

Liuchi Li

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RESEARCH INTERESTS Solid Mechanics; Soft Matter Physics; Geomechanics; Granular (Meta-)Materials; Dynamic Fracture; Scientific Computing; High-speed Optical Sensing.

ACADEMIC EMPLOYMENT **Princeton University, Princeton, NJ, USA**

Assistant Professor of Civil and Environmental Engineering, January 2025-.
Visiting Research Scholar of Civil and Environmental Engineering, July 2024-Present.

École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

Visiting Assistant Professor of Civil Engineering, November 2024-January 2025.

- *Host: Data-Driven Mechanics Laboratory, EPFL ENAC*

- *Sponsor: SNSF scientific exchange grant*

Johns Hopkins University, Baltimore, MD, USA

Postdoctoral Research Fellow, August 2021 to June 2024.

- *Advisors: K.T. Ramesh, Todd C. Hufnagel*

Lawrence Berkeley National Laboratory, Berkeley, CA, USA

Postdoctoral Research Fellow, July 2020 to July 2021.

EDUCATION **California Institute of Technology, Pasadena, CA, USA**

Ph.D. in Applied Mechanics, September 2014 to June 2020.

Minor in Applied and Computational Mathematics, September 2014 to June 2020.

- *Advisor: José E. Andrade*

- *Committee: Chiara Daraio, Kaushik Bhattacharya, and Ares J. Rosakis*

M.S. in Applied Mechanics, September 2014 to June 2016.

Tongji University, Shanghai, China

B.S. with honor in Civil Engineering, September 2010 to June 2014.

HONORS AND AWARDS

1. *Early Career Travel Award*, Gordon Research Conference on Multifunctional Materials and Structures, 2024.
2. *Future Faculty Symposium Selectee*, Society of Engineering Science, 2023.

3. *Early Career Travel Award*, APS Topical Group on Shock Compression of Condensed Matter (SCCM23), 2023.
4. *Thomas J. R. Hughes Fellowship*, US National Committee for Theoretical and Applied Mechanics (USNC/TAM), 2022.
5. *Option Fellowship for Graduate Studies*, California Institute of Technology, 2015.
6. *Third Place*, ASCE Mid-Pacific Steel Bridge Competition, 2014.
7. *University Outstanding Graduate*, Tongji University, 2014.
8. *Academic Excellence Scholarship*, Tongji University, 2011-2014.

PUBLICATIONS
UNDER
PREPARATION

(* for equal contribution, † for corresponding authorship)

1. **L Li**, A Zare, X Xu, V Kilic, K Hom, L Kecskes, S Klark, K Fezzaa, C Smith, J Harris, KT Ramesh[†], and TC Hufnagel[†]. “Quantitative *in situ* studies of dynamic fracture in a lithium metasilicate glass-ceramic using X-ray phase contrast imaging.” (2025).

REFEREED
JOURNAL
PUBLICATIONS

(* for equal contribution, † for corresponding authorship)

1. W Zhou, N Sujeeka, **L Li**, AG Izard, H Yan, AK Prachet, P Patel, X Xia, and C Daraio. “3D polycatenated architected materials.” *Science* 387, 269-277 (2025).
2. **L Li**[†], V Kilic, M Alemohammade, L Yang, KT Ramesh, MA Foster, and TC Hufnagel[†]. “[Shack-Hartmann wavefront sensing: A new approach to time-resolved measurement of the stress intensity factor during dynamic fracture.](#)” *Mechanics of Materials*, 105010, (2024).
3. **L Li**[†], J Rao, TC Hufnagel, and KT Ramesh. “[Meso-scale size effects of material heterogeneities on crack propagation in brittle solids: Perspectives from phase-field simulations.](#)” *International Journal of Solids and Structures*, 112795, (2024).
4. Y Zhao, J Choo, Y Zhang, and **L Li**. “[Coupled material point and level set methods for simulating soils interacting with rigid objects with complex geometry.](#)” *Computers and Geotechnics*, 105708, (2023).
5. **L Li**[†], K Karapiperis, and JE Andrade. “[Emerging contact force heterogeneity in ordered soft granular media.](#)” *Mechanics of Materials*, 104055, (2021).
6. Y Wang*, **L Li***, D Hofmann, JE Andrade, and C Daraio. “[Structured fabrics with tunable mechanical properties.](#)” *Nature*, 596, 238-243 (2021).
7. JM Harmon, K Karapiperis, **L Li**, S Moreland, and JE Andrade. “[Modeling connected granular media: particle bonding within the level set discrete element method.](#)” *Computer Methods in Applied Mechanics and Engineering*, 373, 113486, (2021).
8. **L Li** and JE Andrade. “[Identifying spatial transitions in heterogeneous granular flow.](#)” *Granular Matter*, 22, 1-16, (2020).
9. **L Li**, E Marteau, and JE Andrade. “[Capturing the inter-particle force distribution in granular material using LS-DEM.](#)” *Granular Matter*, 21(3), 43, (2019).

10. X Lu, S Zeng, **L Li**, J Qian, and M Huang. “Two-dimensional discrete element simulation of the mechanical behavior and strain localization of anisotropic dense sands.” *Granular Matter*, 21(2), 37, (2019).
11. S Feng, Z Shi, Y Shen, and **L Li**. “Elimination of loess collapsibility with application to construction and demolition waste during dynamic compaction.” *Environmental Earth Sciences*, 73(9), 5317-5332, (2015).

OPEN-SOURCE
SOFTWARE

1. **Liuchi Li**. “A finite-element multi-body contact mechanics software for modeling the dynamics of soft granular media.” [[GitHub](#)]
2. **Liuchi Li**. “A parallelized variational phase-field simulator for modeling dynamic fracture processes in solids.” [[GitHub](#)]

INVITED
TALKS (SELECTED)

1. **Liuchi Li et al.** “Mechanics of contact and fracture for resilient civil infrastructure.” *Institute for Building Materials, ETH Zurich*, Zurich, Switzerland. December 2024.
2. **Liuchi Li et al.** “Mechanics of contact and fracture for resilient civil infrastructure.” *School of Architecture, Civil and Environmental Engineering, EPFL*, Lausanne, Switzerland. December 2024.
3. **Liuchi Li et al.** “Mechanics of contact and fracture for resilient civil infrastructure.” *Department of Civil and Environmental Engineering, Princeton University*, Princeton, UJ, USA. March 2024.
4. **Liuchi Li et al.** “Mechanics of contact and fracture for resilient civil infrastructure.” *Department of Civil and Environmental Engineering, The University of Utah*, Salt Lake City, UT, USA. March 2024.
5. **Liuchi Li et al.** “Mechanics of contact and fracture (by design) towards functional structures for harsh environments.” *Department of Aerospace Engineering, Texas A&M University*, College Station, TX, USA. February 2024.
6. **Liuchi Li**, Jack Rao, Todd Hufnagel, and KT Ramesh “Meso-scale size effects of material heterogeneities on crack propagation in brittle solids.” *Gordon Research Seminar on Multifunctional Materials and Structures*, Ventura, CA, USA. January 2024.
7. **Liuchi Li et al.** “Mechanics of contact and fracture (by design) for a sustainable built environment.” *Department of Mechanics and Engineering Science, Peking University*, Beijing, China. December 2023.
8. **Liuchi Li et al.** “Architecting discrete solids: A framework towards design of functional structures for extreme conditions.” *School of Civil and Environmental Engineering, Cornell University*, Ithaca, NY, USA. March 2023.
9. **Liuchi Li et al.** “Understanding granular physics for engineering adaptive systems: A roadmap towards advanced infrastructure.” *Department of Civil and Environmental Engineering, University of Pittsburgh*, Pittsburgh, PA, USA. February 2022.
10. **Liuchi Li**, Yifan Wang, Chiara Daraio, José E. Andrade, and Douglas Hofmann. “Robust design of robotic fabrics through topological optimization.” *IEEE International Conference on Soft Robotics (RoboSoft) 2022*, Edinburgh, UK. April 2022.

11. **Liuchi Li**, José E. Andrade, Chiara Daraio, Yifan Wang, Konstantinos Karapiperis, and Douglas Hofmann. “Understanding the collective behaviors of granular systems: A numerical modeler’s perspective.” *Computational Solid Mechanics Laboratory, EPFL, Lausanne, Switzerland*. June 2021.
12. **Liuchi Li**, José E. Andrade, Chiara Daraio, Yifan Wang, Konstantinos Karapiperis, and Douglas Hofmann. “Linking micro-structure to macro-behavior of granular media: From flowing heterogeneously to morphing adaptively.” *Hopkins Extreme Materials Institute, Johns Hopkins University, Baltimore, MD, USA*. April 2021.
13. **Liuchi Li**, José E. Andrade, Chiara Daraio, Yifan Wang, and Douglas Hofmann. “Linking micro-structure to macro-behavior of granular media: From flowing heterogeneously to morphing adaptively.” *Department of Mechanical Engineering and Materials Science, Yale University, New Heaven, CT, USA*. March 2021.
14. **Liuchi Li**, Eloise Marteau, and José E. Andrade. “Granular material simulation: can discrete element method quantitatively predict inter-particle forces?” *Knowels’ Symposium 2018, California Institute of Technology, Pasadena, CA, USA*. May 2018.

CONFERENCE
TALKS/POSTERS

1. **Liuchi Li**, Velat Kilic, KT Ramesh, Mark Foster, and Todd Hufnagel. “Shack-Hartmann wave-front sensing: A new approach to time-resolved measurement of the stress intensity factor during dynamic fracture.” *2024 Society of Engineering Science Annual Technical Meeting*. August 2024 [Talk]
2. **Liuchi Li**, Velat Kilic, KT Ramesh, Mark Foster, and Todd Hufnagel. “Shack-Hartmann wave-front sensing: A new approach to time-resolved measurement of the stress intensity factor during dynamic fracture.” *Fracture across fields: insights from materials science, biology, and geophysics; Princeton Theoretical Science Workshop*. May 2024 [Poster]
3. **Liuchi Li**, Jack Rao, Todd Hufnagel, and KT Ramesh. “Meso-scale size effects of material heterogeneities on crack propagation in brittle solids.” *2024 Gordon Research Conference on Multifunctional Materials and Structures*. February 2024 [Poster]
4. **Liuchi Li**, Velat Kilic, Mark Foster, Todd Hufnagel, and KT Ramesh. “A new experimental technique for characterizing the dynamic failure processes in glass-ceramics.” *2023 Society of Engineering Science Annual Technical Meeting*. October 2023 [Talk]
5. **Liuchi Li**, Jack Rao, Todd Hufnagel, and KT Ramesh. “Meso-scale size effects of material heterogeneities on crack propagations in brittle solids.” *2023 Society of Engineering Science Annual Technical Meeting*. October 2023 [Talk]
6. **Liuchi Li**, Velat Kilic, Milad Alemohammad, Mark Foster, Todd Hufnagel, and KT Ramesh. “A XPCI-SHWFS integrated technique for measuring the dynamic fracture toughness of brittle materials.” *23rd Biennial Conference on Shock Compression of Condensed Matter (SCCM23)*. June 2023 [Poster]
7. **Liuchi Li**, Velat Kilic, Milad Alemohammad, Mark Foster, Todd Hufnagel, and KT Ramesh. “Experimental and computational investigations on the dynamic failure processes in glass-ceramics.” *2022 Society of Engineering Science Annual Technical Meeting*. October 2022 [Talk]

8. **Liuchi Li**, Konstantinos Karapiperis, and José E. Andrade. “Emerging contact force heterogeneity in ordered soft granular media.” *2022 Society of Engineering Science Annual Technical Meeting*. October 2022. [Poster]
9. **Liuchi Li**, Todd Hufnagel, and KT Ramesh. “Experimental and computational investigations on the dynamic failure processes in glass-ceramics.” *19th National Congress on Theoretical and Applied Mechanics*. June 2022 [Talk]
10. **Liuchi Li**, Yifan Wang, Chiara Daraio, José E. Andrade, and Douglas Hofmann. “Structured fabrics with tunable mechanical properties.” *19th National Congress on Theoretical and Applied Mechanics*. June 2022 [Talk]
11. **Liuchi Li**, Konstantinos Karapiperis, and José E. Andrade. “A multi-body contact mechanics FEM method and its application to granular physics.” *2021 Society of Engineers Virtual Month*. October 2021. [Poster]
12. **Liuchi Li**, Konstantinos Karapiperis, and José E. Andrade. “A multi-body contact mechanics FEM method and its application to granular physics.” *25th International Congress of Theoretical and Applied Mechanics*, Milano, Italy. August 2021. [Short talk with poster]
13. **Liuchi Li**, Yifan Wang, Chiara Daraio, and José E. Andrade. “Reconfigurable textiles with controllable stiffness.” *Engineering Mechanics Institute Conference*, New York City, NY. May 2020. [Abstract accepted for talk but symposium cancelled due to Covid-19]
14. **Liuchi Li** and José E. Andrade. “Identifying spatial transitions in heterogeneous granular flow.” *Engineering Mechanics Institute Conference*, Pasadena, CA. June 2019. [Talk]
15. **Liuchi Li**, Eloise Marteau, and José E. Andrade. “Capturing the inter-particle force distribution in granular material using LS-DEM.” *Engineering Mechanics Institute Conference*, Boston, MA. July 2018. [Talk]
16. **Liuchi Li**, Eloise Marteau, and José E. Andrade. “Capturing the inter-particle force distribution in granular material using LS-DEM”. *13th World Congress on Computational Mechanics*, New York City, NY. June 2018. [Talk]
17. **Liuchi Li** and José E. Andrade. “Effect of volume fraction on the effective friction of transient granular avalanche in a rotating drum.” *Engineering Mechanics Institute Conference*, San Diego, CA. June 2017. [Talk]
18. **Liuchi Li** and José E. Andrade. “Experimental study of the dynamics of transient avalanche of elongated particle assemblies.” *Engineering Mechanics Institute Conference*, Nashville, TN. June 2016. [Talk]

TEACHING

Teaching Assistant, AE/ME 225: Plasticity, Winter 2019.

EXPERIENCE

- *Instructor: José E. Andrade*

- *Duties: holding regular office hours and grading homework.*

MENTORING

Cecily Sunday, visiting graduate student at Caltech, Spring 2019.

EXPERIENCE

- *Project: Dynamics of granular flow in discharging silo and rotating drum.*

- *Mentored on performing image analysis and DEM simulations.*

Eleni Blatsouka, summer research undergraduate at Caltech, Summer 2019.

- *Project: Stability of architected granular structure under seismic loading.*
- *Mentored on performing experiments using shaking tables and image analysis using MATLAB.*

Junhe Cui, summer research undergraduate at Caltech, Summer 2021.

- *Currently Ph.D. student in Mechanical Engineering at Columbia University*
- *Project: Internal structures of sands under cyclic loadings.*
- *Mentored on performing DEM simulations and data analysis.*

Nand Vommi, summer research undergraduate at Johns Hopkins, Summer 2022.

- *Project: Experimental studies on the dynamic fracture process of glass-ceramics.*
- *Mentored on sample preparations and image analysis.*

Jack Rao, summer research undergraduate at Johns Hopkins, Summer 2022.

- *Currently Ph.D. student in Mechanical Engineering at Stanford University*
- *Project: Parallel computation implementation of phase-field methods for fracture modeling.*
- *Mentored on MPI/OpenMP implementation and domain decomposition methods.*

Sai Divvela, summer high school student at Johns Hopkins, Summer 2022

- *Currently undergraduate student in Computer Science at the University of Maryland, College Park*
- *Project: An adaptive meshing technique for composite material microstructure representation.*
- *Supported by the Army Educational Outreach Program (AEOP).*
- *Mentored on the utilization of GMSH and data analysis.*

PROFESSIONAL MEMBERSHIPS

American Society of Mechanical Engineers; American Society of Civil Engineers; American Physical Society; American Ceramic Society; Society of Engineering Science.

SERVICES

1. Volunteer, *Engineering Mechanics Institute Conference*, Pasadena, June 2019.
2. Exhibitor and volunteer, “*Science for March*” outreach event, Pasadena, March 2018.
3. Journal reviewer: *Granular Matter*; *Physical Review E*; *International Journal of Numerical Methods in Engineering*; *Mechanics of Materials*; *Journal of Theoretical, Computational and Applied Mechanics*; *Nature Communications*.
4. Conference symposium organizer: *Society of Engineering Science (SES)*, *International Conference on Computational Plasticity (COMPLAS)*, *International Conference on Particle-based Methods (PARTICLE)*.

SELECTED MEDIA COVERAGES

1. “[Cracking the code on brittle materials](#)”. *Hopkins Extreme Material Institute*, June 2024.
2. “[Chain mail fabric stiffens under pressure](#)”. *Physics World*, September 2021.
3. “[Shapeshifting armor could let humans build bionic exoskeletons](#)”. *Inverse*, August 2021.
4. “[A flexible fabric could harden into a temporary house or bridge](#)”. *Scientific American*, August 2021.

5. [“Chain Mail-Inspired Smart Fabric Turns Rigid Under Pressure”](#). *Yahoo!*, August 2021.
6. [“Crean el tejido de los trajes de los superhéroes, capaz de volverse flexible o rígido a voluntad”](#). *El Español*, August 2021.
7. [“Materials: ‘Chain mail’ that toughens under pressure”](#). *Nature Asia*, August 2021.
8. [“3D Printed ‘Chain mail’ paves the way for next-generation smart fabrics”](#). *3D Printing Industry*, August 2021.
9. [“Scientists discover a flexible fabric that can be used to make a real-life superhero suit”](#). *Business Insider India*, August 2021.
10. [“Knights of SPACE! Chain mail-inspired material that can hold over 30 times its own weight could be used in astronauts’ spacesuits in the future, scientists say”](#). *Daily Mail*, August 2021.
11. [“The brain cells that help animals navigate in 3D”](#). *Nature Podcast*, August 2021.
12. [“The smart chain mail fabric that can stiffen on demand”](#). *Nature Video*, August 2021.
13. [“Material inspired by chain mail transforms from flexible to rigid on command”](#). *Caltech News*, August 2021.
14. [“Chain-mail fabric stiffens under confining pressure”](#). *Nature News and Views*, August, 2021.
15. [“How do landslides and mudslides occur?”](#). *Caltech News*, November 2018.