact factor = 4.821, number of citations=29.)

J38. X. Zhong†, **W.C. Sun**♦, An adaptive reduced-dimensional discrete element model for dynamic responses of granular materials with high-frequency noises, *International Journal of Multiscale Computational Engineering*, 16(4):345-366, doi:10.1615/IntJMultCompEng.2018026895, 2018. [URL] (Impact factor = 1.016, number of citations=1.)

J39. L. Mishnaevsky♦, C. Linder, **W.C. Sun**, Preface: Multiscale computational analysis of complex materials, *International Journal of Multiscale Computational Engineering*, doi:10.1615/IntJMultCompEng.2018027912, 2018. (Impact factor = 1.016, number of citations=0.)

2019

J40. G. Liu†, **W.C. Sun**♦, S. M. Lowinger, Z Zheng, M Huang, J. Peng, Coupled flow network and discrete element modeling of injection-induced crack propagation and coalescence in brittle rock, *Acta Geotechnica*, 14(3):843-868, doi:10.1007/s11440-018-0682-1, 2019. [URL] (Impact factor = 3.247, number of citations=13.)

J41. K. Wang, **W.C. Sun**♦, An updated Lagrangian LBM-DEM-FEM coupling model for dual-permeability porous media with embedded discontinuities, *Computer Methods in Applied Mechanics and Engineering*, 334:276-305, doi:10.1016/j.cma.2018.09.034, 2019. [URL] (Impact factor = 4.821, number of citations=10.)

J42. K Wang, **W.C. Sun**♦, Meta-modeling game for deriving theory-consistent, micro-structure-based tractionseparation laws via deep reinforcement learning, *Computer Methods in Applied Mechanics and Engineering*, 346:216-241, doi:10.1016/j.cma.2018.11.026, 2019. [URL] (Impact factor = 4.821, number of citations=17.)

J43. A. Qinami† , E. C. Bryant, **W.C. Sun**, M. Kaliske♦, Circumventing mesh bias by r- and h-adpative techniques for variational eigen-fracture, *International Journal of Fracture*, doi:10.1007/s10704-019-00349-x, 2019. [URL] (Impact factor =2.884, number of citations=8.)

J44. C. Liu, **W.C. Sun**♦, Shift domain material point method for solids in the finite deformation range, *Computational Particle Mechanics*, *special thematic issue for Meshfree and Particle Methods for Modeling Extreme Loadings*, doi:10.1007/s40571-019-00239-y, 2019. [PDF] (Impact factor =1.566, number of citations=1.)

J45. K. Kang, **W.C. Sun**♦, Q. Du, A cooperative two-player game for automated generations of elastoplasticity theories and models with AI-guided experimentation, *Computational*

*Mechanics, special issue for Data-Driven Modeling and Simulations: Theory, Methods and Applications*, doi:10.1007/s00466-019-01723-1, 2019. [PDF] (Impact factor = 3.159, number of citations=4.)

J46. E. C. Bryant, **W.C. Sun**♦, A micromorphic-regularized anisotropic Cam-clay for capturing size-dependent anisotropy of geomaterials, *Computer Methods in Applied Mechanics and Engineering*, 354:56-95, doi:10.1016/j.cma.2019.05.003, 2019. [PDF] (Impact factor = 4.821, number of citations=1.)

*J47.* S. Na, E.C. Bryant, **W.C. Sun**♦, A configurational force for adaptive re-meshing of gradient-enhanced poromechanics problems with history-dependent variables, *Computer Methods in Applied Mechanics and Engineering*, doi:10.1016/j.cma.2019.112572, 2019. (Impact factor = 4.821, number of citations=1.) [PDF]

*J48.* Y. Heider, **W.C. Sun**♦, Phase field modeling of capillary-induced fracture in unsaturated porous media: drying-induced vs. hydraulic-driven cracking, *Computer Methods in Applied Mechanics and Engineering*, 359:112647, doi: 10.1016/j.cma.2019.112647, 2019. (Impact factor = 4.821, number of citations=3.) [PDF]

J49. H.S Suh, **W.C Sun**♦, An open-source FEniCS implementation of a phase field fracture model for micropolar continua, International Journal for Multiscale Computational Engineering, doi:10.1615/IntJMultCompEng.2020033422, 2019 (Impact factor = 1.016, number of citations=0.). [Preprint]

J50. R. Ma, **W.C. Sun**♦, FFT-based solver for higher-order and multi-phase-field fracture models applied to strongly anisotropic brittle materials and poly-crystals, *Computer Methods in Applied Mechanics and Engineering*, 362:112781 doi:10.1016/j.cma.2019.112781, 2020. (Impact factor = 4.821, number of citations=0.) [PDF]

J51. Y. Heider, K. Wang, **W.C. Sun**♦, SO (3)-invariance of graph-based deep neural network for anisotropic elastoplastic materials, *Computer Methods in Applied Mechanics and Engineering*, doi:10.1016/j.cma.2020.112875, 2020. (Impact factor = 4.821, number of citations=0.)

***In progress manuscripts:*** (List in Chronological Order)

J52. X. Zhong†, **W.C. Sun**♦, Y. Dai, A reduced-dimensional explicit discrete element solver for simulating granular mixing problems, submitted to *Granular Matter*, 2019.

J53. R. Ma, **W.C. Sun**♦, Computational thermomechanics for crystalline rock. Part II: modeling damage-plasticity, healing and precipitation creeps in strongly anisotropic polycrystalline materials, submitted to *Computer Methods in Applied Mechanics and Engineering*, 2019.

J54. H.S. Suh, D. O'Conner, **W.C. Sun**♦, A phase field model for cohesive fracture in micropolar continua, submitted to *Computer Methods in Applied Mechanics and Engineering*, 2019. [Manuscript]

J55. N. Vlassis, Ran Ma, **W.C. Sun**♦, Geometric deep learning for computational mechanics Part I: Stored elastic energy functional for anisotropic materials undergoing large deformation, submitted to *Computer Methods in Applied Mechanics and Engineering*, 2019. [Manuscript]

J56. C. Liu, **W.C. Sun**♦, ILS-MPM: An unbiased Nitsche's algorithm for frictional level set contacts via material point method, submitted to *Computer Methods in Applied Mechanics and Engineering*, 2019. [Manuscript]

J57. N. de Marchi, **W.C. Sun**♦, Shear wave splitting and polarization in fluid-infiltrating porous media with volumetric-deviatoric coupling, prepared for submission to *International Journal of Numerical and Analytical Methods in Geomechanics.*

J58. E.C. Bryant, **W.C. Sun**♦, Dynamic phase field modeling for frictional contacts of closed an branched cracks, prepared for submission to *Computer Methods in Applied Mechanics and Engineering.*

J59. K. Wang, **W.C. Sun**♦, A non-cooperative meta-modeling game for automated third-party training, validating, and falsifying constitutive laws with parallelized adversarial attacks, prepared for submission to *Computer Methods in Applied Mechanics and Engineering*.

J60. K. Wang, **W.C. Sun**♦, A multi-phase-field fracture model for brittle directional fractures of micropolar materials in the finite deformation range, prepared for submission to *Computer Methods in Applied Mechanics and Engineering*.

***Proceedings of Refereed Conferences:*** (List in Chronological Order)

C1. **W.C. Sun**, J.E. Andrade, Capturing the effective permeability of field compaction band using hybrid lattice Boltzmann/Finite element simulations, Proceedings of 9th World Congress of Computational Mechanics/APCOM 2010, Sydney, Australia, doi:10.1088/1757-899X/10/1/012077, 2010. [PDF].

C2. **W.C. Sun**, J.E. Andrade, Surface slumping of submarine slope and its relation to material instability, Proceedings of 16th US National Congress on Theoretical and Applied Mechanics, University Park, Pennsylvania, 2010. [PDF].

C3. **W.C. Sun**, J.E. Andrade, Diffuse bifurcations of porous media under partially drained conditions, *Springer Series in Geomechanics and Geoengineering*, 2:61-64, doi:10.1007/978-3-642-19630-0_16, 2011. [PDF].

C4. **W.C. Sun**, Stabilized mixed finite element modeling of unsaturated flow barrier and fractured porous media at finite strain, 17th US National Congress on Theoretical and Applied Mechanics, Michigan State University, 2014. [PDF].

C5. **W.C. Sun**, M.R. Kuhn, J.W. Rudnicki, A micromechanical analysis on permeability evolutions of a dilatant shear band, Proceedings of the 48th American Rock Mechanics Association Symposium, University of Minnesota, 2014. [PDF].

C6. Q. Chen**, W.C. Sun,** J.T. Ostien**,** Finite element analysis of hydro-mechanical coupling effects on shear failures of fully saturated collapsible geomaterials, Soil Behavior and Geomechanics GSP 236, GeoShanghai, Shanghai, China, 2014 [PDF].

C7. J. Zhao, N. Guo, **W.C. Sun**, A multiscale study of inherent anisotropy and strain localization in granular soils, 15th Asian Regional Conference on Soil Mechanics and Geotechnical Engineering, Japan, 2015.

C8. O.I. Ulven*, **W.C. Sun**, A. Malthe-Sørenssen, Fluid transport in reaction induced fractures, European Geophysical Union General Assembly, Vienna, Austria, 2015. [PDF].

C9. K. Wang, **W.C. Sun**, A semi-implicit micropolar discrete-to-continuum method for granular materials, VII European Congress on Computational Methods in Applied Science and Engineering, Crete Island, Greece, 2016. [PDF].

C10. K. Wang, **W.C. Sun**, Data-driven Discrete-continuum Method for Partially Saturated Micropolar Porous Media, 6th Biot Conference on Poromechanics - A tribute to Olivier Coussy, Paris, France, 2017.

C11. S. Na, **W.C. Sun**, A multi-phase-field anisotropic damage-plasticity model for crystalline rocks, China-Europe Conference on Geotechnical Engineering, 2018.

C12. S. Na, **W.C. Sun**, A multi-phase-field/polycrystal plasticity for rock salt: micromorphic regularized grain- boundary slip, 5th US Rock Mechanics/Geomechanics Symposium, American Rock Mechanics Association, New York, 2019.

C13. E.C. Bryant, **W.C. Sun**, A micromorphic regularized anisotropic Cam-clay model for capturing the anisotropic size effect of shale, clay and mudstone, 5th US Rock Mechanics/Geomechanics Symposium, American Rock Mechanics Association, New York, 2019.

***Books and Chapters in Books:*** (List in Chronological Order)

B1. N. Lenoir, J.E. Andrade, **W.C. Sun,** J.W. Rudnicki, In situ permeability measurement inside compaction bands using X-ray CT and lattice Boltzmann calculations, Proceedings of 3th International Workshop on X-ray CT for geomaterials, New Orleans, Louisiana, 2010. [PDF].

***Other Major Publications:***

MP1. B. Jeremic, J. Putnam, Z. Yang, K. Sett, Z. Cheng, J. Liao, G. Jie, **W.C. Sun**, Final Report: Earthquake Response of Bridge Abutment Backfills Constructed with Tire Shreds, University of California Davis, 2005. [PDF].

MP2. **W.C. Sun**, A multi-scale framework for modeling instabilities in fluid-infiltrating porous solids, PhD Dissertation, Northwestern University, June 2011. [PDF].

MP3. R. Gupta, E. Ando, S. Salager, K. Wang, **W.C. Sun**, Open source database for validating and falsifying discrete mechanics models using synthetic granular materials Part I: Experimental tests with particles manufactured by a 3D printer, *Mendeley Data*, doi:10.17632/n6t49stxrh.1, 2018. (Supplement data for verification, validation and falsification of published work Gupta et al. Acta Geotechnica [PDF].)

MP4. K. Wang, **W.C. Sun**, Discrete element traction-separation data for meta-modeling, Mendeley Data, doi:10.17632/n5v7hyny8n.1, 2019. (Supplement data for meta-modeling games published in Computer Methods in Applied Mechanics and Engineering [PDF].)

***Patents: N/A***

***Major New Products, Processes, Designs, or Systems:***

- **Albany/LCM**: The PI implemented the finite and small strain poromechanics and thermos-hydromechanics finite element capabilities in Sandia National Laboratories' Albany Multiphysics code. The PIs of this project were Andrew W. Salinger and Alejandro Mota.

- **Deal.ii/Geocentric**: The PI and his students have formulated, implemented, verified and validated a frozen soil model and a finite strain thermo-hydro-mechanics model for frozen soil with unfrozen flow inside. Furthermore, a phase field modeling framework has been implemented by the PI's team to study the propagation of a compaction band, the strongly anisotropic brittle fracture in rocks, the plastic deformation of polycrystals and the size-dependent anisotropy of natural geo-materials.

- **DPS Deep learning poromechanics simulator**: The PI and his students have formulated, implemented, verified and validated a DEM-FEM model for dry, unsaturated and saturated porous media. In the proposed model, fluid flow can be modeled via a network or a Lattice Boltzmann model. Recurrent neural networks trained via dataset fusion from experimental data and RVE sub-scale simulations are used as placeholders.

***Research Funding History:*** (List in Chronological Order, amount or portion of the award is listed for multi-PI projects*)*

The research group is currently supported by the Department of Energy, Army Research Office, Air Force Office of Scientific Research, National Science Foundation (CMMI and EAR divisions), Department of Defense, Sandia National Laboratories, the National Nuclear Security

Administration, and Columbia University. The PI received the Young Investigator Program Award from the Army Research Office in 2015, another Young Investigator Program Award from the Air Force Office of Scientific Research in 2017 and the NSF CAREER award from the Mechanics of Materials and Structures Program of National Science Foundation in 2019. **Since joining Columbia in Spring 2014 and with a $40,000 startup fund, the PI has been awarded more than 4.75 million US dollars for his own research expenses** (more than half from single-PI projects, the rest from MURI and other projects). The PI also joined forces in collaborative projects within the department, school, university and with external collaborators on various other projects with total support of **over 8.0 million dollars**. The PI has so far secured at least two single-PI or MURI grants with more than $600K of funds through open competitions from the following federal agencies: NSF, ARO, AFOSR, and DOE.

**As the Principal Investigator in Funded Single-PI Projects** (in chronological order)

1. A multiscale analysis on the moisture effect of dynamics responses of granular matters
    - Funding Agency: Army Research Office
    - Duration: 1/1/2015-9/1/2015.
    - Amount: $50,000 in total
    - PI: **W.C. Sun**

2. Modeling chemical driven fractured rocks by integrating 3D printing digenesis and multiscale computations
    - Funding Agency: Columbia University Provost's Grants Program.
    - Duration: 1/1/2015-12/31/2015
    - Amount: $15527 in total, $9472 per year
    - PI: **W.C. Sun**

3. A discrete-continuum coupling method for environmental-driven fracture in rock Funding Agency: Sandia National Laboratories
    - Duration: 6/1/2015-12/31/2017.
    - Amount: $30,000 in total, $15,000 per year
    - PI: **W.C. Sun**

4. A phase field Arlequin model for resolving non-local hydromechanical effects of porous media across time and spatial Scales
    - Funding Agency: National Science Foundation
    - Duration: 8/1/2015-7/31/2018
    - Amount: $300,000 in total, $100,000 per year
    - PI: **W.C. Sun**

5. Adaptive phase field modeling of crack and anticrack
    - Funding Agency: Extreme Science and Engineering Discovery Environment (XSEDE)
    - Duration: 9/1/2015-8/31/2016

- Amount: 50,000 Service Unit (roughly equivalent to $50, 000)
- PI: **W.C. Sun**

6. **Young Investigator Program Award**: Understanding hydro-mechanical coupling mechanism of wetted granular matters beyond the pendular regime
    - Funding Agency: Army Research Office
    - Duration: 9/1/2015-8/31/2018
    - Amount: $150,000 in total from ARO ($347,000 including cost sharing), $50,000 per year from ARO
    - PI: **W.C. Sun**

7. Cryo-mechanics of unsaturated frozen soils during freeze-thaw cycle
    - Funding Agency: Army Research Office, Department of Defense
    - Duration: 9/1/2015-9/1/2017
    - Amount: $108,889 in total, one-time expense for equipment.
    - PI: **W.C. Sun**

8. Numerical Modeling of hydraulic fracture
    - Funding Agency: Sandia National Laboratories.
    - Duration: 5/25/2016-8/31/2016
    - Amount: $20,000 in total (cost sharing from Dean's office $3,478)
    - PI: **W.C. Sun**

9. **DOE NEUP**: An integrated multiscale experimental-numerical analysis on reconsolidation of salt-clay mixture for disposal of heat-generating waste
    - Funding Agency: Department of Energy, Nuclear Energy University Program
    - Duration: 10/1/2016-9/31/2019.
    - Amount: $800,000 in total ($160,000 subcontracted to Sandia National Laboratories), $266,666 per year
    - PI: **W.C. Sun**

10. **Young Investigator Program Award**: Modeling the High-rate Responses of Wetted Granular Materials Across Scales and the Third-party Replicable Validation Exercises Utilizing 3D Printers
    - Funding Agency: Air Force Office of Scientific Research
    - Duration: 3/1/2017-2/28/2020
    - Amount: $360,000 in total, $120,000 per year
    - PI: **W.C. Sun**

11. Broaden undergraduate and high school student participation for cold-region computational geomechanics
    - Funding Agency: Army Research Office
    - Duration: 6/1/2018-5/31/2019

- Amount: $16,397 in total, $16,397 per year
- PI: **W.C. Sun**

12. Phase field modeling of ice-segregation induced fracture and thawing plasticity in frozen geomaterials with unfrozen water
    - Funding Agency: Army Research Office
    - Duration: 6/1/2018-5/31/2021
    - Amount: $360,000 in total, $120,000 per year
    - PI: **W.C. Sun**

13. INTERN: Adaptive phase field Arlequin models for material failures
    - Funding Agency: National Science Foundation
    - Duration: 1/1/2019-12/31/2019
    - Amount: $50,000, in total $50,000 per year
    - PI: **W.C. Sun**

14. **NSF Early CAREER Development Award**: Computational failure mechanics across multiple scales with deep reinforcement learning
    - Funding Agency: National Science Foundation
    - Duration: 1/1/2019-12/31/2023
    - Amount: $594,156 in total, $194,156 first year $100,000 per year afterward (with $94,156 as supplement for HPC)
    - PI: **W.C. Sun**

15. Broaden undergraduate and high school student participation for cold-region soil mechanics
    - Funding Agency: Army Research Office
    - Duration: 6/1/2019-5/31/2020
    - Amount: $10,000 in total, $10,000 per year
    - PI: **W.C. Sun**

16. **DURIP**: A TPU-enhanced deep reinforcement learning approach for automated generations of interpretable models for energetic materials across length scales
    - Funding Agency: National Science Foundation
    - Duration: 1/1/2019-12/31/2023
    - Amount: $94,156 in total, $94,156 per year
    - PI: **W.C. Sun**

**As Co-Principal Investigator in Funded Multiple-PI Projects** (in chronological order)

17. Experimental and digital rock physics in relation to hydraulic and electrical transport properties of porous sandstone
    - Funding Agency: Hong Kong Research Council
    - Duration: 6/1/2015-12/31/2015
    - Amount: $160,530 (Sun's activities: $20,000 in total)

- PI: T.F. Wong, co-PI: **W.C. Sun**

18. Collaborative Research: Alteration of mantle peridotite: Geochemical fluxes and dynamics of far from equilibrium transport
    - Funding Agency: National Science Foundation
    - Duration: 8/1/2015-7/31/2018
    - Amount: $1,968,362 in total (Sun's activities: $68,589 in total)
    - PI: P. Kelemen, co-PI: **W.C. Sun**, H. Savage, M. Stute, M. Spiegelman

19. STTR: Particulate Composite Mixing Processes
    - Funding Agency: Air Force Office of Scientific Research.
    - Duration: 2/1/2016-1/31/2018
    - Amount: $414,000 in total (Sun's activities: $182,896 in total, $91,448 per year)
    - PI: H. Yin, co-PI: **W.C. Sun**

20. GPU-accelerated computing for CUIT Habanero Cluster
    - Funding Agency: Columbia University
    - Duration: One-time equipment grant, 9/1/2018
    - Amount: $39,000 (with $39,000 matching fund), one-time expense
    - PI: P. Gentine, co-PI: D. Blei, S. Agrawal, **W.C. Sun**, H. Waisman

21. Graduate Fellowship for 13th World Congress in Computational Mechanics

    - Funding Agency: National Science Foundation
    - Duration: 1/1/2018-8/31/2018
    - Amount: $50, 000 in total, one-time expense
    - PI: **W.C. Sun**, co-PI: J. Fish, H. Waisman

22. A Combined experimental and theoretical investigation of reactive flow in brittle media with applications to solid earth geodynamics
    - Funding Agency: National Science Foundation
    - Duration: 8/1/2015-7/31/2018
    - Amount: $409,036 in total (Sun's activities: $34,298 in total)
    - PI: M. Spiegelman, co-PI: **W.C. Sun**, H. Savage, P. Kelemen

23. Purdue Workshop on Damage Mechanics Challenge
    - Funding Agency: Purdue University
    - Duration: One-time grant for workshop expense, April 2019
    - Amount: $25,000 in total
    - PI: L. Pyrak-Nolte (Purdue), co-PI: H. Yoon (Sandia), A. Bobet (Purdue), **W.C. Sun.**

24. Data-driven multiscale poromechanics – bridging scales and physics through graph-based machine learning with uncertainty quantification

- Funding Agency: Columbia University
- Duration: 1/2/2017-12/31/2019
- Amount: $150, 000 in total (Sun's activities: $100,000)
- PI: **W.C. Sun**, co-PI: Q. Du

25. **AFOSR MURI:** Integrating Multiscale Modeling and Experiments to Develop a Meso-Informed Predictive Capability for Explosives Safety and Performance
    - Funding Agency: Air Force Office of Scientific Research
    - Duration: 6/1/2019-5/31/2024
    - Amount: $7,500,000 in total (Sun's activities: $ 861,250 in total, $172,250 per year)
    - PI: T. Sewell (University of Missouri-Columbia), co-PI: H.S. Udaykumar (University of Iowa), D. Dlott (University of Illinois at Urbana-Champaign), C. Picu (Rennselaer Polytechnic Institute), S. Chauhuri (University of Illinois at Chicago), **W.C. Sun** (Columbia), S Baek (University of Iowa)

26. Collaborative Research: I-AIM: Interpretable Augmented Intelligence for Multiscale Material Discovery
    - Funding Agency: National Science Foundation
    - Duration: 9/1/2019-8/31/2021
    - Amount: $2,000,000 in total (Sun's activities: $ 418,000 in total, $209,000 per year)
    - PIs: **W.C. Sun** (Columbia), Wei Chen (Illinois Institute of Technology), Hendrik Heinz (University of Colorado), Yusu Wang (Ohio State University), Yanxin Xu (Johns Hopkins University)

**Pending grant proposals** (in chronological order)

27. Center for micromorphic multiphysics porous and particulate materials simulations within exascale computing workflows
    - Funding Agency: National Nuclear Security Administration
    - Duration: 6/1/2020-5/31/2025 (tentative, recommended for funding on 1/23/2020)
    - Amount: $16,000,000 in total (Sun's activities: $846,868 in total)
    - PI: Richard A Regueiro (Colorado), co-PIs (incomplete list): Christian Linder (Stanford), Amy Clarke (Colorado School of Mine), Khalid Alshibli (University of Tennessee), Hongbing Lu (UT Dallas), **W.C. Sun** (Columbia)

28. Broaden undergraduate and high school student participation for cold-region soil mechanics
    - Funding Agency: Army Research Office
    - Duration: 6/1/2020-8/31/2020 (tentative, recommended for funding on 1/16/2020)
    - Amount: $10,222 in total, $10,222 per year
    - PI: **W.C. Sun**

***Invited Lectures:*** (List in Chronological Order***)***

2013

I1. **W.C. Sun**, Modeling Thermo-hydro-mechanics at finite strain, UC Davis Geotechnical Seminar Series, University of California, Davis, 2013.
I2. **W.C. Sun**, Modeling multiphysical coupling effects of deformation bands across length scales, Lawrence Livermore National Laboratory, Livermore, California, 2013.
I3. **W.C. Sun**, Multiscale modeling of thermo-hydro-mechaical coupling effects in deformation band, Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, Pennsylvania, 2013.
I4. **W.C. Sun**, Modeling fully coupled hydromechanical process in porous media across different length scales, department of civil and environmental engineering, the Hong Kong Polytechnic University, Hong Kong, China, 2013.

2014

I5. **W.C. Sun**, permeability evolutions in shear band, Northeastern Granular Materials Workshop, ***keynote lecture***, Brown University, 2014.
I6. **W.C. Sun**, Modeling multi-physical responses of deformation bands in porous media across length scales, Itasca Consulting Group, Minneapolis, MN, USA, 2014.
I7. **W.C. Sun**, Modeling the multiscale deformation-diffusion process of fluid-infiltrating solids via the Arlequin method, IUTAM symposium, Evanston, 2014.
I8. **W.C. Sun**, Arlequin multiscale modeling of deformation bands, Civil Engineering Seminar, University of Illinois at Chicago, 2014.
I9. **W.C. Sun**, Two-scale modeling of shear bands in fluid infiltrating solids, Joint Materials/Solid Mechanics Seminar Series, Brown University, 2014.

2015

I10. **W.C. sun**, Computational Thermoporomechanics, University of Perugia, Perugia, Italy, 2015.
I11. **W.C. sun**, Multiscale coupling method for fluid-infiltrating porous media at the finite deformation range, Technical University of Dresden, Dresden, Germany, 2015.
I12. **W.C. sun**, Multiscale hydro-mechanical responses of geological materials, National Laboratories, Albuquerque, New Mexico, 2015.

2016

I13. **W.C. sun**, Coupling dissimilar hydromechanical models for fluid-saturated porous media from grain to field scales, Los Alamos National Laboratory, Los Alamos, New Mexico, 2015.
I14. **W.C. Sun**, Multiscale modeling for fluid-infiltrating fractured porous media, the 2015 Claude R. Hocott Lecture, Department of Petroleum and Geosystems Engineering, the University of Texas at Austin, Austin, Texas, 2015.
I15. **W.C. sun**, Concurrent and hierarchical multiscale modeling for strain localization in fluid-infiltrating porous solids, Department of Mechanical engineering, Columbia University, 2015.

I16. **W.C. Sun**, Multiscale modeling of strong and weak discontinuities in porous media, Department of Civil and Environmental Engineering, University of Hong Kong, Hong Kong, 2015.

I17. **W.C. Sun**, Concurrent and hierarchical multiscale modeling of fluid-infiltrating solids, Department of Civil and Environmental Engineering, the Hong Kong University of Science and Technology, Hong Kong, 2015.

I18. **W.C. sun**, Multiscale coupling method for fluid-infiltrating porous media at the finite deformation range, Technical University of Dresden, Dresden, Germany, 2015.

I19. **W.C. sun**, Multiscale hydro-mechanical responses of geological materials, Sandia National Laboratories, Albuquerque, New Mexico, 2015.

I20. **W.C. sun**, Coupling dissimilar hydromechanical models for fluid-saturated porous media from grain to field scales, Los Alamos National Laboratory, Los Alamos, New Mexico, 2015.

I21. **W.C. sun**, Modeling and validating a micropolar multiscale model for wetted granular matters, ***keynote Lecture***, the International Symposium on Plasticity and Its Current Applications, Keauhou Bay, Hawaii, 2016.

I22. **W.C. Sun**, Data-driven multiscale poromechanics for cold region applications, Cold Regions Research and Engineering Laboratory, US Army Corps of Engineers, Hanover, New Hampshire, 2016.

I23. **W.C. Sun**, A variational eigen-deformation model for simulating compaction band and fracture propagation in fluid-infiltrating porous media, Jointed Department Seminar, Department of Civil and Environmental Engineering, Department of Mechanical Engineering, Northwestern University, 2016.

I24. **W.C. Sun**, Multiscale discrete-continuum modeling of fluid-infiltrating, partially-frozen and quasi-brittle porous media, Lawrence Livermore National Laboratory, Livermore, California, 2016.

I25. **W.C.Sun**, Modeling fluid-infiltrating, partially-frozen and quasi-brittle porous media with nonlocal discrete-continuum techniques, Lecture Series on Interaction Modeling in Mechanized Tunneling, Ruhn-University Bochum, Germany, 2016.

I26. **W.C. Sun**, Computational mechanics for porous media in extreme environments**,** Technical University of Dresden, Germany, 2016.

I27. **W.C. Sun**, Computational geomechanics for fluid-infiltrating, thermal-sensitive and partially frozen granular materials, ***keynote lecture***, Machine-ground Interaction Consortium Workshop: Next Generation Mobility Modeling and Simulation, the Suburban Collection Showplace, 46100 Grand River Avenue, Novi, Michigan, 2016.

I28. **W.C. sun**, Some remarks on modeling fluid-infiltrating, thermal-sensitive, and partially-frozen porous media across length scales, Applied Mechanics Colloquia, John A. Paulson School of Engineering and Applied Sciences, Harvard University, 2016.

I29. **W.C. sun**, A multiscale eigenerosion method for propagating fractures in fluid-infiltrating porous media, the 4th International Workshop on Modern Trends in Geomechanics, Assisi, Italy, 2016.

2017

I30. **W.C. Sun**, Data-driven computational geomechanics, Department of Civil Engineering, the University of Hong Kong, 2017.

I31. **W.C. Sun**, Accelerating multiscale discrete-continuum modeling of fluid-infiltrating geomaterials with deep learning, Department of Civil and Environmental Engineering, Hong Kong University of Science and Technology, 2017.
I32. **W.C. Sun**, Hybrid data-driven multiscale modeling of brittle and ductile responses of fluid-infiltrating geomaterials, 2017 AFOSR Young Investigator Research Program Meeting, Basic Research Innovation and Collaboration Center (BRICC), Arlington, 2017.
I33. **W.C. Sun**, A multiscale damage-plasticity model for compaction band and fractures in anisotropic fluid-infiltrating porous media, Department of Earth Science and Engineering, Imperial College London, the United Kingdom, 2017.
I34. **W.C. Sun**, Data-driven multiscale modeling of fractured porous media with cross-validations, Lund University, Lund, Sweden, 2017.
I35. **W.C. Sun**, Data-driven multiscale geomechanics, Geomechanics Department, Sandia National Laboratories, 2017.
I36. **W.C. Sun**, A discrete-continuum coupling model for fractured porous media with embedded branched- discontinuities in the finite deformation range, Department of Civil and Environmental Engineering, Princeton University, 2017.
I37. **W.C. Sun**, A critical comparison of variational phase field and eigen-erosion modeling of fractures in fluid- infiltrating porous media: from brittle faulting to cataclastic flow, Department of Civil and Environmental Engineering, Georgia Institute of Technology, 2017.
I38. **W.C. Sun**, Data-driven computational poromechanics across length scales, Henry L. Pierce Laboratory Seminar Series, Massachusetts Institute of Technology, 2017.
I39. **W.C. Sun**, Multiscale discrete-continuum modeling of porous media in extreme environments, Department Seminar, Department of Civil and Environmental Engineering, New Jersey Institute of Technology, 2017.

2018

I40. **W.C. Sun**, A triple-scale discrete-continuum coupling method for path-dependent porous media enhanced by recurrent and recursive deep learning, ***thematic plenary lecture***, 9th International Conference on Computational Methods, Rome, Italy, 2018.
I41. **W.C. Sun**, K-fold validation for hybridized theory-based/data-driven anisotropic path-dependent constitutive models for geological materials and beyond, Naval Research Laboratory, 2018.
I42. **W.C. Sun**, A multiscale damage-plasticity model for anisotropic fluid-infiltrating crystalline rock salt, Department of Civil and Environmental Engineering, the George Washington University, 2018.
I43. **W.C. Sun**, Computational poromechanics for civil engineering at Columbia University, Research Training Group, Mineral-bonded composites for enhanced structural impact safety (GRK 2050), Technical University of Dresden and German Science Foundation, Germany, 2018.
I44. **W.C. Sun**, A meta-modeling game for deriving theory-consistent microstructure-based constitutive laws for poromechanics problems, Department of Civil and Environmental Engineering, Pennsylvania State University, 2018.

I45. **W.C. Sun**, An adaptive micromorphic-regularized Cam-clay-type model for fluid-infiltrating geological materials, Cold Regions Research and Engineering Laboratory, US Army Corps of Engineers, Hanover, New Hampshire, 2018.
I46. **W.C. Sun**, A cooperative two-player game for automated generations of elasto-plasticity theories and models with AI-guided experimentation, the 3rd Mesoscale Modeling of Explosive Initiation Workshop, Fort Walton Beach, Florida, 2018.
I47. **W.C. Sun**, Meta-modeling of geological materials: generating mathematical models by hybridizing theory and data, Los Alamos National Laboratory, 2018.
I48. **W.C. Sun**, Meta-modeling of porous media with strain localization and embedded strong discontinuities, Sandia National Laboratories, 2018.
I49. **W.C. Sun**, A multiscale damage-plasticity model for capturing brittle-ductile transition in anisotropic fluid-infiltrating porous rock, Department of Mechanical, Aerospace, and Nuclear Engineering, Rensselaer Polytechnic Institute, 2018
I50. **W.C. Sun**, A reinforcement learning approach for modeling the brittle-ductile transition in geological materials, ExxonMobil Research and Engineering Company, 2018.
I51. **W.C. Sun**, Deep-learning enabled multiscale poromechanics: from brittle fracture to ductile flow, Department of Civil and Environmental Engineering, Duke University, 2018.

2019

I52. **W.C. Sun**, Computational soil mechanics beyond critical state plasticity, Winter Workshop on Mineral-bonded Composite for Enhanced Structural Impact Safety, Technische Universität Dresden, Germany, 2019.
I53. **W.C. Sun**, Phase field damage-plasticity frameworks for fluid-infiltrating geomaterials with size-dependent anisotropy for geological disposals, Department of Civil and Environmental Engineering, Stanford University, 2019.
I54. **W.C. Sun**, A cooperative multi-agent game for automated physical model generations with AI-guided experimentation, Mesh-free Methods and Advances in Computational Mechanics Workshop, Pleasanton, California, 2019.
I55. **W.C. Sun**, A cooperative multi-agent game for self-generating/improved physics-constrained constitutive laws with AI-guided experimentations, Workshop on Computational Data Science Approaches for Materials, Los Alamos National Laboratory and Institute of Material Science, Los Alamos New Mexico, 2019.
I56. **W.C. Sun**, A micromorphic phase field framework for geomaterials with size-dependent strong anisotropy**,** Lawrence Livermore National Laboratory, Livermore, California, 2019.
I57. **W.C. Sun**, A cooperative/competitive game approach for automated derivation and validation multiscale predictive material modeling, ***Institute of Material Science Distinguished Lecture Series***, Los Alamos National Laboratory and Institute of Material Science, Los Alamos, New Mexico 2019.
I58. **W.C. Sun,** AFOSR YIP: A non-cooperative game approach for robust multiscale material modeling of wetted micropolar granular materials, Advanced Energetic Materials Tri-Service Program Review, Department of Defense, Arlington, Washington DC, 2019.
I59. **W.C. Sun**, A machine-learning meta-modeling game for generating traction-separation law for frictional interfaces across length scale, Mechanics & Geophysics Symposium, the University of California, San Diego, California, 2019.

I60. **W.C. Sun**, A non-cooperative game approach for robust multiscale material modeling of granular materials, Mechanical and Aerospace Engineering colloquium, Sibley School of Mechanical and Aerospace Engineering, Cornell University, Ithaca, New York, 2019.

I61. **W.C. Sun**, Short course on meta-modeling of complex materials, University of Nottingham, the United Kingdom, W.C. Sun, (12-13th December, 2019).

2020

I62. C. Liu, **W.C. Sun**, ILS-MPM: An Unbiased Implicit Level-set-based Material Point Method for Frictional Particulate Contact Mechanics of Deformable Particles, ***keynote lecture***, IAS workshop: Emerging scales in granular media, Institute for Advanced Study, Hong Kong University of Science and Technology, January 16 2020.

I63. **W.C. Sun**, Geometric learning and non-cooperative game for self-improving constitutive law for polycrystals, Center for Mathematical Research, Barcelona Spain (scheduled, May 11-13, 2020).

***Theses Supervised***

It is the goal of the research group to have at least one PhD student graduated per year. Since 2014, the research group has three former group members (2 PhD students and 1 postdoc) who successfully obtained tenure-track positions. PhD graduates Yang Liu and SeonHong Na became assistant professors at **Northeastern University** (USA) and **McMaster University** (Canada), respectively, in January 2019. Meanwhile, PhD graduate Kun Wang has joined the Theoretical Division of **Los Alamos National Laboratory** as a postdoctoral research scientist, and PhD student Eric Bryant had on-site interview at the Laboratory during the week of January 20th, 2020. He is expected to join the Theoretical Division during the summer of 2020. Another former postdoc research scientist Jinhyun Choo joined the **University of Hong Kong** as an assistant professor of Civil and Environmental Engineering in January 2018.

| | Total | Completed | In Progress |
|---|---|---|---|
| B.S. | N/A | | |
| M.S. | N/A | | |
| Doctoral | | | |
| As Supervisor: | 7 | 3 | 4 |
| As Reader: | 20 | 19 | 1 |

**Current research group:** 4 PhD students, 3 post-doctoral research scientist, 1 associate research scientist.

Doctoral Theses, Supervisor

1. Yang Liu, *Multiscale Modeling of Granular Materials*. Spring 2014- Spring 2016 (co-advised with Jacob Fish). *Now assistant professor at Department of Mechanical and Industrial Engineering, Northeastern University.*

2. SeonHong Na. *Multiscale thermo-hydro-mechanical-chemical coupling effects for fluid-infiltrating crystalline solids and geomaterials: theory, implementation, and validation.* Fall 2014-Fall 2018. Now *assistant professor of Civil and Environmental Engineering.*

3. Kun Wang. *From multiscale modeling to meta-modeling of poromechanics problems*. Spring 2015 to Spring 2019. Now postdoctoral research scientist, Theoretical Division of Los Alamos National Laboratory since September 15th, 2019.

4. Eric Bryant. *Capturing evolving size-dependent anisotropy from brittle fracture to plasticity for geological materials*, Fall 2016-Spring 2020 (proposal defended on 1/22/2020; will join Theoretical Division of Los Alamos National Laboratory as postdoctoral research scientist in summer 2020).

5. Nikolas Vlassis, *Geometric deep learning from multi-graphs and manifolds for computational poromechanics*, pre-qualifying exam.

6. Hyoung Suk Suh, *Multiscale modeling of ice lens growth in frozen soil under changing climate*, pre-qualifying exam.

7. Bahador Bahmani, *Non-cooperative multi-agent game for interpretable data-driven/machine learning enhanced poromechanics*, pre-qualifying exam.

Doctoral Theses, as Reader (On Thesis Committee):

1. Daniel Marasco, PhD, CEEM, successfully defined in May 2014.
2. Abdulhamit Sarac, PhD, ME, successfully defined in May 2014.
3. Lingqi Yang, PhD, successfully defended in January 2015.
4. Shuoshuo Han, Earth Science, successfully defended in January, 2015.
5. Luc Berger-Vergiat, PhD, CEEM, successfully defended in July 2015.
6. Raha Hakimdavar, PhD, CEEM, successfully defended in January 2016.
7. Zifeng Yuan, PhD, CEEM, successfully defended in January 2016.
8. Po-Chieh Liu, PhD, CEEM, successfully defined in May 2016.
9. Nan Hu, PhD, CEEM, successfully defined in August, 2016.
10. Mofstafa Mobasher, PhD, CEEM, passed qualification exam in December 2016.
11. Dimitrios Fafalis, PhD, CEEM, passed qualification exam in March 2017.
12. Lei Xu, PhD, Civil Engineering and Engineering Mechanics, November 2017.
13. Nandan H. Shetty, PhD, Civil Engineering and Engineering Mechanics, November 2017.
14. Yang Jiao, PhD, Civil Engineering and Engineering Mechanics, January 2018.
15. Ines Wollny, PhD, Technical University of Dresden, Germany, January 2018.
16. Breannan Smith, PhD. Computer Science, February 2018.
17. Yunzhe Tao, PhD, Applied Mathematics, November 2018.
18. Peter Yichen Chen, Computer Science, July 2019.
19. Raymond Yun Fei, Computer Science, July 2019.
20. Lompros Svolos, Civil Engineering and Engineering Mechanics, January 2020.

***Research Group Members***

Associate Research Scientist

1. Yousef Heider, PhD (Institute of Continuum Mechanics, University of Stuttgart, Germany), *High-strain-rate responses of geomaterials*, Fall 2018-current.

Postdoctoral Research Scientist

1. Guodong Zhang (University of Notre Dame), *Second-order optimization for geometric learning of microstructures*, Spring 2020-current.

2. Ran Ma, PhD (University of Tennessee), *Fast Fourier Transform Solver for polycrystal plasticity and fractures of reconsolidated salt*, Spring 2019-current.

3. Chuanqi Liu, PhD (Tsinghua University), *Shift domain material point method for crystal plasticity of reconsolidated salt*, Fall 2018-current.

4. SeonHong Na, PhD (Columbia University), joined McMaster University as an assistant professor in January 2019), *Phase field modeling of frozen soil in the changing climate*. Summer-Fall 2018.

5. Jinhyun Choo, PhD (Stanford University), joined McMaster University as an assistant professor in January 2018) *Phase field modeling of crystal growth induced damage in porous media*, Fall 2016-Spring 2018. *Now assistant professor at Hong Kong University.*

PhD Students

1. Yang Liu, *DEM-FEM coupling method for granular materials*. Spring 2014- Spring 2016 (co-advised with Jacob Fish). *Now assistant professor at Northeastern University.*

2. SeonHong Na. *Multiscale modeling of thermo-hydro-mechanical-chemical (THMC) coupling effects in fluid-infiltrating dual-porosity crystalline rock.* Fall 2014-Fall 2017. *Now assistant professor at McMaster University.*

3. Kun Wang, *From multiscale modeling to meta-modeling of fluid-infiltrating porous media*. Spring 2015-Spring 2019. *Now postdoctoral research scientist at Los Alamos National Laboratory.*

4. Eric C. Bryant, *Mechanics of hydraulic fracture across length scales*, Fall 2016-current. (Position held: Presidential Fellowship, 2016-2017; Guggenheim Fellowship).

5. Nikolaos N. Vlassis, *Computational crystal plasticity of geological materials*, Summer 2017-current.

6. Hyoung Suk Suh, *Image-based multiscale computational poromechanics*, Summer 2018-current. (Position held: Presidential Fellow, 2018-2019).

7. Bahador Bahmani, *Applications of combinatorics on data-driven computational mechanics*, Fall 2019-current.

Undergraduate Researchers

1. Steven Michael Lowinger (Columbia), Application of graph theory and small-world network for predicting fracture and damage in brittle rock, Fall 2016-Spring 2017.

2. Efram J Stone (Columbia), *Lattice Boltzmann simulations of flow in sandstone*, Fall 2016.

3. Imer Jasiel del Cid (Columbia), *Discrete element simulations of wetted granular materials*, Fall 2015.

4. Tracy Paltoo (Columbia), *wettability of porous media*. Fall 2018.

5. Elizabeth Rossi (George Washington University), *machine learning of granular responses*, Summer 2019.

High School Summer Interns

1. Brooke Lauren (Mother Seton Regional High School), co-advised with PhD student Eric Bryant, *Army Educational Outreach Program*, Summer 2018.

2. Anish Avasthi (Woodlands High School), co-advised with PhD student Eric Bryant, *Army Educational Outreach Program*, Summer 2018.

3. Sophia Wong (Brooklyn Amity School), *Army Educational Outreach Program*, Summer 2019.

Short-Term Visiting Students (from other universities)

1. Guang Liu, Wuhan University, China), *DEM modeling of hydraulic fracture*, 9/2014-9/2015.

2. Haohui Xin ( Tongji University, China), *Multiscale modeling of selective laser sintering*, 9/2015-8/2017.

3. Zheyuan Zheng (Southeast University), *Brittle-ductile transition of rock*, 9/2014-9/2015.

4. Federica Ronchi (University of Perugia, Italy), *Numerical implementation of finite strain critical state plasticity model in the finite deformation range*, 2/2015-5/2015.

5. Ning Liu (BeiHang University), *Discrete element modeling of salt,* 9/2015-06/2016.

6. Zhilin Liu (Nanjing University of Science and Technology), *SPH modeling of soil-tire interaction*, 9/2015-06/2016.

7. Ole Ivar Ulven, (University of Oslo, Norway), *Discrete element modeling of brittle fracture*, 1/2016-2/2016, 9/2016-10/2016.

8. Luca Tassini (University of Perugia, Italy), *Climate-controlled undrained triaxial compression tests for freezing and thawing soils*, 2/2016-8/2016.

9. Xinran Zhong (Tongji University, China), *Proper orthogonal decomposition method for discrete element simulations*, 9/2016-09/2018.

10. Xin Qin (Tsinghua University, China), *Proper orthogonal method for dynamic responses of soil*, 9/2016-9/2017.

11. Yingfeng Sun (China University of Mining and Technology-Beijing, China), *Digital rock physics for dual-porosity media*, 09/2017-09/2018.

12. Aurel Qinami (Technical University of Dresden, Germany), *Adaptive remeshing for eigen-fracture model*, 10/2017-3/2018.

13. Nico De Marchi (University of Padova, Italy), *Shear wave splitting in anisotropic rock,* 09/2018 - 02/2019.

14. Feng Du, (China University of Mining and Technology-Beijing, China), *Digital rock physics for dual-porosity media*, 09/2018 - 09/2019.

15. Alessandro Milleri (University of Perugia, Italy), *Undrained stress path of frozen sand,* 10/2018 - 03/2019.

16. Nico De Marchi (University of Padova, Italy), *Shear wave splitting of porous media,* 8/1/2018 – 1/31/2019.

17. Marta Morao (University of Padova, Italy), *Recurrent neural network for learning traction-separation laws,* 9/1/2019 – 1/31/2020.

18. Sara Michieletto (University of Padova, Italy), *Deep learning for traction-separation laws,* 9/1/2019 – 1/31/2020.

***Under-represented Group Mentoring***

- Currently mentoring and supervising one undergraduate student from an under-represented group to conduct research and provide career advice.

- Graduated one female PhD student (Yang Liu) who landed a postdoc position at MIT, followed by a tenure-track position at Northeastern.

- Graduated two MS research students (Francisco Contreras and Xian Zhang) from under-represented groups.

- Mentored one undergraduate research student (Imer Jasiel del Cid) from a minority group who successfully presented research results in the form of a manuscript and secured an engineering position at Boeing.

- Secured support from the Army Research Office to support students from under-represented groups to conduct research with the PI for two consecutive years.

***Teaching Experience***

| Term | Subject Number | Title | Role (Lecturer, Lab, Recitation) |
|---|---|---|---|
| Spring 2014 | CIENE3141 | Soil Mechanics | Lecturer |
| Fall 2014 | ENMEE6320 | Computational Poromechanics | Lecturer |
| Spring 2015 | CIENE3141 | Soil Mechanics | Lecturer |
| Fall 2015 | CIENE4253 | Finite Elements for Geotechnical Eng. | Lecturer |
| Spring 2016 | CIEN3141 | Soil Mechanics | Lecturer |
| Fall 2016 | ENMEE6320 | Computational Poromechanics | Lecturer |
| Spring 2017 | CIEN3141 | Soil Mechanics | Lecturer |
| Fall 2017 | CIENE4253 | Finite Elements for Geotechnical Eng. | Lecturer |
| Spring 2018 | CIEN3141 | Soil Mechanics | Lecturer |
| Fall 2018 | ENMEE6320 | Computational Poromechanics | Lecturer |
| Spring 2019 | CIEN3141 | Soil Mechanics | Lecturer |

***Teaching Innovations***
***Indicate any teaching innovations if applicable such as architecting and offering a new course; new teaching methods for a course; new laboratory elements; new on-line elements***

Introduction of a new PhD level graduate course titled Computational Poromechanics. Course description: A fluid infiltrating porous solid is a multiphase material whose mechanical behavior is significantly influenced by the pore fluid. In particular, the diffusion, advection, capillarity, heating, cooling and freezing of the pore fluid as well as the build-up of pore pressure and mass exchanges among the solid and fluid constituents might all influence the stability and integrity of the solid skeleton, causing shrinkage, swelling, fracture or liquefaction. These coupling phenomena are important for numerous disciplines, including, but not limited to, geophysics, biomechanics, and material science. The objective of this course is to present the fundamental principles of poromechanics essential for engineering practice and to prepare students for more advanced studies on mechanics of porous media. This course covers a selected number of topics including, Biot's poroelasticity, mixture theory, constitutive modeling of path independent and

dependent multiphase materials, numerical methods for parabolic and hyperbolic systems, inf-sup condition, stabilization procedures for mixed finite element models, explicit and implicit time integrators, and operator splitting techniques for numerical simulations of poromechanics problems.

***Teaching Evaluations***: (Included Term, number of students, course evaluation score (mean), and instructor evaluation score (mean))

**A.** Courses taught in 2013-2014 (include enrollments and evaluations of courses and instructor)
Fall 2013: Employment not yet started.
Spring 2014: CIENE3141 Soil Mechanics (enrollment = 47, evaluation of course and instructor= (3.29, 3.12), response rate: 36%)

**B.** Courses taught in 2014-2015 (include enrollments and evaluations of courses and instructor)
Fall 2014: ENMEE6320 Computational Poromechanics (enrollment = 12, evaluation of course and instructor = (3.40, 3.85), response rate: 69%)
Spring 2015: CIENE3141 Soil Mechanics (enrollment = 42, overall evaluations of course and instructor = (3.33, 3.33), response rate: 28%)

**C.** Courses taught in 2015-2016
Fall 2015: CIENE4253 Finite Elements for Geotechnical Engineering (enrollments = 6, evaluations of course and instructor = (4.37, 4.62), response rate: 100%),
Spring 2016: CIENE3141 Soil Mechanics (enrollment = 28, overall evaluation of course and instructor = (2.45, 2.55), response rate: 27%)

**D.** Courses taught in 2016-2017
Fall 2016: ENMEE6320 Computational Poromechanics (enrollment = 7, evaluation of course and instructor= (4.75, 5.00), response rate: 60%)
Spring 2017: CIENE3141 Soil Mechanics (enrollment = 27, overall evaluation of course and instruction= (3.11, 3.33), response rate: 33%)

**E.** Courses taught in 2017-2018
Fall 2017: CIENE4253 Finite Elements for Geotechnical Engineering (enrollment = 5, evaluation of course and instructor= (4.75, 5.00), response rate: 60%)
Spring 2018: CIENE3141 Soil Mechanics (enrollment = 22, overall evaluation of course and instruction= (2.50, 2.17), response rate: 27%)

**F.** Courses taught in 2018-2019
Fall 2018: ENMEE6320 Computational Poromechanics (enrollment = 3, evaluation of course and instructor= (4.75, 5.00))
Spring 2019: CIENE3141 Soil Mechanics (enrollment = 28, overall evaluation of course and instructor= (3.20, 2.9, response rate: 36%).

**G.** Courses taught in 2019-2020

Fall 2019: CIENE4253 Finite Elements for Geotechnical Engineering (enrollment = 8, evaluation of course and instructor= (4.00, 4.00), response rate: 87.5%)
Spring 2020: CIENE3141 Soil Mechanics (enrollment = 23, in progress)

***Outreach Efforts:*** (General Public, Media, K-12, Under-Represented Groups)

- Participated in Inside Engineering Lab Visits and hosted Academy of the Holy Angels from New Jersey for a site visit and guest lecture.

- Secured grant from Army Research Office to host high school students for summer research in Summer 2018, summer 2019 and summer 2020.

***Service:***

| Activity | Beginning | Ending |
|---|---|---|
| Department Level | | |
| Member of Graduate Admission Committee, CEEM | 2016 | Current |
| Member of Faculty Search Committee, CEEM | 2016 | 2016 |
| Academic Advisor for Master Students | 2014 | Current |
| Examiner for PhD Screening Exam | 2014 | 2016 |
| Guest Lecturer, Inside Engineering Lab Visit | 2017 | 2017 |
| | | |
| School Level | | |
| Reviewer of the SEAS SIR Seed Fund Program | 2018 | 2019 |
| Artificial Intelligence Working group | 2020 | Current |
| | | |
| University Level | | |
| Reviewer of the RISE program | 2018 | 2019 |

***Professional Service:***
(Proposal Reviewing; Editorial Work; National Committee Work; Conference organization, etc)

Proposal Reviewer and Panelist for the Following Government Agencies:

- Army Corps of Engineers
- Army Research Laboratories
- Army Research Office
- Department of Energy (Nuclear University Program, Scientific Discovery through Advanced Computing)
- European Union Liaison Office (Cellule Europe)
- Germany Research Foundation (Deutsche Forschungsgemeinschaft)
- Hong Kong Research Council
- National Science Foundation ((Division of Civil, Mechanical and Manufacturing Innovation, Division of Earth Sciences, Computational and Data-enabled Science and Engineering Programs)
- Sandia National Laboratories

Editorial Work

- Associate Editor, Computer Modeling in Engineering and Sciences, 2018-current.
- Editorial Broad Member, International Journal for Multiscale Computational Engineering, 2016-current
- Guest Editor, Special issue for computational Poromechanics, International Journal for Multiscale Computational Engineering, 2016
- Guest Co-editor, with Gregory Wagner (Northwestern) and Miugel Bessa (TU Delft), Data-driven computational Modeling and simulations, Computer Modeling in Engineering and Sciences, 2018.
- Guest Co-editor, with Christian Linder (Stanford) and Leon Mishnaevsky (TU Denmark), Multiscale Multiphysics modeling of materials, International Journal for Multiscale Computational Engineering, 2018.

National Committee Work

- Co-chair, Machine Learning and Digital Twins for Computational Science and Engineering, San Diego, 2021.
- Member, Technical Program Committee, 16th US National Congress on Computational Mechanics, Chicago, 2021.
- Track chair, Mechanical Engineering, Engineering Mechanics and Civil Engineering, 2020, Machine Learning in Science and Engineering Conference, Columbia University, New York City, 2020.
- Co-chair & member of Local Organizing Committee, ASCE Engineering Mechanics Conference New York City, 2020.
- Member, International Advisory Board, 2nd International Conference on Energy Geotechnics, La Jolla, CA, 2020.
- Committee Member, Organizing Committee, 5th Rock Mechanics/Geomechanics Symposium, New York City, 2019.
- Committee Member, Organizing Committee, Engineering Mechanics Conference, Caltech, 2019.
- Committee Member, Organizing Committee, the United State Congress of Computational Mechanics, Austin, Texas, 2019.
- Committee Member, Organizing Committee, 5th International Workshop on Rock Physics, Hong Kong, 2019.
- Co-chair, Geomechanics and Geomaterials Track, ASCE Engineering Mechanics Institute Conference, Caltech, 2019.
- Chair, Planning Team, Workshop on Verification and Validation of Computational Models Associated with the Mechanics of Materials, the Minerals, Metals and Materials Society, 2018.
- Committee Member, Computational Mechanics Committee, ASCE Engineering Mechanics Institute, since 2017.
- Committee Member, Granular Mechanics Committee, ASCE Engineering Mechanics Institute, since 2017.
- Committee Member, Elasticity Committee, ASCE Engineering Mechanics Institute, since 2017.
- Committee Member, Poromechanics Committee, ASCE Engineering Mechanics Institute

- Committee Member, Computational Geotechnics Committee, ASCE Geo-Institute, since 2017.
- Committee Member, International scientific committee member of the Engineering Mechanics Institute International Conference at Hong Kong Polytechnic University (2015).
- Committee Member, Digital Rock and Granular Physics, EMI Stanford (2015).
- Committee Member, Multiscale Modeling of Granular Materials, 13th US National Congress on Computational Mechanics, San Diego (2015).
- Committee Member, Multiphysical Modeling of Geomaterials, 13th US National Congress on Computational Mechanics, San Diego (2015).

Organizer of Domestic and International Conferences and Professional Meetings:

- Lead organizer, Mini-symposium on Computational Geomechanics, 15th US National Congress on Computational Mechanics, Austin, Texas (2019).
- Co-organizer, Mini-symposium on Crystalline and Anisotropic Rock Mechanics, Engineering Mechanics Institute Conference, Caltech, Pasadena (2019).
- Co-organizer, Mini-symposium on Computational Geomechanics, Engineering Mechanics Institute Conference, Caltech, Pasadena (2019).
- Co-organizer, Mini-symposium on Additive Manufacturing and Digital Rock Physics for Granular and Fractured Materials, 20th International Conference on Fluid Flow Problems (FEF-2019), Northwestern University, Evanston (2019).
- Lead Organizer, Mini-symposium on Computational Geomechanics, Computational Geomechanics Mini-symposium at Engineering Mechanics Institute Conference, Boston (2018).
- Lead Organizer, Computational Geomechanics Mini-symposium at 18th US National Congress of Theoretical and Applied Mechanics, Northwestern University (2018).
- Co-organizer, International Symposium on Multiscale Computational Analysis of Complex Materials, Copenhagen/Lyngby, Denmark (2017).
- Local Organization Committee of World Congress of Computational Mechanics New York (2018).
- Primary Convener, Data-driven and theoretical approaches for modeling, prediction, analysis of thermo- hydro-mechanical behaviors of frozen soil and rocks, AGU Fall Meeting 2017 (2017).
- Computational Geomechanics Mini-symposium at 14th US National Congress on Computational Mechanics, Montreal, Canada (2017).
- Computational Geomechanics Mini-symposium at Engineering Mechanics Institute Conference, San Diego (2017).
- Mini-symposium on Fluid- and chemical-driven fractures of porous media, AGU Fall Meeting, San Francisco (2016).
- Failure and Instabilities in Soft Materials and Geomaterials Mini-symposium at the 7th International Conference on Computational Methods, Berkeley (2016).
- Mini-symposium on Multiscale Multiphysical Process in Fractured Rock and Modeling of Coupled Transport Phenomena in Fracture Networks, AGU Fall Meeting, San Francisco (2016).
- Symposium on Computational Mechanics of Materials and Structures, University of

Maryland, College Part Marriott Hotel and Conference Center (2016).
- Mini-symposium on Computational Geomechanics, Engineering Mechanics Institute, ASCE, Nashville (2016).
- Symposium on Computational Mechanics of Materials and Structures, SES Meeting, University of Maryland, College Park (2016).
- Failure and Instabilities in soft materials and geomaterials, The 7th International Conference on Computational Methods, Berkeley, CA (2016).
- Digital Rock Physics, 3D Printing and More, Mineral and Rock Physics Sessions, AGU 2014 Fall Meeting, San Francisco (2015).
- Computational Geomechanics Symposium at the United States National Congress of Theoretical and Applied Mechanics at Michigan State University (2014).

Reviewer of Peer-reviewed Journals:
- Acta Geotechnica
- ASCE Journal of Geotechnical and Geo-environmental Engineering
- ASCE Journal of Engineering Mechanics
- Computer Methods in Applied Mechanics and Engineering
- Computer and Geotechnics
- Computational Particle Mechanics
- Computational Mechanics
- European Journal of Mechanics A/Solids
- European Journal of Civil Engineering
- Finite Element Analysis and Design
- Granular Matters
- Géotechnqiue
- Géotechnqiue Letters
- International Journal of Fracture
- International Journal for Multiscale Computational Engineering
- International Journal for Numerical and Analytical Methods in Geomechanics
- International Journal for Numerical Methods in Engineering
- International Journal of Solids and Structures
- International Journal of Plasticity
- Journal of Geophysical Research (Solid Earth)
- Journal of Fluid Mechanics
- Journal of the Mechanics and Physics of Solids
- Meccanica
- Mechanics of Materials
- Mechanics Research Communication
- Nature Scientific Reports
- Soil Dynamics and Earthquake Engineering
- the Geological Society of America Bulletin

Reviewer for the Conferences and Professional Meetings:
- Engineering Mechanics Institute Conference, Caltech, California, 2019.

- 51th US Rock Mechanics/Geomechanics Symposium, San Francisco, 2017.
- Engineering Mechanics Institute International Conference, Hong Kong, 2015
- Engineering Mechanics Institute Conference, Stanford, California, 2015.
- ASCE GeoFlorida 2010: Advances in Analysis, Modeling and Design, Florida, 2010.

***Current Professional Organization Membership:***

- Member, GAMM Gesellschaft für Angewandte Mathematik und Mechanik, 2016-current
- Member, Engineering Mechanics Institute, 2014-current
- Member, American Society of Civil Engineers, 2014-current
- Member, American Society of Mechanical Engineers, 2014-current
- Member, International Society of Porous Media, 2014-current
- Member, Sigma Xi the scientific research society, 2013-current
- Member, American Geophysical Union, 2010-current
- Member, UC Davis Chapter, the Honor Society of Phi Kappa Phi, since 2003
- Member, California Lambda Chapter, Tau Beta Pi, since 2003
- Member, UCAD Chapter, Golden Key International Honor Society, since 2003