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
rhurley6@jhu.edu, http://hurley.me.jhu.edu, (Updated September 9, 2021)

PROFESSIONAL PREPARATION

Lawrence Livermore National Laboratory	Computational Geosciences	Postdoc, 2015-2017
California Institute of Technology	Applied Mechanics	Ph.D., 2015 (Conferred June 2016)
California Institute of Technology	Applied Mechanics	M.S., 2012
University of Maryland, College Park	Civil Engineering	B.S., 2011

APPOINTMENTS

Assistant Professor, Mechanical Engineering, Johns Hopkins University	2018-Present
Faculty Fellow, Hopkins Extreme Materials Institute, Johns Hopkins University	2018-Present
Assistant Professor (Secondary Appointment), Civil & Systems Engineering, Johns Hopkins	2020-Present
Lecturer, WSE Engineering for Professionals (EP), Johns Hopkins University	2021-Present
Postdoctoral Research Staff Member, Lawrence Livermore National Laboratory	2015-2017
Assistant Research Professor of Mechanical Engineering, Johns Hopkins University	2015-2017
Graduate Research Assistant, California Institute of Technology	2011-2015

AWARDS AND HONORS

Army Educational Outreach Program (AEOP) Mentor of the Year Award	2021
U.S. National Science Foundation (NSF) CAREER Award, PMP Program, CBET Division	2020
Defense University Research Instrumentation Program (DURIP) Award, U.S. Army Research Office	2019
Secretary's Appreciation Award, U.S. DOE, for contributions to the Source Physics Experiment	2017
Laboratory Directed Research and Development (LDRD) Award (Single-PI), LLNL	2016
Runner up, Computational Inelasticity Paper Competition, EMI Conference (Stanford, CA)	2015
Engineering Mechanics Institute (EMI) Conference Travel Award (Stanford, CA)	2015
1st Place, Young Stress Analyst Competition, ICEM16 Conference (Cambridge, UK)	2014
1st Place, Computational Mechanics Poster Competition, EMI Conference (Evanston, IL)	2013
National Science Foundation Graduate Research Fellowship Runner Up	2013
Caltech Option Fellowship for Graduate Studies	2012
University of Maryland Presidential Scholarship	2007-2011
A. James Clark School of Engineering Scholarship	2007-2011

JOURNAL PUBLICATIONS

Hurley group Postdoc advisee at Johns Hopkins University
Hurley group Ph.D. or M.S. advisee at Johns Hopkins University
Hurley group Undergraduate or High School advisee at Johns Hopkins University
***Hurley as PI or Co-PI while at Johns Hopkins University**
§Hurley as PI and corresponding author while at Lawrence Livermore National Lab

33. **R.C. Hurley***, D.C. Pagan, E.B. Herbold, & **C. Zhai** (2021). Examining the applicability of micromechanics theories for cementitious composites using *in-situ* X-ray measurements, *In review.*
32. **G. Shahin**, E.B. Herbold, S.A. Hall, & **R.C. Hurley*** (2021). A hierarchy of length scales in the mechanical behavior of 3D granular materials, *In review.*
31. **C. Zhai**, **N. Albayrak**, J. Engqvist, S.A. Hall, J. Wright, M. Majkut, E.B. Herbold, & **R.C. Hurley*** (2021). History, structure, and stress dependence of local rearrangements in 3D granular media, *In review.*

30. X. Sun, Q. Yang, S. Chocron, **R.C. Hurley***, R.A. Haber, J.C. LaSalvia, & K.T. Ramesh (2021). Effects of particle size, shape and loading rate on the compaction of an advanced granular ceramic, *In review.*
29. A. Bhattacharjee, **R.C. Hurley***, L. Graham-Brady (2021). Predicting high rate granular transition and fragment statistics at the onset of granular flow for brittle ceramics, *In Revision, Journal of the American Ceramic Society.*
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, *In Press, Journal of the American Ceramic Society.*
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**, 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.**, **R.C. Hurley***, & Brady, L.G. (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**, **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**[§]*, 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.

Beginning of Research Substantially or Fully Executed at Johns Hopkins University

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**[§], 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**[§], 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.

JOURNAL MANUSCRIPTS IN FINAL PREPARATION

- **K. Lee** & **R.C. Hurley*** (2021). Force inference in 3D granular materials: Uncertainty analysis and application to synchrotron data.
- **B. Kuwik**, **M. Garcia**, **G. Shahin**, & **R.C. Hurley*** (2021). Experimental breakage mechanics of confined granular media across strain rates.
- **B. Kuwik**, **G. Kim**, **C. Zhai**, **M. Daud**, & **R.C. Hurley*** (2021). Roughness and humidity effects on contact, friction, and contact plasticity revealed by micromechanical analysis and testing.

BOOK CHAPTERS

- **R.C. Hurley***, B. Marks, & E. Andò (2021). In-situ full-field imaging in modern experimental granular mechanics, in *Mechanics of Granular Materials*, *Invited, in preparation.*

Beginning of 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

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

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

OTHER CONFERENCE PROCEEDINGS

- **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.

CURRENT AND PAST SUPPORT AT JOHNS HOPKINS UNIVERSITY

Hurley's share of funding at JHU as PI: $2,196,711.

- U.S. National Science Foundation (NSF), CMMI. "Concrete Micromechanics Validated with In-Situ Stress and Strain Measurements". Role: Sole PI. Funding: **$351,556**. Period of Performance: 9/1/2021 - 8/31/2024.
- 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.
- 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). Share of Funding: **$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: **$535,414**. Period of Performance: 5/1/2020 - 4/30/2025.
- 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: **$222,000**. Period of Performance: 6/1/2019 - 12/31/2021.

Beginning of past Support

- 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 Perfor-

mance: 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

- United States Geological Survey (USGS). "Toward Quantitatively Validating Force Chain Buckling as a Granular Fault Gouge Stick-Slip Mechanism". Role: Sole PI. Funding: **$99,977**. Period of Performance: 1/1/2022 - 12/31/2021.
- U.S. Department of Energy (DOE). "Integrated X-ray Probes for In-Situ Deformation and Fracture Studies of Sandstone". Role: Sole PI. Funding: **$496,977**. Period of Performance: 11/1/2021 - 10/31/2024.
- 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: **$450,000**. Period of Performance: 1/1/2022 - 12/31/2024.

PAST 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).

TEACHING AT JOHNS HOPKINS UNIVERSITY

UG=Undergrad, G=Grad(Typical Year), overall student review.

- Mechanics of Solids & Materials I (G1-Core.). Fall 2021.
- Mechanics of Solids & Structures: Theory and Applications II (Whiting School EP Program). Developed Spring/Summer 2021. First offering in Spring 2022.
- Mechanics of Solids & Materials II (G1-Core. 11 students). Review: 4.40/5.0. Spring 2021
- Micromechanics of Heterogeneous and Granular Materials (G1+Elective. 9 students). Review: 4.50/5.0. Fall 2020
- Mechanics of Solids & Materials II (G1-Core. 9 students). Review: 4.56/5.0. Spring 2020
- Mechanics of Solids & Materials I (G1-Core. 16 students). Review: 4.40/5.0. Fall 2019.
- Mechanics of Solids & Materials II (G1-Core. 9 students). Review: 4.33/5.0. Spring 2019.
- Mechanics of Solids & Materials II (G1-Core. 16 students). Review: 3.81/5.0. 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.

ADVISING (RESEARCH AND ACADEMIC) AT JOHNS HOPKINS UNIVERSITY

- Postdoctoral Advisees:
  - Mohmad Mohsin Thakur (2021 - present)
  - Ghassan Shahin (2020 - present)
    - Co-authored one paper, Shahin *et. al,* (2021). *In Review.*
  - Chongpu Zhai (2018 - 2021, now Assistant Professor, Xi'an Jiaotong University, Xi'an, China)
    - Co-authored seven papers, Zhai *et. al., J. Mech. Phys. Solids*, (2019). • Zhai *et. al., JOM*, (2020). • Zhai *et. al., Proc. Natl. Acad. Sci. U.S.A.*, (2020). • Gupta *et al., Journal of Applied Physics*, (2021). • Zhai *et. al., In Review*, (2021). • Hurley *et. al., In Review*, (2021). • Kuwik, *et. al., In final preparation*, 2021.
  - Mehmet Cil (2017 - 2019, now at Schlumberger, Houston, TX) (co-advisor L. Graham-Brady)
    - Co-authored three papers, Cil *et. al, J. Am. Ceram. Soc.,* (2019). • Cil *et. al., J. Eng. Mech.,* (2020). • Cil *et. al., J. Dyn. B. Mater.,* (2020).

- Ph.D. Student Advisees:
  - Sohanjit Ghosh, Ph.D. Student (2021 - present)
  - Kwangmin Lee, Ph.D. Student (2020 - present)
    - Co-authored one paper, Lee and Hurley, *In Review*, (2021).
  - Brett Kuwik, Ph.D. Student (2019 - present)
    - Co-authored three papers, Kuwik and Hurley, 2021. *EPJ Web of Conferences for Powders & Grains.* • Kuwik, *et. al., In final preparation* (2021).
  - Adyota Gupta, Ph.D. Student (2018 - present) (co-advised with K.T. Ramesh)
    - Co-authored one paper, Gupta *et. al., J. Appl. Physics*, (2021).
- M.S. Student Advisees:
  - Surya Kolluri, M.S. Student (2020 - present)
  - Ziheng Wang, M.S. Student (2020 - 2021)
  - Arthur Ding, M.S. Student (2018 - 2020, now at Naval Air Systems Command, San Diego)
- D. Eng. Student Advisees (Primary Advisor Jaafar El-Awady):
  - Austin DiOrio, D.Eng. Student (2021 - present)
- Undergraduate Researchers:
  - Maximilian Garcia, JHU ME, an MSEE Undergraduate Intern (2021 - Present)
  - Jacob Kim, JHU ME (2021 - Present)
  - Maxim Daud, JHU ME (2019 - Present)
  - Dan Zanko, JHU ME (Spring 2018)
- Undergraduate Academic Advising
  - Faculty Advisor to 14 ME Undergraduates in Class of 2025.
- High School Researchers:
  - Nahuel Albayrak, Chesapeake Science Point High School (Research & Engineering Apprenticeship (REAP) Program) in Summer 2020, rising JHU Applied Mathematics undergraduate, Summer 2021.
    - Co-authored one paper, Zhai *et. al.,* 2021. *In review.*

EDUCATIONAL SERVICE AT JOHNS HOPKINS UNIVERSITY

- Department Qualifying Examination:
  - Organizer for Mechanics and Materials Qualifying Exam, 2018-Present.
- Graduate Board Oral Examination Committee:
  - 2018: (1x) Civil Engineering, (2x) Mechanical Engineering.
  - 2019: (1x) Physics.
  - 2020: (2x) Civil Engineering.
  - 2021: (1x) Materials Science & Engineering. (1x) Civil Engineering.
- Defense Committee Member ($^{+}$Denotes Hurley as Reader/Signer for Library):
  - 2018: (1x)
    - Thomas C. O'Connor (Physics, Advisor Mark Robbins) - *The nonlinear mechanics and rheology of oriented polymers*
  - 2019: (1x)
    - Joel T. Clemmer (Physics, Advisor Mark Robbins) - *Scale invariant dynamics of interfaces and sheared solids*
  - 2020: (2x)
    - $^{+}$Joseph Monti (Physics, Advisor Mark Robbins) - *Granular flow of an advanced ceramic under extreme multi-axial loading*
    - $^{+}$Alex (Xiangyu) Sun (Mechanical Engineering, Advisor KT Ramesh) - *Contact and friction for surfaces with roughness on atomic to macroscopic scales*
  - 2021: (4x)
    - $^{+}$Amartya Bhattacharjee (Civil Engineering, Advisor Lori Graham-Brady) - *Fragmentation, granular transition & impact performance of ceramics*

    - ∗ $^{+}$Jason Parker (Mechanical Engineering, Advisor KT Ramesh) - *Effect of microstructure on the dynamic behavior of Ultra-High-Molecular-Weight Polyethelene (UHMWPE) composites*
    - ∗ $^{+}$Yuan Tian (Materials Science & Engineering, Advisor Mingwei Chen) - *Study of fast dynamics of metallic glasses by MeV ultrafast electron diffraction*
    - ∗ Derek Brehm (Physics, Advisor Petar Maksimovic) - *Pairs of Boosted Higgs and Where to Find Them*
- 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.
- Co-advised (as faculty review committee) Biomedical Engineering Senior Design Team in design of "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.
- Hosted high school summer intern through the Hopkins Extreme Materials Institute's Research and Engineering Apprenticeship Program (REAP). Summer 2020, 2021.
    - Received Army Educational Outreach Program (AEOP) Mentor of the Year Award, 2021.

INSTITUTIONAL SERVICE 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, 2018.
    - Mechanical Engineering Department, 2018.
- Committees:
    - Mechanical Engineering Department Seminar Committee, 2019-Present.
    - Steering committee, Hypervelocity Facility for Impact Research (HyFIRE), 2019-Present.
    - Selection and purchasing committee, Hopkins Extreme Materials Institute's Micro-Computed Tomography Machine, 2018.
- 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.

EDUCATIONAL SERVICE OUTSIDE JOHNS HOPKINS UNIVERSITY

- Thesis committee member: Manasa Bhat, Indian Institute of Science (IISc), Bangalore (advisor, Tejas Murthy), 2020-present.
- Thesis/defense examiner: Olga Stamati, Laboratoire 3SR, University Alpes, Grenoble 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 COMMUNITY

- **Conference and Workshop Organization**:
    - Chair of Annual Mach Conference (150-250 attendees), Annapolis, MD. (April 2022).
    - Co-Chair (w/ Lori Graham-Brady) of Annual Mach Conference (150-250 attendees), Annapolis, MD. (April 2020, April 2021).
    - Local Organizing Committee, Engineering Mechanics Institute (EMI) Annual Conference, Baltimore MD, May 2022.

  - Co-Organizer (w/ K. Shanks, M. Miller, D. Pagan, M. Hassani, N. Bouklas), workshop on "In-situ x-ray tools for structural materials", Cornell High Energy Synchrotron Source (CHESS), Ithaca, NY, July, 2021.
  - Chair, Army Research Office (ARO) funded workshop on "Mathematical Challenges Associated with Failure of Brittle Solids", Johns Hopkins University, Baltimore, MD, May 2019.
- **Mini-Symposium or Plenary Sessions Co-Organizer at Conferences**:
  - "Mechanics and Physics of Granular Materials", Engineering Mechanics Institute (EMI) Annual Conference, Virtual, May 2022. Co-organized symposium with Granular Mechanics Technical Committee.
  - "Mechanics and Physics of Granular Materials", Engineering Mechanics Institute (EMI) Annual Conference, Virtual, May 2021. Co-organized symposium with Granular Mechanics Technical Committee.
  - "Mechanics and Physics of Granular Materials", Engineering Mechanics Institute (EMI) Annual Conference, Columbia University, New York, NY, June 2020. Co-organized symposium with Granular Mechanics Technical Committee. (postponed one year due to COVID-19).
  - "Mechanics of Rocks and Anisotropic Polycrystals", Engineering Mechanics Institute (EMI) Annual Conference, Caltech, Pasadena, CA, June 2019.
  - "Opportunities for Materials Science and Engineering at National User Facilities" Plenary Session, 2019 Mach Conference, Annapolis, MD, April 2019.
  - "High-Pressure Material Properties" Plenary Session, 2018 Mach Conference, Annapolis, MD, April 2018.
- **Editorial service**:
  - 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`).
- **Proposal reviewing in past 5 years**:
  - American Chemical Society Petroleum Research Fund (ACS-PRF) (1 review since 2020).
  - U.S. National Science Foundation (NSF) CBET Division (1 panel since 2018).
  - U.S. Army Research Office (ARO) (2 reviews since 2019).
  - U.S. National Aeronautics and Space Administration (NASA) (1 panel, 2019).
  - Hong Kong Research Grants Council (6 proposals since 2017).
  - Czech National Science Foundation (1 proposal 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

- 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. Mini-symposia organizer of *Granular Materials* and *Computational Mechanics* committees.
- Society of Experimental Mechanics (SEM), 2019-Present.
- Society of Engineering Science (SES), 2017-Present.
- American Physical Society (APS) (Active in DSOFT), 2016-Present.

- International Association of Computed Tomography (IntACT), 2017-Present.

INVITED PRESENTATIONS AND SEMINARS

28. **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 presentation).**
27. **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).**
26. **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)**.
25. **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)**.
24. **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 (NWEC) Meeting*, Virtual. **(Invited talk at closed meeting)**.
23. **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).**
22. **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).**
21. **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 (ISRD) Workshop*, Cornell, NY, Virtual. **(Invited workshop presentation).**
20. **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. **(University seminar).**
19. **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].
18. **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).**
17. **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)**.
16. **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 conference session keynote)**.
15. **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 conference session keynote)**.
14. **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)**.

13. **R.C. Hurley** (May 2019). Measure 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)**.
12. **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)**.
11. **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 Worksop of GDRI M2UN*, Georgetown University, Washington DC. **(Invited workshop talk)**.
10. **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)**.
9. **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 Lab seminar)**.
8. **R.C. Hurley**, C. Zhai, E.B. Herbold, S.A. Hall, Engqvist, J., D.C. Pagan, Majkut, M., Wright, J., Lind, J. (July 2018). Grain-resolved structure, stress, and force measurements in friction 3D granular materials. *Granular Matter Gordon Research Conference*, Easton, MA. **(Invited workshop talk)**.

Beginning of Research Substantially or Fully Executed at Johns Hopkins University

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**, E.B. Herbold, S.A. Hall, Wright, J., D.C. Pagan, Lind, J., Homel, M.A., Akin, M.C. (June 2017). Understanding mechanics and stress transmission in granular solids by combining 3DXRD and XRCT. *CHESS User's Meeting*, Ithaca, NY. **(Invited workshop talk in invite-only session)**.
5. **R.C. Hurley**, S.A. Hall, Andrade, J.E., Wright, J. (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**, Andrade, J.E. (May 2015). 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**, Andrade, J.E. (Nov. 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**, Andrade, J.E. (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)**.

CONTRIBUTED PRESENTATIONS

- **R.C. Hurley** (July 2021). Stress and force measurement uncertainties in 3D granular materials. *Powders and Grains Conference, 2021*, Virtual.
- **R.C. Hurley** (June 2021). X-ray tomography and 3D X-ray diffraction for quantifying particle rearrangements in granular materials. *3DMS Conference, 2021*, Virtual.
- **R.C. Hurley** (April 2021). History, structure, and stress dependence of local rearrangements in 3D granular media from machine learning. *Mach Conference, 2021*, 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.
- **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.
- **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.
- **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.
- **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 ccontinuum properties of granular materials using discrete experiments and simulations. *APS March Meeting*, Los Angeles, CA.

Beginning of Research Substantially or Fully Executed at Johns Hopkins University

---

- **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).

CONTRIBUTED PRESENTATIONS BY 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
(First author is presenter)

- **B. Kuwik**, **R.C. Hurley*** (July 2021). Breakage mechanics and particle morphology analysis of dynamically-compacted granular materials. *Powders and Grains, 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.
- **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.
- **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.
- **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.
- **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).