Liuchi Li

CONTACT INFORMATION

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RESEARCH INTERESTS

(Computational) Mechanics, Soft Matter Physics, (Optical) Sensing, Geometry, Many-body (Frictional) Contact, Fracture

ACADEMIC EMPLOYMENT

Princeton University, Princeton, NJ, USA

Assistant Professor of Civil and Environmental Engineering, January 2025-Present.

- *Associated Faculty*, Princeton Materials Institute (PMI);
- *Associated Faculty*, Princeton Institute for Computational Science & Engineering (PICSciE);
- *Associated Faculty*, High Meadows Environmental Institute (HMEI);
- *Associated Faculty*, Andlinger Center for Energy and the Environment (ACEE).

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

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. *Mechanics of Materials Early Career Award*, Elsevier, 2025.
2. *Early Career Travel Award*, Gordon Research Conference on Multifunctional Materials and Structures, 2024.
3. *Future Faculty Symposium Selectee*, Society of Engineering Science, 2023.
4. *Early Career Travel Award*, APS Topical Group on Shock Compression of Condensed Matter (SCCM23), 2023.
5. *Thomas J. R. Hughes Fellowship*, US National Committee for Theoretical and Applied Mechanics (USNC/TAM), 2022.
6. *Option Fellowship for Graduate Studies*, California Institute of Technology, 2015.
7. *Third Place*, ASCE Mid-Pacific Steel Bridge Competition, 2014.
8. *University Outstanding Graduate*, Tongji University, 2014.
9. *Academic Excellence Scholarship*, Tongji University, 2011-2014.

Refereed Journal Publications

(* for equal contribution, † for corresponding authorship; **Postdocs**, **Graduate students**, **Visiting personnel** while in the group)

At Princeton:

1. **L Li**† and K Karapiperis. "Geometry-mediated shear softening in dense ordered granular packings." ***Soft Matter***, (2026).
2. **EM del Castillo** and **L Li**†. "Crack steering in a homogeneous solid via out-of-plane constraints: A three-dimensional phase-field modeling study." ***Extreme Mechanics Letters***, 88 (2026).
3. **EM del Castillo** and **L Li**†. "Assessing variational phase-field fracture against LEFM predictions for crack-tip dynamics." ***International Journal of Solids and Structures***, 340 (2026).

Before Princeton:

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." ***Journal of the American Ceramic Society***, e70262, (2026).
2. 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) [Cover article].
3. **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) [2025 MECHMAT Early Career Award].

4. **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).
5. 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).
6. **L Li**†, K Karapiperis, and JE Andrade. "Emerging contact force heterogeneity in ordered soft granular media." ***Mechanics of Materials***, 104055, (2021).
7. Y Wang*, **L Li***, D Hofmann, JE Andrade, and C Daraio. "Structured fabrics with tunable mechanical properties." ***Nature***, 596, 238-243 (2021).
8. 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).
9. **L Li** and JE Andrade. "Identifying spatial transitions in heterogeneous granular flow." ***Granular Matter***, 22, 1-16, (2020).
10. **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).
11. 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).
12. 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).

Grants/Projects (Only funded ones are listed)

- **Princeton School of Engineering and Applied Science's Innovation Grant**, 2026 - 2027
  Topic: Harnessing the interplay among (many-body) frictional contact, porosity, and fluid flow towards effective and environmentally sustainable coastal protection;
  Role: Sole PI.

- **ERC Horizon Marie Sklodowska-Curie Actions Staff Exchanges**, 2026 - 2030
  Topic: Multi-scale mechanics of advanced materials under hypervelocity impact;
  Role: Participant, Partner institution: EPFL; Lead institution: Universidad Carlos III de Madrid.

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, friction, fracture in (and for) materials, structures, and the environment." *Department of Civil Engineering & Engineering Mechanics, Columbia University*, New York City, NY, USA. December 2026.
2. **Liuchi Li et al**. "Mechanics of contact, friction, fracture in (and for) materials and the environment." *PMI Annual Symposium, Princeton University*, Princeton, NJ, USA. April 2026.
3. **Liuchi Li et al**. "Mechanics of many-body frictional contact in (and for) granular rheology and elasticity." *Joint Graduate Seminar of the Department of Mechanical Engineering and Industrial and Systems Engineering, The University of Iowa*, Iowa City, IA, USA. February 2026.
4. **Liuchi Li et al**. "Mechanics of many-body frictional contact in (and for) granular rheology and elasticity." *Department of Civil and Environmental Engineering, The Hong Kong University of Science and Technology*, Hong Kong, SAR China. January 2026.
5. **Liuchi Li et al**. "Mechanics of many-body frictional contact by design for granular rheology and elasticity." *Lectures on Frontier Discipline, Tsinghua Shenzhen International Graduate School*, Shenzhen, Guangdong, China. January 2026.
6. **Liuchi Li et al**. "Mechanics of contact and fracture (by design) for resilient civil infrastructure." *Department of Geotechnical Engineering, Tongji University*, Shanghai, Shanghai, China. December 2025.
7. **Liuchi Li et al**. "Mechanics of contact, friction, and fracture (by design) - Towards the interaction between the natural and built environment." *LAMP Seminar, Department of Mechanical Engineering and Applied Mechanics, UPenn*, Philadelphia, PA, USA. December 2025.
8. **Liuchi Li et al**. "How the same small-scale contact process connects to different large-scale mechanical properties ranging from rheology to elasticity." *21st Annual Northeastern Granular Materials Workshop, Yale University*, New Haven, CT, USA. June 2025.
9. **Liuchi Li et al**. "Mechanics of frictional contact by design towards granular metamaterials and their (potential) applications." *Complex Fluids Group, Princeton University*, Princeton, NJ, USA. June 2025.
10. **Liuchi Li et al**. "Mechanics of contact and fracture for resilient civil infrastructure." *Institute for Building Materials, ETH Zurich*, Zurich, Switzerland. December 2024.
11. **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.
12. **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.
13. **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.
14. **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.

15. **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.
16. **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.
17. **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.
18. **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. Februrary 2022.
19. **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.
20. **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.
21. **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.
22. **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.
23. **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**, Konstantinos Karapiperis. "Shearing dense granular crystals in confined space can be easy: A geometry-mediated interplay between (simple) elasticity and (multi-body) contact." *20th U.S. National Congress of Theoretical and Applied Mechanics (USNC/TAM)*. June 2026 [Talk]
2. **Liuchi Li**, Konstantinos Karapiperis. "Shearing dense granular crystals in confined space can be easy: A geometry-mediated interplay between (simple) elasticity and (multi-body) contact." *20th Northeast Complex Fluids and Soft Matter Workshop*. February 2026 [Talk]
3. **Liuchi Li**, Konstantinos Karapiperis. "Shearing dense granular crystals in confined space can be easy: A geometry-mediated interplay between (simple) elasticity and (multi-body) contact." *2026 Gordon Research Conference on Multifunctional Materials and Structures*. January 2026 [Poster]

4. **Liuchi Li**, Velat Kilic, KT Ramesh, Mark Foster, and Todd Hufnagel. "Shack-Hartmann wavefront sensing: A new approach to time-resolved measurement of the stress intensity factor during dynamic fracture." *2025 Society of Engineering Science Annual Technical Meeting.* October 2025 [Talk]
5. **Liuchi Li**, Velat Kilic, KT Ramesh, Mark Foster, and Todd Hufnagel. "Shack-Hartmann wavefront 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]
6. **Liuchi Li**, Velat Kilic, KT Ramesh, Mark Foster, and Todd Hufnagel. "Shack-Hartmann wavefront 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]
7. **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]
8. **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]
9. **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]
10. **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]
11. **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]
12. **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]
13. **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]
14. **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]
15. **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]

16. **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]
17. **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 canceled due to Covid-19]
18. **Liuchi Li** and José E. Andrade. "Identifying spatial transitions in heterogeneous granular flow." *Engineering Mechanics Institute Conference*, Pasadena, CA. June 2019. [Talk]
19. **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]
20. **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]
21. **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]
22. **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 Experience

Instructor, CEE 361/MAE 325/MSE 331: Matrix Structural Analysis and Introduction to Finite Element Methods, Spring 2025, Fall 2025, Fall 2026, at Princeton.

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

Mentoring

At Princeton (both current and past members):

Postdocs:

- **Kunyu Yang**, 2025 - Present.
  Topic: Fluid-structure interactions by design towards adaptive and sustainable coastal protection.

- **Enrique M. Del Castillo**, 2025 - 2026.
  Topic: Nonlinear mechanics and physics of dynamic fracture in (brittle) solids.
  Last known position: Assistant Professor at Northeastern University, MA, USA.

Graduate students:

- **Yuyuan (Lisa) Shao**, 2026 - Present.
  Topic: Computational mechanics (and AI) for the nonlinear physics of dynamic (brittle) fracture.

- **Xiwei Pan**, 2025 - Present.

Topic: Computational mechanics for contact and friction in (and for) complex material systems.

Undergraduate students:

- **John Cureton**, 2025 - 2026.
  Topic: Guiding 3D crack propagation through designed lateral strains: A computational dynamic linear elastic fracture mechanics approach.
  Last known position: Civil Associate – Bridge at Michael Baker International, NC, USA.

- **Elinald Desroches** (co-advised by Ning Lin), 2025 - 2026.
  Topic: Fracture mechanics, materials.

- **Jackeline S. Sacasari** (co-advised by Guy Nordenson), 2025 - 2026.
  Topic: Historic Masonry Domes in Seismic Regions.

Before Princeton:

- **Nand Vommi**, summer research undergraduate at Johns Hopkins, Summer 2022.
  Last known position: MEP engineer at Turner Construction Company.

- **Jack Rao**, summer research undergraduate at Johns Hopkins, Summer 2022.
  Last known position: Ph.D. student at Stanford MechE.

- **Sai Divvela**, summer high school student at Johns Hopkins, Summer 2022.
  Last known position: undergraduate student at UMD CS.

- **Junhe Cui**, summer research undergraduate at Caltech, Summer 2021.
  Last known position: Ph.D. student at Columbia MechE.

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

- **Cecily Sunday**, visiting graduate student at Caltech, Spring 2019.
  Last known position: Postdoctoral scholar at UMD AE.

PROFESSIONAL MEMBERSHIPS

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

SERVICES

1. General exam committee: Yangwoo Lee (CEE, Advisor: Claire White); Kent Eng (CEE, Advisor: Branko Glisic); Aaron Spaulding (CEE, Advisor: Ning Lin), Zhaoyang Song (CEE, Advisor: Maria Garlock); Meddelin Setiawan (CEE, Advisor: Claire White); Chenxiao Tian (CEE, Advisor: Jürgen Hackl); Lucien Tsai (CEE, Advisor: Glaucio Paulino); Borui Xu (CEE, Advisor: Glaucio Paulino); Margi Gajjar (CEE, Advisor: Reza Moini); Antu Acharya (CEE, Advisor: Reza Moini).
2. Ph.D. FPO committee/reader: Emily Alcazar (CEE, Advisor: Glaucio Paulino); Kevin Liu (CEE, Advisor: Glaucio Paulino); Gaoyuan Wu (CEE, Advisor: Maria Garlock); Axel Larsson (CEE,

Advisor: Sigrid Adriaenssen); Austin Fan (CBE, Advisor: Kelsey Hatzell); Tejas Dethe (MAE, Advisors: Andrej Kŏsmrlj & Howard A. Stone); Evan Willmarth (Yale ME, Advisor: Corey O'Hern).

3. Faculty advisor to first-year BSE students: Class of 2029 and 2030, Rockefeller College.
4. Journal reviewer: *Granular Matter*; *Physical Review E*; *Physical Review Letters*; *International Journal of Numerical Methods in Engineering*; *Finite Elements in Analysis & Design*; *Mechanics of Materials*; *Journal of Theoretical, Computational and Applied Mechanics*; *European Journal of Mechanics/A Solids*; *International Journal of Mechanical Sciences*; *Nature Communications*; *Journal of Applied Mechanics*.
5. Conference symposium organizer: *Society of Engineering Science*; *International Conference on Computational Plasticity*; *International Conference on Particle-based Methods*.