

# Ryan C. Hurley

Assistant Professor of Mechanical Engineering  
Faculty Fellow of the Hopkins Extreme Materials Institute  
Johns Hopkins University, 3400 North Charles Street, Malone 140, Baltimore MD, 21218  
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## PROFESSIONAL PREPARATION

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Lawrence Livermore National Laboratory	Computational Geosciences	Postdoc, 10/2015-11/2017
California Institute of Technology	Applied Mechanics	Ph.D., 9/2015
California Institute of Technology	Applied Mechanics	M.S., 6/2012
University of Maryland, College Park	Civil Engineering	B.S., 6/2011

## APPOINTMENTS

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Assistant Professor, Mechanical Engineering, Johns Hopkins University (JHU)	1/2018-Present
Faculty Fellow, Hopkins Extreme Materials Institute, JHU	1/2018-Present
Assistant Professor (Secondary Appointment), Civil & Systems Engineering, JHU	3/2020-Present
Lecturer, WSE Engineering for Professionals (EP), JHU	1/2022-Present
Postdoctoral Research Staff Member, Lawrence Livermore National Laboratory	10/2015-11/2017
Assistant Research Professor of Mechanical Engineering, JHU	10/2015-12/2017
Graduate Research Assistant, California Institute of Technology	10/2011-9/2015

## AWARDS AND HONORS

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Air Force Office of Scientific Research (AFOSR) Young Investigator Program (YIP) Award	2022
2021 Best Paper Award, Journal of American Ceramic Society, for two papers titled “Models for the behavior of boron carbide in extreme dynamic environments” and “Fragmentation and granular transition of ceramics for high rate loading”. Awarded at MS&T22.	2022
Army Educational Outreach Program (AEOP) Mentor of the Year Award	2021
U.S. National Science Foundation (NSF) CAREER Award, PMP Program, CBET Division	2020
Secretary’s Appreciation Award, U.S. DOE, for contributions to the Source Physics Experiment	2017
1st Place, Young Stress Analyst Competition, ICEM16 Conference (Cambridge, UK)	2014
1st Place, Computational Mechanics Poster Competition, EMI Conference (Evanston, IL)	2013
University of Maryland Presidential Scholarship	2007-2011
A. James Clark School of Engineering Scholarship	2007-2011

## STUDENT / MENTEE AWARDS AND HONORS

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<b>Adyota Gupta (Ph.D. student)</b> – Audience Vote for Best Poster in Interactions Matter Session of 2021 Society of Engineering Science Conference	2021
<b>Brett Kuwik (Ph.D. student)</b> – Judge’s Vote for Best Poster in Interactions Matter Session of 2021 Society of Engineering Science Conference	2021
<b>Max Garcia (Undergraduate Student)</b> – Judge’s Vote for Best Poster (2nd Author) in Interactions Matter Session of 2021 Society of Engineering Science Conference	2021

## JOURNAL PUBLICATIONS

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**Hurley current Postdoc advisee at Johns Hopkins University**

**Hurley current Ph.D. or M.S. advisee at Johns Hopkins University**

**Hurley current Undergraduate or High School advisee at Johns Hopkins University**

**\*Hurley as PI and corresponding author at Johns Hopkins University**

**§Hurley as PI and corresponding author while at Lawrence Livermore National Lab**

**†Hurley's advisee or co-advisee at Johns Hopkins University as corresponding author**

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### Manuscripts In Review

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4. **A. Gupta**, K.T. Ramesh & **R.C. Hurley\*** (2023). An Inclusion Model for Predicting Granular Elasticity Incorporating Force Chain Mechanics, *In review*.
  3. **R.C. Hurley\***, **G. Shahin**, **B.S. Kuwik**, & **K. Lee** (2023). Assessing Continuum Plasticity Postulates with Grain-Scale Stress and Strain Measurements in Triaxially-Compressed Sand, *In review*.
  2. **G. Shahin**, **C. Zhai**, **R.C. Hurley\*** (2023). Micromechanics of bonded granular materials investigated through x-ray tomography and x-ray diffraction, *In review*.
  1. M. Bhat M I, **R.C. Hurley**, & T.G. Murthy (2023). Micro mechanics of contact-bound cohesive granular materials in confined compression, *In review*.
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### Published, In Press, or Accepted

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40. **R.C. Hurley\***, D.C. Pagan, E.B. Herbold, & **C. Zhai** (2023). Examining the applicability of micromechanics theories for cementitious composites using *in-situ* X-ray measurements, *International Journal of Solids and Structures*, 267, 112162.
39. X. Sun, **B.S. Kuwik**, Q. Yang, S. Chocron, **R.C. Hurley**, R.A. Haber, J. C. LaSalvia, K.T. Ramesh. (2023). Effects of Particle Size, Shape and Loading Rate on the Normal Compaction of an Advanced Granular Ceramic, *Powder Technology*, 417, 118243.
38. **B. Kuwik**, **G. Kim**, **C. Zhai**, **M. Daud**, & **R.C. Hurley\*** (2023). Roughness and humidity effects on contact, friction, and contact plasticity revealed by micromechanical testing and analysis, *Tribology International*, 178(B), 108075.
37. **M. Thakur**, N. Axel Henningsson, J. Engqvist, P.O. Autran, J.P. Wright, & **R.C. Hurley\*** (2023). On mesoscale modeling of concrete: Role of heterogeneities on local stresses, strains, and representative volume element, *Cement and Concrete Research*, 163, 107031.
36. **G. Shahin** & **R.C. Hurley\*** (2022). Micromechanics and strain localization in sand in the ductile regime, *Journal of Geophysical Research - Solid Earth*, 127, e2022JB024983.
35. **B. Kuwik**, **M. Garcia**, & **R.C. Hurley\*** (2022). Experimental breakage mechanics of confined granular media across strain rates, *International Journal of Solids and Structures*, 259, 112024.
34. **G. Shahin** & **R.C. Hurley\*** (2022). HP-TACO: A High-Pressure TriAxial COmpression Apparatus for *In-Situ* X-ray Measurements in Geomaterials, *Review of Scientific Instruments*. 91, 113907.
33. **K. Lee**, & **R.C. Hurley\*** (2022). Force inference in 3D granular materials: Uncertainty analysis and application to force statistics in 3D, *Physical Review E*, 105, 064902.
32. **R.C. Hurley\*** & **C. Zhai** (2022). Opportunities and needs for measuring time-resolved force chain evolution in 3D granular materials, *Papers in Physics*, 14, 140003.
31. A. Bhattacharjee, **R.C. Hurley**, L. Graham-Brady (2022). Fragmentation and granular transition of ceramics for high rate loading, *Journal of the American Ceramic Society*, 105 (5), 3062-3080.
30. **C. Zhai**, **N. Albayrak**, J. Engqvist, S.A. Hall, J. Wright, M. Majkut, E.B. Herbold, & **R.C. Hurley\*** (2022). Quantifying local rearrangements in 3D granular materials: rearrangement measures, correlations, and relationship to stresses, *Physical Review E*, 105 (1), 014904.
29. **G. Shahin**, E.B. Herbold, S.A. Hall, & **R.C. Hurley\*** (2022). A hierarchy of length scales in the mechanical behavior of 3D granular materials, *Extreme Mechanics Letters*, 51, 101590.
28. K.T. Ramesh, L. Graham-Brady, W. Goddard, **R.C. Hurley**, M. Robbins, A. Tonge, A.L. Tonge, A. Bhattacharjee, J.T. Clemmer, Q. Zeng, W. Li, Y. Shen, Q. An, N. Mitra. (2021). Models for the behavior and failure of boron carbide in extreme dynamic environments, *Journal of the American Ceramic Society*, 105 (5), 3043-3061.

27. **A. Gupta**, R. Crum, **C. Zhai**, K.T. Ramesh, & **R.C. Hurley\*** (2021). Measuring particle-scale 3D granular dynamics during rapid compression from 2D X-ray images, *Journal of Applied Physics*, 129: 225902.
26. A. Bhattacharjee, A. Bhaduri, **R.C. Hurley**, L. Graham-Brady (2021). Failure modeling and sensitivity analysis of ceramics under impact, *Journal of Applied Mechanics*, 88(5), 051007.
25. D. Wei,, **R.C. Hurley**, L.H. Poh, D. Dias-da-Costa, & Y. Gan (2020). The role of particle morphology on concrete fracture behavior: A meso-scale modelling approach. *Cement and Concrete Research*, 134, 106096.
24. **C. Zhai**, E.B. Herbold, & **R.C. Hurley\*** (2020). The influence of structure and forces on ultrasound transmission in granular media, *Proceedings of the National Academy of Sciences*, 117 (18), 16234-16242.
23. **M. Cil**<sup>†</sup>, Q. Zeng, **R.C. Hurley**, & L. Graham-Brady (2020). An integrative model for the dynamic behavior of brittle materials based on microcracking and breakage mechanics, *Journal of the Dynamic Behavior of Materials*, 1-17.
22. Stamati, O., Andò, E., E. Roubin, R. Cailletaud, M. Wiebicke, G. Pinzon, C. Courture, **R.C. Hurley**, et. al. (2020). spam: Software for Practical Analysis of Materials, *Journal of Open Source Software*, 5 (51), 2286.
21. **C. Zhai**, D.C. Pagan, & **R.C. Hurley\*** (2020). *In-situ* X-ray tomography and 3DXRD measurements of cemented granular materials. *JOM*, 72, 18-27.
20. **Cil, M.**<sup>†</sup>, **R.C. Hurley**, & L. Graham-Brady (2020). A constitutive model for brittle granular materials considering the competition between breakage and dilation, *Journal of Engineering Mechanics*, 146(1), 04019110.
19. **R.C. Hurley\*** & J.D. Hogan (2020). Workshop on Mathematical Challenges in Brittle Material Failure. *Journal of the Dynamic Behavior of Materials*, 6, 14-23.
18. **C. Zhai**, E.B. Herbold, S.A. Hall, & **R.C. Hurley\*** (2019). Particle rotations and energy dissipation during mechanical compaction of granular materials. *Journal of the Mechanics and Physics of Solids*, 129, 19-38.
17. **M. Cil**<sup>†</sup>, **R.C. Hurley**, & L. Graham-Brady (2019). A rate-dependent constitutive model for brittle granular materials based on breakage mechanics. *Journal of the American Ceramic Society*, 102(9), 1-11.
16. **R.C. Hurley\*** & D.C. Pagan (2019). An *in-situ* study of stress evolution and fracture growth during compression of concrete. *International Journal of Solids and Structures*, 168, 26-40.
15. **R.C. Hurley\***, E.B. Herbold, & D.C. Pagan (2018). Characterization of crystal structure, kinematics, stresses, and rotations in angular granular quartz during compaction. *Journal of Applied Crystallography*, 51(4), 1021-1034.
14. J.P. Marshall, **R.C. Hurley**, A.D., I. Vlahinic, C. Senatore, K. Iagnemma, B. Trease, & J.E. Andrade (2018). Failures in sand in reduced gravity environments. *Journal of the Mechanics and Physics of Solids*, 113, 1-12.
13. **R.C. Hurley**<sup>§\*</sup>, J. Lind, D.C. Pagan, M.C. Akin, & E.B. Herbold (2018). *In situ* grain fracture mechanics during uniaxial compaction of granular solids. *Journal of the Mechanics and Physics of Solids*, 112, 273-290.

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Above This Line: Research Substantially or Fully Executed at Johns Hopkins University

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12. O. Vorobiev, S. Ezzedine, & **R.C. Hurley** (2018). Near-field non-radial motion generation from underground chemical explosions in jointed granite. *Geophysical Journal International*, 212(1), 25-41.
11. **R.C. Hurley**<sup>§</sup>, S.A. Hall, & J. Wright, (2017). Multi-scale mechanics of granular solids from grain-resolved x-ray measurements. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 473(2207), 0491.
10. **R.C. Hurley**<sup>§</sup>, J. Lind, D.C. Pagan, M.C. Akin, & E.B. Herbold (2017). Linking initial microstructure and local response during quasi-static granular compaction. *Physical Review E*, 96(1), 012905.
9. **R.C. Hurley**, O.Y. Vorobiev, & S.M. Ezzedine (2017). An algorithm for continuum modeling of rocks with multiple embedded nonlinearly-compliant joints. *Computational Mechanics*, 60(2), 235-252.

8. **R.C. Hurley**, & J.E. Andrade (2017). Continuum modeling of rate-dependent granular flows in SPH. *Computational Particle Mechanics*, 4(1), 119-130.
7. **R.C. Hurley**, S.A. Hall, J.E. Andrade & J. Wright (2016). Quantifying interparticle forces and heterogeneity in 3D granular materials. *Physical Review Letters*, 117, 098005.
6. **R.C. Hurley**, K.W. Lim, G. Ravichandran, & J.E. Andrade (2016). Dynamic inter-particle force inference in granular materials: Method and application. *Experimental Mechanics*, 56(2), 217-229.
5. **R.C. Hurley**, & J.E. Andrade (2015). Friction in inertial granular flows: competition between dilation and grain-scale dissipation rates. *Granular Matter*, 17(3), 287-295.
4. **R.C. Hurley**, E. Marteau, G. Ravichandran, & J.E. Andrade (2014). Extracting inter-particle forces in opaque granular materials: beyond photoelasticity. *Journal of the Mechanics and Physics of Solids*, 63, 154-166.
3. A.M. Booth, **R.C. Hurley**, M.P. Lamb, & J.E. Andrade (2014). Force chains as the link between particle and bulk friction angles in granular material. *Geophysical Research Letters*, 41(24), 8862-8869.
2. X. Zhao, **R. Hurley**, M. Sutton, W. Fourney, U. Leiste, & X. Deng (2014). Small scale models subjected to buried blast loading part II: frame accelerations with hulls and additional mitigation methods. *Experimental Mechanics*, 54(5), 857-869.
1. X. Zhao, G. Shultis, **R. Hurley**, M. Sutton, W. Fourney, U. Leiste, & X. Deng (2014). Small scale models subjected to buried blast loading part I: floorboard acceleration and related passenger injury metrics with protective hulls. *Experimental Mechanics*, 54(4), 539-555.

#### BOOK CHAPTERS

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- **R.C. Hurley\***, B. Marks, & E. Andò (2022). In-situ full-field imaging in modern experimental granular mechanics, in *Mechanics of Granular Materials, Invited, in preparation*.

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Above This Line: Research Substantially or Fully Executed at Johns Hopkins University

- **R.C. Hurley**, K.W. Lim, & J.E. Andrade (2015). Grain-Scale Measurements During Low Velocity Impact in Granular Media. *Rapid Penetration into Granular Media: Visualizing the Fundamental Physics of Rapid Earth Penetration*, pp. 291-317.
- T. Brodrick, **R.C. Hurley**, & W.L. Fourney (2014). Mitigation of loading on personnel in light-armored vehicles using small model testing. *Blast Mitigation*, (pp. 249-277), Springer, New York.

#### PEER-REVIEWED CONFERENCE PROCEEDINGS

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- **B. Kuwik**, **R.C. Hurley\*** (2021). Quantifying Energy Dissipation Due to Breakage During Confined Dynamic Granular Compaction. *EPJ Web of Conferences for Powders & Grains*, 249, 07006. Virtual Conference, July 2021.
- **R.C. Hurley\*** (2021). Stress and force measurement uncertainties in 3D granular materials. *EPJ Web of Conferences for Powders & Grains*, 249, 02009. Virtual Conference, July 2021.

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Above This Line: Research Substantially or Fully Executed at Johns Hopkins University

- E.B. Herbold, M.A. Homel, J. Lind, R. Crum, **R.C. Hurley**, B.J. Jensen, A.J. Iverson, C.T. Owens, C.A. Carlson, & M.C. Akin (2018). Microscale investigation of dynamic impact of dry and saturated glass powder. *AIP Conference Proceedings*, 1979, 070015. St. Louis, MO, July 2017.
- M.A. Homel, E.B. Herbold, J. Lind, Darren C. Pagan, R. Crum, **R.C. Hurley**, & M.C. Akin (2018). Microscale investigation of dynamic impact of dry and saturated glass powder. *AIP Conference Proceedings*, 1979, 070015. St. Louis, MO, July 2017.
- **R.C. Hurley**, S.A. Hall, J.E. Andrade, & J. Wright (2017). Force measurements in stiff, 3D opaque granular materials. *EPJ Web of Conferences for Powders & Grains*, 140, 02006. Montpellier, France, July 2017.
- **R.C. Hurley**, & J.E. Andrade (2015). A smoothed particle hydrodynamics method for coupled gas-porous media flows. *Engineering Mechanics Institute (EMI) Computational Inelasticity Paper Competition*, Stanford, CA, June 2015.

- **R.C. Hurley**, & J.E. Andrade (2015). Strength of granular materials in transient and steady state rapid shear. *Procedia Engineering*, 103, 237-245. Boulder, CO, April 2015.

#### OTHER CONFERENCE PROCEEDINGS

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- **R.C. Hurley**, & Andrade, J.E. (2015). A smoothed particle hydrodynamics method for coupled gas-porous media flows. *Engineering Mechanics Institute (EMI) Computational Inelasticity Paper Competition*, Stanford, CA, June 2015.

#### CURRENT SUPPORT AT JOHNS HOPKINS UNIVERSITY

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Hurley's share of current and completed support at JHU as PI: \$3,260,152

- Defense University Research Instrumentation Program (DURIP), Army Research Office (ARO). "An Extreme Pressure Triaxial Compression Apparatus for In-Situ Studies of Geomaterial Deformation Mechanisms". Role: Sole PI. Funding during period of performance: **\$116,464**. Period of Performance: 1/1/2023 - 12/31/2023 (Estimated).
- U.S. Department of Energy (DOE). "Integrated X-ray Probes for In-Situ Deformation and Fracture Studies of Sandstone". Role: Sole PI. Funding during period of performance: **\$496,977**. Period of Performance: 7/15/2022 - 7/14/2025.
- U.S. Air Force Office of Scientific Research (AFOSR). "YIP: Effects of Material and Morphology on 3D Particle and Pore Dynamics During Rapid Compaction of Granular Materials". Role: Sole PI. Funding during period of performance: **\$450,000**. Period of Performance: 3/1/2022 - 2/28/2025.
- U.S. National Science Foundation (NSF), CMMI. "Concrete Micromechanics Validated with In-Situ Stress and Strain Measurements". Role: Sole PI. Funding during period of performance: **\$351,556**. Period of Performance: 9/1/2021 - 8/31/2024.
- U.S. Defense Threat Reduction Agency (DTRA). "Constitutive Models for Soils, Rocks, and Concrete". (part of "Materials Science in Extreme Environments University Research Alliance" (MSEE URA)). Role: PI, Leader of Focus Area (4 PIs total). Hurley's share of funding during period of performance: **\$822,869**. Period of Performance: 7/1/2020 - 12/31/2025.
- U.S. National Science Foundation (NSF), CBET. "CAREER: Quantifying Local Rearrangements and Their Effects in 3D Granular Materials". Role: Sole PI. Funding during period of performance: **\$535,414**. Period of Performance: 5/1/2020 - 4/30/2025.

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#### Beginning of completed Support

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- U.S. Army Research Laboratory (ARL). "Calibrating and Validating Granular Flow Model Parameters to Aid in Integrative Modeling" (part of Materials in Extreme Dynamic Environments (MEDE) Collaborative Research Alliance). Role: PI within Ceramics Group. Hurley's share of funding during period of performance: **\$222,000**. Period of Performance: 6/1/2019 - 12/31/2021.
- Space@Hopkins, Johns Hopkins University. "Electrostatically-Charged Contact Mechanics in Lunar and Martian Dust Environments". A seed grant. Role: PI (w/ Rui Ni, JHU). Share of Funding: **\$18,866**. Period of Performance: 9/1/2020 - 8/31/2021.
- Defense University Research Instrumentation Program (DURIP), Army Research Office (ARO). "A System for In-Situ Studies of the Contact Mechanics Between Geomaterials". Role: Sole PI. Funding: **\$151,845**. Period of Performance: 4/4/2019 - 4/3/2020.
- Army Research Office (ARO). "Workshop on Identifying Mathematical Challenges Associated with Dynamic Failure of Brittle Materials". Role: Sole PI. Share of Funding: **\$24,605**. Period of Performance: 1/25/2019 - 9/24/2019.
- Subcontract from Lawrence Livermore National Laboratory to Johns Hopkins University, "Unraveling Force Chains and Failure in Granular Materials". Role: Sole PI. Funding: **\$69,556**. Period of Performance: 1/25/2018 - 9/31/2018.

## PENDING SUPPORT AT JOHNS HOPKINS UNIVERSITY \_\_\_\_\_

Hurley's share of pending support at JHU as PI: \$2,136,344

- Johns Hopkins University. “Unraveling the Influence of Porosity and Texture on Properties of Geophysical Materials”. Role: Lead PI. Co-PI: June Wicks (JHU). Funding during period of performance: **\$100,000**. Period of Performance: 7/1/2023 - 6/30/2025 (Estimated).
- Johns Hopkins University. “Assessing Fundamental Postulates of Plasticity Theories for Geomaterials”. Role: Sole PI. Funding during period of performance: **\$75,000**. Period of Performance: 7/1/2023 - 6/30/2025 (Estimated).
- U.S. National Science Foundation (NSF), DMR. “Collaborative Research: DMREF: Iterative Design and Fabrication of Multiscale Hyperuniform Materials for Targeted Mechanical and Transport Properties”. Role: PI for JHU. Lead PI/Institution: K. Daniels / NCSU. Other PIs/Institutions: C. Rock / NCSU; K. Newhall / UNC; M Porter / UCLA. Hurley funding during period of performance: **\$323,000**. Total funding to all PIs and institutions: \$2,000,000. Period of Performance: 12/1/2023 - 11/30/2027 (Estimated).
- U.S. National Science Foundation (NSF), DMR. “MRI: Track 1 Acquisition of a Gantry-Based X-ray Computed Tomography System for 3D Dynamic Imaging”. Role: PI. Co-PIs: T.C. Hufnagel, T.M. McQueen. Funding during period of performance: **\$1,378,126**. Period of Performance: 9/1/2023 - 8/31/2026 (Estimated).
- U.S. National Aeronautics and Space Administration (NASA) “Rapid Compaction of Regolith During Impact Events: The Role of Granular Mechanics in Impact Energy Transfer”. Role: PI, with “Future Investigator” (FI) Sohanjit Ghosh, 2nd Year Ph.D. Student in Hurley Group. Response to “Future Investigators in NASA Earth and Space Science and Technology, FINESST” announcement. Funding during period of performance: **\$150,000**. Period of Performance: 9/1/2023 - 8/31/2026 (Estimated).
- U.S. National Science Foundation (NSF). “REU Supplement for NSF Award#2125023”. Role: Sole PI. Funding during period of performance: **\$7,800**. Period of Performance: 6/1/2023 - 5/31/2023 (Estimated).
- U.S. National Science Foundation (NSF). “REU Supplement for NSF Award#1942096”. Role: Sole PI. Funding during period of performance: **\$6,825**. Period of Performance: 6/1/2023 - 5/31/2023 (Estimated).
- United States Geological Survey (USGS). “Toward Quantitatively Validating Force Chain Buckling as a Granular Fault Gouge Stick-Slip Mechanism”. Role: Sole PI. Funding during period of performance: **\$95,593**. Period of Performance: 4/1/2023 - 3/31/2023 (Estimated). *Recommended for funding pending outcome of the Continuing Resolution.*

## COMPLETED SUPPORT AT LAWRENCE LIVERMORE NATIONAL LABORATORY \_\_\_\_\_

- Laboratory Directed Research and Development (LDRD) Grant, Lawrence Livermore National Laboratory, “Unraveling Force Chains and Failure in Granular Materials”. Role: Sole PI. Funding: **\$550,000**. Period of Performance: 10/1/2016 - 9/31/2018 (departed LLNL on 11/8/2017).

## INVITED SEMINARS (UNIVERSITIES, LABORATORIES, DOCTORAL SCHOOLS) \_\_\_\_\_

15. **R.C. Hurley** (May 2023). Title TBD. *Center for Science and Protection of Engineered Environments (SPREE) Seminar Series, Department of Civil and Environmental Engineering, Northwestern University, Northwestern University, Evanston, Ill. (Invited university seminar).*
14. **R.C. Hurley** (February 2023). Using X-rays to Study the Micromechanics of Granular Materials Across Time and Length Scales. *Rocky Mountain Mechanics Seminar Series, CU Boulder, Colorado. (Invited university seminar).*
13. **R.C. Hurley** (September 2022). Measuring Stresses and Forces in 3D Granular Materials with X-rays. *A two-hour lecture given as part of the 2022 ALERT Geomaterials Doctoral School, Grenoble, France. (Invited doctoral school seminar).*
12. **R.C. Hurley** (September 2022). Measuring Stresses and Forces in Granular Materials with Pho-

- toelasticity. *A two-hour lecture given as part of the 2022 ALERT Geomaterials Doctoral School, Grenoble, France. (Invited doctoral school seminar).*
11. **R.C. Hurley** (December 2021). Quantifying the Micromechanics of Sand and Concrete With X-rays. *Department Seminar Series, Department of Mechanical and Industrial Engineering, New Jersey Institute of Technology, Virtual. (Invited university seminar).*
  10. **R.C. Hurley** (April 2021). Quantifying the Causes of Local Rearrangements in 3D Granular Media Using Machine Learning. *Laboratoire 3SR (Soils, Solids, Structures), University of Grenoble, 3SR Seminar Series, Grenoble, France, Virtual. (Invited university seminar).*
  9. **R.C. Hurley** (April 2021). Experimental Micromechanics of 3D Granular Materials with Applications to Force Chains, Waves, Rearrangements, Length Scales. *Center for Science and Protection of Engineered Environments (SPREE) Seminar Series, Department of Civil and Environmental Engineering, Northwestern University, Virtual. (Invited university seminar).*
  8. **R.C. Hurley** (September 2020). Experimental Micromechanics of 3D Granular Materials: Force Chains, Waves, and Rearrangements. University of California, Santa Cruz, CA, Virtual. **(Invited university seminar).**
  7. **R.C. Hurley** (August 2020). Experimental Micromechanics of 3D Granular Materials: Force Chains, Waves, and Rearrangements. Sandia National Laboratory, Albuquerque, NM, Virtual. **(Invited laboratory seminar).**
  6. **R.C. Hurley** (April 2020). Mechanics of Granular Materials at "Micro" Length and Time Scales from In-Situ X-ray Measurements *Mechanical Engineering Department Seminar Series, Johns Hopkins University, Baltimore, Maryland, Virtual. (Invited university seminar).*
  5. **R.C. Hurley** (January 2020). Quantifying Micro-scale Mechanisms of Geomaterial Behavior Using X-rays. *Laboratoire 3SR (Soils, Solids, Structures), University of Grenoble, 3SR Seminar Series, Grenoble, France. (Invited university seminar).*
  4. **R.C. Hurley** (July 2019). Measuring Contact- and Particle-Scale Behavior in 3D Granular Materials with X-rays and Waves. *Granular Forum, University of Sydney, Sydney, Australia. (Invited university seminar).*
  3. **R.C. Hurley** (May 2019). Measuring Contact- and Particle-Scale Behavior in 3D Granular Materials with X-rays and Waves. *Complex Matter and Biophysics Seminar Series, North Carolina State University, Raleigh NC. (Invited university seminar).*
  2. **R.C. Hurley** (November 2018). X-ray Tomography and Diffraction for Granular Micromechanics. *Hong Kong University Civil Engineering Department Seminar, Hong Kong, China. (Invited university seminar).*
  1. **R.C. Hurley** (October 2018). Combining In-situ X-ray Imaging and Diffraction to Understand the Micromechanics and Failure Processes of Granular Materials. *Brown Bag Seminar Series, Indian Head NSWC, Indian Head, MD. (Invited laboratory seminar).*

#### INVITED TALKS (WORKSHOPS OR CONFERENCES)

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24. **R.C. Hurley** (May 2023). Ultrasound and Acoustic Wave Propagation Measurements in Rocks and Granular Media Made Concurrently with In-Situ Synchrotron X-ray Imaging. *2023 American Society of Acoustics (ASA) Meeting, Chicago, Illinois. (Invited symposium talk).*
23. **R.C. Hurley** (March 2023). Advances in Micromechanics and Digital Twin Modeling of Concrete and Geologic Materials Aided by In-Situ Tomography and 3D X-ray Diffraction. *TMS 2023 Annual Meeting, San Diego, CA. (Invited symposium talk).*
22. **R.C. Hurley** (October 2022). Linking Granular Micromechanics to Macroscopic Plasticity in Triaxial Tests and Other Geometries. *Society of Engineering Science (SES) Annual Meeting, University of Texas, A&M. (Invited symposium keynote).*
21. **R.C. Hurley** (September 2022). In-Situ Multi-Modal X-ray Imaging for Structure and Stress Distributions in Mechanically-Loaded Granular Media. *Lorentz Workshop, "Image is Everything", Leiden, Netherlands. (Invited workshop keynote).*
20. **R.C. Hurley** (March 2022). Towards Quantitative Measurement and Use of Grain Stresses and

- Forces in Granular Materials. *Workshop titled: Mechanics of Granular Materials: What's Next?*, International Research Network GeoMech, Virtual. **(Invited workshop keynote)**.
19. **R.C. Hurley** (January 2022). Linking Mechanisms to Penetration Response of Sands and Rocks: Experiments, Models, and Uncertainty Quantification in the MSEE URA. *Nuclear Weapons Effects Collaborative (NWECC) Meeting*, Virtual. **(Invited talk at invite-only DTRA meeting)**.
  18. **R.C. Hurley** (September 2021). Inferring 3D Granular Dynamics From In-Situ X-ray Radiography and XPCI: Recent Advances, Limitations, and Opportunities. *Workshop on Enabling 3D Mesoscale Imaging Under Dynamic Conditions*, Los Alamos National Laboratory, Virtual. **(Invited workshop keynote)**.
  17. **R.C. Hurley** (March 2021). Quantifying Local Rearrangements in Granular Media Using X-ray Tomography, Diffraction, and Machine Learning. *APS March Meeting 2021*, Virtual. **(Invited conference talk)**.
  16. **R.C. Hurley** (January 2021). Research on Geomaterial Constitutive Laws in the MSEE-URA and Related Challenges and Capabilities for Dynamic Material Behavior Studies. *Nuclear Weapons Effects Collaborative (NWECC) Meeting*, Virtual. **(Invited talk at invite-only DTRA meeting)**.
  15. **R.C. Hurley** (June 2020). Simultaneous *In-Situ* Synchrotron Tomography and Diffraction to Study the Mechanical Behavior of Granular Materials *1st In-Situ Studies of Rock Deformation (ISRDR) Workshop*, Cornell, NY, Virtual. **(Invited workshop presentation)**.
  14. **R.C. Hurley** (March 2020). Mechanics of Deformation in 3D Granular Materials using X-ray Measurements. *APS March Meeting 2020*, Virtual. **(Invited conference talk)** [Cancelled due to COVID19].
  13. **R.C. Hurley** (January 2020). Microstructural Characterization: Applications to Granular Cohesion. *International Fine Particle Research Institute (IFPRI) Workshop on Particle Technology: Mechanisms of Cohesion at the Single Particle Level and Their Influence on Bulk Properties*, Philadelphia, Pennsylvania. **(Invited talk at invite-only industry consortium (IFPRI) workshop)**.
  12. **R.C. Hurley** (October 2019). Multi-Scale Relationships from Grain-Resolved In-Situ Measurements in 3D Granular Materials. *Society of Engineering Science (SES) Annual Meeting*, St. Louis, Missouri. **(Invited symposium keynote)**.
  11. **R.C. Hurley** (July 2019). In-situ X-ray Tomography and Diffraction: Probing Granular Micromechanics and Energy Dissipation During Compaction. *International Conference on Tomography of Materials & Structures (ICTMS)*, Cairns, Australia. **(Invited symposium keynote)**.
  10. **R.C. Hurley** (May 2019). Measuring Contact- and Particle-Scale Behavior in 3D Granular Materials. *Frontiers in Applied and Computational Mathematics, Northeastern Complex Fluids & Soft Matter Workshop*, New Jersey Institute of Technology, Newark NJ. **(Invited workshop talk)**.
  9. **R.C. Hurley** (December 2018). Combining *In-situ* X-ray Imaging and Diffraction to Understand the Micromechanics and Failure Processes of Granular Materials. *Multi-scale Materials Under the Nanoscope, Annual Workshop of GDRI M2UN*, Georgetown University, Washington DC. **(Invited workshop talk)**.
  8. **R.C. Hurley** (June 2018). Grain-resolved structure, stress, and force measurements in friction 3D granular materials. *Granular Matter Gordon Research Conference*, Easton, MA. **(Invited workshop talk)**.

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Above This Line: Research Substantially or Fully Executed at Johns Hopkins University

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7. **R.C. Hurley**, (December 2017). Studies of micromechanics and failure in granular materials using X-ray computed tomography and diffraction. *GM3: Geo-Mechanics: From Micro to Macro, UK Annual Traveling Workshop*, London, England. **(Invited conference keynote (only keynote talk at conference))**.
6. **R.C. Hurley** (June 2017). Understanding mechanics and stress transmission in granular solids by combining 3DXRD and XRCT. *CHESS User's Meeting*, Ithaca, NY. **(Invited workshop keynote)**.
5. **R.C. Hurley** (May 2016). Inter-particle force inference in opaque granular materials imaged using XRCT and 3DXRD. *SIAM Conference on Mathematical Aspects of Materials Science*, Philadelphia,



- PA. (Invited conference talk in invite-only session).
4. **R.C. Hurley**. A Smoothed Particle Hydrodynamics Method for Coupled Gas-Porous Media Flows. *Engineering Mechanics Institute Annual Meeting*, Palo Alto, CA. (**Invited Talk in Student Paper Competition in Computational Inelasticity, 2nd Place Finish**).
  3. **R.C. Hurley** (September 2014). Inferring inter-particle forces in opaque granular materials. *British Society for Strain Measurement Workshop*, Teddington, UK. (**Invited poster**).
  2. **R.C. Hurley** (July 2014). Measuring dynamic inter-particle force transmission in opaque granular media. *International Conference on Experimental Mechanics*, Cambridge, UK. (**Invited talk, First Place in Young Stress Analyst Competition**).
  1. **R.C. Hurley** (June 2014). The microscopic origin of friction in granular matter. *U.S. National Congress on Theoretical and Applied Mechanics (USNCTAM)*, East Lansing, MI. (**Invited session keynote**).

#### INVITE-ONLY WORKSHOP PARTICIPATION (TALKS OR OTHER ROLES) \_\_\_\_\_

Participation at invited speaker level or invited participant for workshops not involving talks.

10. *ALERT Geomaterials Doctoral School*, Aussois, France, September 2022.
9. *Image is Everything, Lorentz Workshop*, Leiden, Netherlands, September 2022.
8. *Mechanics of Granular Media: What's Next?*, *International Research Network GeoMech and Northwestern University*, March 2022 (virtual).
7. *Process-Structure-Performance: X-ray Experiments to Understand Materials Behavior*, *Los Alamos National Laboratory (LANL)*, February 2022 (virtual).
6. *Nuclear Weapons Effects Collaborative Meeting*, *Defense Threat Reduction Agency (DTRA)*, January 2022 (virtual).
5. *Enabling 3D Mesoscale Imaging Under Dynamic Conditions*, *Los Alamos National Laboratory (LANL)*, September 2021 (virtual).
4. *Nuclear Weapons Effects Collaborative Meeting*, *Defense Threat Reduction Agency (DTRA)*, January 2021 (virtual).
3. *1st In-Situ Studies of Rock Deformation (ISRD) Workshop*, Cornell University, June 2020 (virtual).
2. *Workshop on Particle Technology: Mechanisms of Cohesion at the Single Particle Level and Their Influence on Bulk Properties*, *International Fine Particle Research Institute (IFPRI)*, Philadelphia, January 2020.
1. *Multi-scale Materials Under the Nanoscope*, *GDRI M2UN*, Georgetown University, December 2018.

#### CONTRIBUTED PRESENTATIONS BY HURLEY AND MENTEES \_\_\_\_\_

\*Hurley as PI or Co-PI while at Johns Hopkins University

**Hurley group postdoc advisee at Johns Hopkins University**

**Hurley group Ph.D. advisee at Johns Hopkins University**

**Hurley group Undergraduate or High School advisee at Johns Hopkins University**

(Underlined author is presenter)

- **M. Thakur**, **R.C. Hurley\*** (November 2022). Role of heterogeneities on local stresses and strains in concrete using x-ray computed tomography imaging, 3D x-ray diffraction and mesoscale simulations. *iDICs Conference, 2022*, Boston, MA.
- **S. Ghosh**, **R.C. Hurley\*** (October 2022). Effects of particle size and material on the 3D particle scale dynamics of shock compression in granular materials. *Society of Engineering Science (SES) Annual Conference, 2022*, College Station, Texas.
- **A. Gupta**, K.T. Ramesh, **R.C. Hurley\*** (October 2022). Linking microscopic force-chains to macroscale mechanical response in granular media. *Society of Engineering Science (SES) Annual Conference, 2022*, College Station, Texas.
- **G. Shahin**, **R.C. Hurley\*** (August 2022). Strain localization and micromechanics in ductile sand. *Rock Deformation Gordon Research Conference (GRC)*, Lewiston, ME. (Poster presentation).
- **R.C. Hurley\*** (August 2022). Unlocking grain-resolved stresses in rocks with multi-modal x-ray

- measurements. *Rock Deformation Gordon Research Conference (GRC)*, Lewiston, ME. (Poster presentation).
- [S. Ghosh](#), [R.C. Hurley\\*](#) (June 2022). Inferring 3D particle-scale dynamics from 2D in-situ x-ray images in rapid compaction of granular materials. *Granular Matter Gordon Research Conference (GRC)*, Easton, MA. (Poster presentation).
  - [K. Lee](#), [R.C. Hurley\\*](#) (June 2022). Uncertainty analysis of inferred inter-particle forces in granular materials: application to 3D experimental data. *Granular Matter Gordon Research Conference (GRC)*, Easton, MA. (Poster presentation).
  - [R.C. Hurley\\*](#), [G. Shahin](#) (June 2022). A New Device for In-Situ Laboratory and Synchrotron Studies of Geomaterials During High Pressure Triaxial Tests. *International Conference on Tomography of Materials and Structures*, Grenoble, France. In-person oral presentation.
  - [R.C. Hurley\\*](#), [A. Gupta](#), R. Crum, [C. Zhai](#), K.T. Ramesh (June 2022). Quantifying Particle-Scale 3D Granular Dynamics During Rapid Compaction from Time-Resolved In-Situ 2D X-ray Images. *Society of Experimental Mechanics (SEM) Annual Meeting*, Pittsburgh, PA. In-person oral presentation.
  - [R.C. Hurley\\*](#), D. Pagan, E. Herbold, [C. Zhai](#), [G. Shahin](#), [B. Kuwik](#) (June 2022). Examining the Micromechanics of Cementitious Composites and Rocks Using In-Situ X-ray Tomography and 3D X-ray Diffraction. *Society of Experimental Mechanics (SEM) Annual Meeting*, Pittsburgh, PA. In-person oral presentation.
  - [R.C. Hurley\\*](#), [B. Kuwik](#), [M. Garcia](#) (June 2022). Quantification of Breakage During the Compaction of Granular Materials. *Society of Experimental Mechanics (SEM) Annual Meeting*, Pittsburgh, PA. In-person oral presentation.
  - [R.C. Hurley\\*](#) (June 2022). Micromechanics of Cementitious Composites Through X-ray Tomography and Diffraction. *Engineering Mechanics Institute (EMI) Conference, 2022*, Johns Hopkins University, Baltimore, MD. In-person oral presentation.
  - [M. Thakur](#), [R.C. Hurley\\*](#) (June 2022). Role of Heterogeneities on Local Stresses and Strains in Concrete Using X-ray Computed Tomography and Mesoscale Simulations. *Engineering Mechanics Institute (EMI) Conference, 2021*, Johns Hopkins University, Baltimore, MD. In-person oral presentation.
  - [G. Shahin](#), [R.C. Hurley\\*](#) (June 2022). Hierarchy of Structural and Mechanical Length Scales in Granular Systems. *Engineering Mechanics Institute (EMI) Conference, 2021*, Johns Hopkins University, Baltimore, MD. In-person oral presentation.
  - [B. Kuwik](#), [M. Garcia](#), [R.C. Hurley\\*](#) (June 2022). From 2D to 3D: Resolving Flow Fields Around Sand Penetrators from Flash X-ray Imaging. *Engineering Mechanics Institute (EMI) Conference, 2021*, Johns Hopkins University, Baltimore, MD. In-person oral presentation.
  - [R.C. Hurley\\*](#), G. Shahin (April 2022). Sand Under Pressure: New In-Situ Quantification of High Pressure Triaxial Tests. *2022 Mach Conference*, Baltimore, Maryland.
  - [B. Kuwik](#), [R.C. Hurley\\*](#) (April 2022). From 2D to 3D: Resolving Flow Fields Around Sand Penetrators from Flash X-ray Imaging. *2022 Mach Conference*, Virtual.
  - [A. Gupta](#), K.T. Ramesh, [R.C. Hurley\\*](#) (April 2022). The effect of force-chain buckling and fabric on bulk stiffness and stress response in granular media. *2022 Mach Conference*, Virtual.
  - [R.C. Hurley\\*](#), C. Zhai (March 2022). Quantifying Rearrangement Statistics, Correlations, and Contributions to Macroscopic Strain in 3D Granular Materials Using X-ray Measurements. *2022 APS March Meeting*, Chicago, Illinois.
  - [B. Kuwik](#), [M. Garcia](#), [R.C. Hurley\\*](#) (October 2021). Quantification of breakage during the compaction of granular materials. *Society of Engineering Science Annual Conference, 2021*, Virtual. *Judge's Vote for Best Poster in Interactions Matter Session of 2021 Society of Engineering Science Conference*.
  - [A. Gupta](#), K.T. Ramesh, [R.C. Hurley\\*](#) (October 2021). The effect of force-chain buckling and fabric on bulk stiffness and stress response in granular media. *Society of Engineering Science Annual Conference, 2021*, Virtual. *Audience Vote for Best Poster in Interactions Matter Session of 2021 Society of Engineering Science Conference*.

- **R.C. Hurley\*** (July 2021). Stress and force measurement uncertainties in 3D granular materials. *Powders and Grains Conference, 2021*, Virtual.
- **B. Kuwik, R.C. Hurley\*** (July 2021). Breakage mechanics and particle morphology analysis of dynamically-compacted granular materials. *Powders and Grains, 2021*, Virtual.
- **R.C. Hurley\***, C. Zhai (June 2021). X-ray tomography and 3D X-ray diffraction for quantifying particle rearrangements in granular materials. *3DMS Conference, 2021*, Virtual.
- **A. Gupta**, K.T., Ramesh, **R.C. Hurley\*** (April 2021). The effect of fabric on stability and wave propagation in granular media. *Mach Conference, 2021*, Virtual.
- **R.C. Hurley\***, C. Zhai (April 2021). History, structure, and stress dependence of local rearrangements in 3D granular media from machine learning. *Mach Conference, 2021*, Virtual.
- **A. Gupta**, R.C. Crum, **C. Zhai**, K.T., Ramesh, **R.C. Hurley\*** (March 2021). Inferring 3D Particle Kinematics from 2D X-ray Images. *APS March Meeting, 2021*, Virtual.
- **C. Zhai, N. Albayrak**, J. Engqvist, S.A. Hall, J. Wright, M. Majkut, E.B. Herbold, & **R.C. Hurley\*** (January 2021). History, structure, and stress dependence of local rearrangements in 3D granular media from machine learning. *Sand and Sound 2021 (Symposium with JHU, NCSU, Scripps)*, Virtual.
- **R.C. Hurley\*** (January 2021). In-Situ X-ray Tomography and 3D X-ray Diffraction for Studying Geomaterials. *Sand and Sound 2021 (Symposium with JHU, NCSU, Scripps)*, Virtual.
- **C. Zhai**, E.B. Herbold, **R.C. Hurley\*** (January 2021). Ultrasound wave propagation in granular materials. *Sand and Sound 2021 (Symposium with JHU, NCSU, Scripps)*, Virtual.
- **Gupta, A.**, Ramesh, K.T., **R.C. Hurley\*** (January 2021). Inferring 3D Particle Kinematics from 2D X-ray Images. *Sand and Sound 2021 (Symposium with JHU, NCSU, Scripps)*, Virtual.
- **C. Zhai**, E.B. Herbold, **R.C. Hurley\*** (September 2020). Ultrasound wave propagation in granular materials. *Society of Engineering Science, 2020 Virtual Conference (SES 2020)*.
- **Gupta, A.**, Ramesh, K.T., **R.C. Hurley\*** (September 2020). The effect of fabric on stability and wave propagation in granular media. *Society of Engineering Science, 2020 Virtual Conference (SES 2020)*.
- **Gupta, A.**, Ramesh, K.T., **R.C. Hurley\*** (January 2020). Quantifying Kinematics During High Strain-Rate Loading of Granular Materials. *44th International Conference and Expo on Advanced Ceramics and Composites (ICACC 2020)*, Daytona Beach, FL.
- **R.C. Hurley\*** & D.C. Pagan (October 2019). X-ray tomography and diffraction measurements to study elasticity and fracture in concrete. *Society of Engineering Science (SES) Annual Meeting*, St. Louis, Missouri.
- **Gupta, A.**, Ramesh, K.T., **R.C. Hurley\*** (October 2019). Quantifying Kinematics During High Strain-Rate Loading of Granular Materials. *Society of Engineering Science (SES) Annual Meeting*, St. Louis, Missouri.
- **C. Zhai**, E.B. Herbold, **R.C. Hurley\*** (October 2019). Ultrasound Wave Propagation in Granular Materials. *Society of Engineering Science (SES) Annual Meeting*, St. Louis, Missouri.
- **R.C. Hurley\*** & D.C. Pagan (July 2019). X-ray tomography and diffraction measurements to study elasticity and fracture in concrete. *International Conference on Tomography of Materials & Structures (ICTMS)*, Cairns, Australia.
- **R.C. Hurley\***, D.C. Pagan, Lind, J., Akin, M.C., E.B. Herbold (June 2019). In-situ Tomography and Diffraction Measurements to Study Elasticity and Fracture in Concrete. *Engineering Mechanics Institute (EMI) Annual Meeting*, Pasadena, CA.
- **C. Zhai**, E.B. Herbold, **R.C. Hurley\*** (June 2019). Ultrasound Wave Propagation in Granular Materials. *Engineering Mechanics Institute (EMI) Annual Meeting*, Pasadena, CA.
- **C. Zhai**, E.B. Herbold, S.A. Hall, **R.C. Hurley\*** (June 2019). An in-situ study of grain kinematics and micromechanics under uniaxial and triaxial compaction. *Granular Matter Gordon Research Conference (GRC)*, Easton, MA. (Poster presentation).
- **R.C. Hurley\***, D.C. Pagan, Lind, J., Akin, M.C., E.B. Herbold (May 2019). Combining in-situ X-ray tomography and diffraction to study the effects of microstructure on fracture in concrete and granular materials. *Society of Experimental Mechanics Annual Meeting*, Reno, NV.

- **R.C. Hurley\***, C. Zhai, E.B. Herbold, S.A. Hall, Wright, J. (April 2019). Experimental studies of micro-macro relations and length scales in granular materials. *Mach Conference*, Annapolis, MD.
- **R.C. Hurley\***, S.A. Hall, Engqvist, J., E.B. Herbold, Majkut, M., Wright, J. (October 2018). In-situ X-ray Tomography and Diffraction Studies of Granular Micromechanics. *Society of Engineering Science Annual Meeting*, Madrid, Spain.
- **R.C. Hurley\***, D.C. Pagan, Lind, J., Akin, M.C., E.B. Herbold (June 2018). X-ray imaging of fracture and comminution during compaction of granular materials. *U.S. National Congress on Theoretical and Applied Mechanics (USNCTAM)*, Chicago, IL.
- **R.C. Hurley\***, Nair, S.D., Nygren, K.E., D.C. Pagan (May 2018). Non-Destructive X-ray Probes of Fracture Network and Stress Evolution in Cement-Based and Matrix-Based Composites During Loading. *Engineering Mechanics Institute Annual Meeting (ASCE)*, Boston, MA.
- **R.C. Hurley\***, D.C. Pagan, Lind, J., Akin, M.C., E.B. Herbold (April 2018). Characterizing quasi-static grain fracture and comminution during compaction of granular solids using X-ray measurements. *Mach Conference*, Annapolis, MD.
- **R.C. Hurley\***, S.A. Hall, Wright, J., E.B. Herbold (March 2018). Investigating continuum properties of granular materials using discrete experiments and simulations. *APS March Meeting*, Los Angeles, CA.

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- **R.C. Hurley**, E.B. Herbold, D.C. Pagan, S.A. Hall, Wright, J., Lind, J., Akin, M.C. (July 2017). Investigating *in situ* failure in granular materials. *Society of Engineering Science 2017 Meeting*, Boston, MA.
- **R.C. Hurley**, S.A. Hall, Andrade, J.E., Wright, J. (July 2017). Inter-particle force measurements in 3D, frictional, opaque granular materials. *Powders and Grains*, Montpellier, France.
- **R.C. Hurley**, Lind, J., Akin, M.C., D.C. Pagan, E.B. Herbold, Homel, M.A., Crum, R. (June 2017). Microstructure and Failure Analysis During Granular Compaction Using XRCT and 3DXRD. *International Conference on Tomography in Materials and Structures*, Lund, Sweden.
- **R.C. Hurley**, S.A. Hall, Andrade, J.E., Wright, J. (July 2016). Inter-particle force measurements in 3D, frictional, opaque granular materials. *Gordon Research Conference on Granular Matter*, Easton, MA.
- **R.C. Hurley**, Vorobiev, O.Y., Ezzedine, S.M. (July 2016). Modeling wave propagation in jointed rock masses at various spatial resolutions. *SEG/AGU Conference on Upper Crustal Rock Physics*, Hilo, HI.
- **R.C. Hurley**, Andrade, J.E. (Oct. 2015). SPH modeling of granular flows with viscoplastic constitutive laws. *Society of Engineering Science Annual Meeting*, College Station, TX.
- **R.C. Hurley**, Andrade, J.E. (Sept. 2015). Coupled gas-porous media flows using Smoothed Particle Hydrodynamics. *IV International Conference on Particle-Based Methods*, Barcelona, Spain.
- **R.C. Hurley**, Andrade, J.E. (Oct. 2014). Friction in Inertial Granular Flows: Microscopic and Macroscopic Origins. *Society of Engineering Science*, West Lafayette, IN.
- **R.C. Hurley**, Lim, K.W., Andrade, J.E. (July 2014). A novel method for measuring dynamic force transmission in granular materials. *International Conference on Experimental Mechanics*, Cambridge, UK.
- **R.C. Hurley**, Andrade, J.E. (Aug. 2013). The origin of friction and rate-dependence in dense granular flows. *Engineering Mechanics Institute Annual Meeting (ASCE)*, Evanston, IL. (First Place in Computational Mechanics Poster Competition).

## TEACHING AT JOHNS HOPKINS UNIVERSITY

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UG=Undergrad. G=Grad(Typical Year). Overall student review of quality: mean / median / total possible.

- Mechanics of Solids & Materials II (G1-Core. 13 students). Review: TBD. Spring 2023.
- Mechanics of Solids & Structures: Theory and Applications II (EP Program). Spring 2023
- Modern Tools and Applications in Experimental Solid Mechanics (UG/G1-Elective). Review: Review: 4.6/4.0/5.0. Fall 2022.

- Mechanics of Solids & Materials II (G1-Core. 13 students). Review: 4.64/5.0/5.0. Spring 2022.
- Mechanics of Solids & Structures: Theory and Applications II (EP Program). Spring 2022
- Mechanics of Solids & Materials I (G1-Core. 16 students). Review: 3.69/4.0/5.0. Fall 2021.
- Mechanics of Solids & Materials II (G1-Core. 11 students). Review: 4.40/4.5/5.0. Spring 2021
- Micromechanics of Heterogeneous and Granular Materials (G1+Elective. 9 students). Review: 4.50/4.5/5.0. Fall 2020
- Mechanics of Solids & Materials II (G1-Core. 9 students). Review: 4.56/5.0/5.0. Spring 2020
- Mechanics of Solids & Materials I (G1-Core. 16 students). Review: 4.40/5.0/5.0. Fall 2019.
- Mechanics of Solids & Materials II (G1-Core. 9 students). Review: 4.33/5.0/5.0. Spring 2019.
- Mechanics of Solids & Materials II (G1-Core. 16 students). Review: 3.81/4.0/5.0. Spring 2018.
- Mechanics of Solids & Materials Graduate Seminar (40+ students and postdocs, engaged in research presentations, group presentations, and external presentations). Fall 2019, Spring 2020, Fall 2020, Spring 2021, Fall 2021, Spring 2022, Fall 2022.
  - *Role involves working closely with student organizers to design group presentations, external presentations from faculty, and professional development workshops*

## ADVISING (RESEARCH AND ACADEMIC) AT JOHNS HOPKINS UNIVERSITY \_\_\_\_\_

- Research and Scientific Staff Mentees:
  - Michael Mengason (2022 - present) (NIST-PREP Associate Research Scientist, NIST Mentor Dr. Aron Newman)
- Postdoctoral Advisees:
  - Xiao Zhang (2022 - present) (NIST-PREP Postdoc, NIST Mentor Dr. Aron Newman)
  - Ye Tian (2022 - present)
  - Mohmad Mohsin Thakur (2021 - present)
    - \* Co-authored one paper (published) as first author.
  - Ghassan Shahin (2020 - 2022, now Marie Sklodowska-Curie Postdoctoral Fellow, EPFL, Lausanne, Switzerland)
    - \* Co-authored four first-author papers (three published, one in review).
  - Chongpu Zhai (2018 - 2021, now Assistant Professor, Xi'an Jiaotong University, Xi'an, China)
    - \* Co-authored eight papers (seven published, one in review), four as first author.
  - Mehmet Cil (2017 - 2019, now at Cibor Geoconsultants) (co-advisor L. Graham-Brady)
    - \* Co-authored three first-author papers (all published).
- Ph.D. Student Advisees:
  - Sohanjit Ghosh, Ph.D. Student (2021 - present)
  - Kwangmin Lee, Ph.D. Student (2020 - present)
    - \* Co-authored one paper (published) as first author.
  - Brett Kuwik, Ph.D. Student (2019 - present)
    - \* Judges' Vote for Best Poster (first author) in Interactions Matter Session of 2021 Society of Engineering Science Conference.
    - \* Co-authored two papers as first author (published).
  - Adyota Gupta, Ph.D. Student (2018 - present) (K.T. Ramesh as co-advisor (Hurley primary))
    - \* Audience Vote for Best Poster in Interactions Matter Session of 2021 Society of Engineering Science Conference.
    - \* Co-authored one paper (published) as first author.
    - \* Intern at Eglin Air Force Base through AFRL Scholar Program, summer 2022.
- M.S. Student Advisees:
  - Siddhartha Pattisapu, M.S. Student (2022 - present)
  - Surya Kolluri, M.S. Student (2020 - 2022, now Ph.D. student in Solid Mechanics at Brown University)
    - \* Master's Essay: *Local rearrangement and micromechanical similarities between shear bands and simple shear in granular materials*

- Ziheng Wang, M.S. Student (2020 - 2021, now Ph.D. student at Purdue University)
- Arthur Ding, M.S. Student (2018 - 2020, now at Naval Air Systems Command, San Diego)
- D. Eng. Students Committee Member:
  - Austin DiOrio, D.Eng. Student (2021 - present) (Advisor Jaafar El-Awady)
- Undergraduate Researchers:
  - Sean Enright, JHU ME (Fall 2022 - present)
  - Maximilian Garcia, JHU ME, MSEE Undergraduate Intern (2021 - 2022, now Design Engineer at Alphatec Spine)
    - \* Judges' Vote for Best Poster (second author) in Interactions Matter Session of 2021 Society of Engineering Science Conference.
    - \* Co-authored one paper (published) as second author.
  - Jacob Kim, JHU ME (2021 - Present, full-time in Summers 2021 and 2022, now on leave of absence of military service)
    - \* Co-authored one paper (published) as second author.
  - Maxim Daud, JHU ME (2019 - 2022, Full-Time in Summer 2022, now in U.S. Marine Corp)
    - \* Co-authored one paper (published) as fourth author.
  - Samuel Budoff, Rising Sophomore in Mechanical Engineering, West Point (Hosted through NSERC program, Summer 2022)
  - Aidan Looney, Rising Sophomore in Operations Research, West Point (Hosted through NSERC program, Summer 2022)
  - Dan Zanko, JHU ME (Spring 2018)
- High School Researchers:
  - Phoebe Dainer, Walt Whitman High School (Research & Engineering Apprenticeship (REAP) Program, Summer 2022).
  - Nahuel Albayrak, Chesapeake Science Point High School (Research & Engineering Apprenticeship (REAP) Program, Summers 2020 and 2021. Now UGrad in Applied Mathematics at Johns Hopkins University.)
    - \* Co-authored one published paper as second author.
- Undergraduate Academic Advising
  - Faculty Advisor to 20 ME Undergraduates in Class of 2025.

## EDUCATIONAL SERVICE AT JOHNS HOPKINS UNIVERSITY ---

- Department Qualifying Examination (DQE):
  - Organizer for Mechanics and Materials Qualifying Exam, 2019-Present.
- Graduate Board Oral (GBO) Examination Committee:
  - 2018: (1x) Civil Engineering, (2x) Mechanical Engineering.
  - 2019: (1x) Physics.
  - 2020: (2x) Civil Engineering.
  - 2022: (5x) Mechanical Engineering
- Defense Committee Member (+Hurley as Thesis Reader/Signer for Library, <sup>0</sup>Hurley as Chair).
  - 2018: (1x)
    - \* Thomas C. O'Connor (Physics, Advisor Mark Robbins)
  - 2019: (1x)
    - \* Joel T. Clemmer (Physics, Advisor Mark Robbins)
  - 2020: (2x)
    - \* +Joseph Monti (Physics, Advisor Mark Robbins)
    - \* +Alex (Xiangyu) Sun (Mechanical Engineering, Advisor KT Ramesh)
  - 2021: (4x)
    - \* +Amartya Bhattacharjee (Civil and Systems Engineering, Advisor Lori Graham-Brady)
    - \* +Jason Parker (Mechanical Engineering, Advisor KT Ramesh)
    - \* +Yuan Tian (Materials Science & Engineering, Advisor Mingwei Chen)

- \* Derek Brehm (Physics, Advisor Petar Maksimovic)
- 2022: (1x)
- \* <sup>0</sup>Xia Yan (Civil Engineering, Advisor Thomas Gernay)
- Co-advised (w/ Prof. Rui Ni) JHU’s SEDS (Students for Exploration and Development of Space) team in NASA’s 2021 Lunar Dust Challenge. Attended weekly meetings, provided technical feedback, provided use of laboratory facilities for prototyping. Fall 2020.
- Faculty review committee for Biomedical Engineering Senior Design Team designing “Osteocast”, a deformable and reusable cast for wrist fractures that uses vacuum-induced stiffening of granular media. Attended meetings and provided technical feedback. Fall 2018 – Fall 2019.

## INSTITUTIONAL SERVICE AT JOHNS HOPKINS UNIVERSITY \_\_\_\_\_

- Led a significant portion of the proposal effort for the \$30M five-year (2020-2025) *Materials Science in Extreme Environments University Research Alliance (MSEE-URA)* at Johns Hopkins University (funded by the Defense Threat Reduction Agency (DTRA)) by writing the portion of the proposal describing a four-PI effort on “Geomaterial Constitutive Laws” and writing the entire “Facilities and Other Resources” document for the 18-institute, 40-PI proposal. I continue to lead biweekly meetings of 4 PIs and 15 graduate-student, postdoctoral, and research scientist participants in technical discussions related to “Geomaterial Constitutive Laws”. I also meet on an approximately monthly basis with DTRA and other Department of Defense (DOD) employees or contractors for technical or work-force development discussions.
- Contributed video and audio with Ph.D. students, postdocs, and research engineers in the Hopkins Extreme Materials Institute for *Hopkins on the Hill 2021*, a biennial showcase of the range, value, and impact of federally funded research and programming at Johns Hopkins University.
- PI of major shared facilities:
  - MicroCT Facility containing an RX Solutions EasyTom 160 and Deben Load Stages.
  - Impact Facility including an Instron CAEST 9350 Droptower Impact System.
  - Particle Characterization Facility including a Morphologi4 ID.
- Faculty Search Committees:
  - Hopkins Extreme Materials Institute, 2023.
  - Mechanical Engineering Department, 2021-2022.
  - Mechanical Engineering Department, 2018.
  - Hopkins Extreme Materials Institute, 2018.
- Committees / Reviews:
  - Reviewer for Robbins Ph.D. and Future Faculty awards, July 2022.
  - Reviewer for eight SURPASS white papers by WSE/APL research teams, June 2022.
  - Member, Mechanical Graduate Recruiting and Admissions Committee, 2022-Present.
  - Member, Mechanical Engineering Department Seminar Committee, 2019-Present.
  - Member, Steering Committee, Hypervelocity Facility for Impact Research (HyFIRE), 2019-Present.
  - Selection and Purchasing Committee, Hopkins Extreme Materials Institute’s Micro-Computed Tomography Machine, 2018.

## EDUCATIONAL SERVICE OUTSIDE OF JOHNS HOPKINS UNIVERSITY \_\_\_\_\_

- Organizer and Instructor for ALERT Geomaterials’ immersive Doctoral School in Aussois, France, September 2022 (co-organizers and co-instructors Benjy Marks, Edward Andó, Joshua Dijksman) .
  - Developed and presented four hours of interactive lectures and two hours of Q&A within broader 2.5-day / 20-hour program for over 100 doctoral students and postdocs to gain practical experience with techniques on the cutting edge of “Advanced Experimental Geomechanics”. Specific topics presented by Hurley include photoelasticity (setting up and using polariscopes to analyze granular mechanics) and multi-modal x-ray measurements (combining x-ray tomography

and 3D x-ray diffraction to make structure, kinematics, and stress measurements in granular materials, concrete, and rocks).

- Thesis committee member: Manasa Bhat, Indian Institute of Science (IISc), Bangalore (advisor, Tejas Murthy), 2020-present.
- Thesis/defense examiner: Olga Stamati, Laboratoire 3SR, University Grenoble, Alpes, France (advisors, Y. Malecot, E. Roubin), May 2020. (with F. Hild, Y. Malecot, J.S. Baptist, E. Andó, E. Roubin.)
- Mentor of six Summer Undergraduate Research Fellows (SURFs) at Lawrence Livermore National Laboratory (2017) and California Institute of Technology (2013).

## SERVICE TO THE PROFESSION

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- **Conference and Workshop Chair or Organizer:**
  - Mach Conference (150-250 attendees), held annually in April in MD.
    - \* Chair of conference, 2022–present
      - *Role includes design of technical program, communication to over 200 community members to solicit mini-symposium and plenary speaker proposals, weekly meetings with JHU staff to coordinate logistics and make financial decisions, vendor fundraising, and movement of the annual event back to an in-person format and to a new venue in 2023.*
    - \* Co-chair of conference (w/ Lori Graham-Brady), 2020–2021
      - *Chair and co-chair roles include scientific program development, plenary speaker invitations, moderating some plenary sessions, mini-symposium proposal review, conference introductions and announcements, developing a virtual conference environment in response to Covid-19*
  - Engineering Mechanics Institute (EMI) Annual Conference
    - \* Local organizing committee, 2022. Conference held May 2022 at Johns Hopkins University
      - *Role included outreach to mini-symposium organizers, organization and approval of a subset of abstracts, judging of student video competition in 2022*
  - Workshop on “In-situ x-ray tools for structural materials”, Cornell High Energy Synchrotron Source (CHESS), Ithaca, NY, July, 2021
    - \* Co-organizer and moderator (w/ K. Shanks, M. Miller, D. Pagan, M. Hassani, N. Bouklas)
      - *Role included identifying speakers, soliciting talks, organizing scientific program, moderating talks and discussions through one half-day of the two-day workshop*
  - Army Research Office (ARO) funded workshop on “Mathematical Challenges Associated with Failure of Brittle Solids”, Johns Hopkins University, Baltimore, MD, May 2019
    - \* Chair and PI (Co-I’s J. Hogan, S. Kalidindi) of proposal for workshop funding.
      - *Role included identifying speakers, developing scientific program and discussions, invitations, moderation, and writing a final report and journal paper*
- **Conference and Workshop Plenary or Symposium Organizer:**
  - Society of Engineering Science (SES) Annual Conference, Mini-Symposium Organizer
    - \* “Mechanics of Granular Media: Experiments, Theory, Modeling”, October 2023 (University of Minnesota)
      - *Role involves soliciting and reviewing abstracts, arranging schedule of talks, moderating subset of sessions*
  - Engineering Mechanics Institute (EMI) Annual Conference, Mini-Symposium Organizer
    - \* “Mechanics and Physics of Granular Materials”, May 2020 (Columbia University), 2021 (Virtual), and 2022 (Johns Hopkins University)
      - *Role involves soliciting and reviewing abstracts, arranging schedule of talks, moderating subset of sessions*
    - \* “Mechanics of Rocks and Anisotropic Polycrystals”, June 2019 (Caltech)
      - *Role involves soliciting and reviewing abstracts, arranging schedule of talks, moderating*



*subset of sessions*

- Mach Conference, Annapolis, MD
  - \* “Opportunities for Materials Science and Engineering at National User Facilities” Plenary Session, 2019 Mach Conference
    - *Role involves identifying and inviting two plenary speakers (J. Almer, G. Collins), introductions, moderating questions, and moderating 30-minute panel discussion after two plenary talks*
  - \* “High-Pressure Material Properties” Plenary Session, 2018 Mach Conference
    - *Role involves identifying and inviting two plenary speakers (N. Thadhani, T. Duffy), introductions, moderating questions, and moderating 30-minute panel discussion after two plenary talks*
- **Editorial service:**
  - Editor of iMechanica Journal of the Month Club, 2023 calendar year.
  - Co-editor of Open Geomechanics, a diamond open-access journal launched in 2018 to foster the publication of open-access geomechanics research (<https://opengeomechanics.centre-mersenne.org>). Other co-editors: C. Viggiani, D.M. Wood, I. Herle, C. Tamagnini, E. Ando, J. Dijkstra, B Marks, D.J. Frost, C. Arson, E. Gerolymatou
- **Proposal reviewing in past 5 years:**
  - American Chemical Society Petroleum Research Fund (ACS-PRF) (1 proposal review since 2020).
  - U.S. Department of Energy (DOE) (1 proposal review since 2022).
  - U.S. National Science Foundation (NSF) CBET Division (1 panel (4 proposals) since 2018).
  - U.S. Army Research Office (ARO) (3 proposal reviews since 2019).
  - U.S. National Aeronautics and Space Administration (NASA) (1 panel (3 proposals), 2019).
  - Hong Kong Research Grants Council (8 proposal reviews since 2017).
  - Czech National Science Foundation (1 proposal reviews since 2018).
  - Cornell High Energy Synchrotron Source (CHESS) beamtime proposals (>20 since June 2019).
- **Paper reviewing within past 5 years:**
  - *Proceedings of the National Academy of Sciences of the United States of America, Physical Review Letters, Journal of Applied Mechanics, Soft Matter, Granular Matter, Journal of Geophysical Research, Journal of Engineering Mechanics, Proceedings of the Royal Society of London A, Acta Geotechnica, Computer Methods in Applied Mechanics and Engineering, Computational Mechanics, International Journal for Numerical and Analytical Methods in Geomechanics, Review of Scientific Instruments, PLoS One, International Journal of Solids and Structures, Experimental Mechanics, Physica A.*

## PROFESSIONAL MEMBERSHIPS AND COMMITTEES

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- In-Situ Rock Deformation Steering Committee (IRSD), 2022-Present.
- American Society of Civil Engineers (ASCE), 2020-Present
  - International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), 2020-Present. Corresponding TC105 Committee Member from USA (Geo-Mechanics from Micro to Macro).
  - Engineering Mechanics Institute (EMI) Member, 2015-Present. Member of *Granular Materials* and *Computational Mechanics* technical committees. Mini-symposium organizer for *Granular Materials* technical committee.
    - \* *For Granular Materials Technical Committee: Solicited and reviewed abstracts and served as a judge for 2022 and 2023 student poster competitions.*
- Society of Experimental Mechanics (SEM), 2019-Present.
- Society of Engineering Science (SES), 2017-Present.
- American Physical Society (APS) (Active in DSOFTE), 2016-Present.
  - *For DSOFTE: Served as judge for student poster competition, 2022 APS March Meeting*

## PROFESSIONAL DEVELOPMENT COURSES

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- *Foundations of Leadership and Management*, Carey Business School, Johns Hopkins University, January 2022 – 18-hour Executive Education course.
- *Leading Organizational Change*, Carey Business School, Johns Hopkins University, November 2022 – 18-hour Executive Education course.
- *Interpersonal Communication and Conflict Management*, Carey Business School, Johns Hopkins University, January 2023 – 18-hour Executive Education course.
- *Best Practices in University Teaching*, Johns Hopkins University, January 2022, a 13-hour course offered by the Johns Hopkins University Center for Teaching Excellence and Innovation covering: effective assessment strategies, evidence-based teaching strategies, inclusive pedagogy.