

# Ruobing Bai

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Assistant Professor, Mechanical and Industrial Engineering, Northeastern University  
203 Snell Engineering Center, 360 Huntington Ave, Boston, MA 02115  
Email: [ru.bai@northeastern.edu](mailto:ru.bai@northeastern.edu) Office phone: 617-373-7150  
<https://sites.google.com/view/ruobingbai>

## EDUCATION

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**Ph.D., Engineering Sciences** 2018  
Harvard University  
Thesis: "Fatigue of Hydrogels"  
Advisor: Zhigang Suo

**B.S., Theoretical and Applied Mechanics** 2012  
Peking University  
Thesis: "Stress Analysis of Lithium Ion Batteries with Surface Effect and Phase Transition"  
Advisor: Huiling Duan

## ACADEMIC POSITIONS

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**Assistant Professor** Jan 2021 - Now  
Northeastern University, Department of Mechanical and Industrial Engineering

**Postdoctoral Fellow** Aug 2018 - Dec 2020  
California Institute of Technology, Department of Mechanical and Civil Engineering  
Advisor: Kaushik Bhattacharya

**Postdoctoral Fellow** May 2018 - Aug 2018  
**Graduate Research Assistant** Sept 2012 - May 2018  
Harvard University, John A. Paulson School of Engineering and Applied Sciences  
Advisor: Zhigang Suo

## RESEARCH INTERESTS

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- Solid mechanics and large deformation
- Damage, fracture, fatigue, debonding, strengthening, toughening, and adhesion
- Stimuli-responsive actuation and instability
- Multifunctional materials and sustainable materials
- Multiphysical processes

## JOURNAL PUBLICATIONS

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1. A. Anssari-Benam, Z. Wei, R. Bai, "Modelling the Deformation of Polydomain Liquid Crystal Elastomers as a State of Hyperelasticity". *Journal of Elasticity*, 2024.
2. Q. Yin, Y. A. Manav, Y. Wan, B. Davaji, R. Bai, "Strong and Highly Switchable Soft Sticky Adhesives". *Submitted*, 2024.
3. Y. Wang, Z. Wei, T. Ji, R. Bai, H. Zhu, "Highly Ionic Conductive, Stretchable, and Tough Ionogel for Flexible Solid-State Supercapacitor". *Small*, 2023.
4. D. Cao, T. Ji, Z. Wei, W. Liang, R. Bai, K. S. Burch, M. Geiwitz, H. Zhu, "Enhancing Lithium Stripping Efficiency in Anode-Free Solid-State Batteries through Self-Regulated Internal Pressure". *Nano Letters*, 2023.
5. Z. Wei, P. Wang, R. Bai, "Thermomechanical Coupling in Polydomain Liquid Crystal Elastomers". *Journal of Applied Mechanics*, 2024.
6. Y. Xiao, Q. Li, X. Yao, R. Bai, W. Hong, C. Yang, "Fatigue of Amorphous Hydrogels with Dynamic Covalent Bonds". *Extreme Mechanics Letters*, 2022.

- Z. Wei, R. Bai, "Temperature-Modulated Photomechanical Actuation of Photoactive Liquid Crystal Elastomers," *Extreme Mechanics Letters*, 2022.
- R. Bai, E. Ocegueda, K. Bhattacharya, "Photochemical-Induced Phase Transitions in Photoactive Semicrystalline Polymers". *Physical Review E*, 2021.
- M. Hua, C. Kim, Y. Du, D. Wu, R. Bai, X. He, "Swaying Gel: Chemo-mechanical Self-Oscillation Based on Dynamic Buckling". *Matter*, 2021.
- R. Bai, Y. S. Teh, K. Bhattacharya, "Collective Behavior in the Kinetics and Equilibrium of Solid-State Photoreaction". *Extreme Mechanics Letters*, 2021.
- R. Bai, K. Bhattacharya, "Photomechanical Coupling in Photoactive Nematic Elastomers". *Journal of the Mechanics and Physics of Solids*, 2020.
- J. Yang, J. Steck, R. Bai, Z. Suo, "Topological Adhesion II. Stretchable Adhesion". *Extreme Mechanics Letters*, 2020.
- B. Chen, J. Yang, R. Bai, Z. Suo, "Molecular Staples for Tough and Stretchable Adhesion in Integrated Soft Materials". *Advanced Healthcare Materials*, 2019.
- J. Yang, R. Bai, J. Li, C. Yang, X. Yao, Q. Liu, J. Vlassak, D. J. Mooney, Z. Suo, "Design Molecular Topology for Wet-Dry Adhesion". *ACS Applied Materials & Interfaces*, 2019.
- J. Yang, R. Bai, B. Chen, Z. Suo, "Hydrogel Adhesion: A Supramolecular Synergy of Chemistry, Topology, and Mechanics". *Advanced Functional Materials*, 2019.
- R. Bai, J. Yang, X. P. Morelle, Z. Suo, "Flaw-Insensitive Hydrogels under Static and Cyclic Loads". *Macromolecular Rapid Communications*, 2019.
- R. Bai, B. Chen, J. Yang, Z. Suo, "Tearing a Hydrogel of Complex Rheology". *Journal of the Mechanics and Physics of Solids*, 2019.
- R. Bai, J. Yang, Z. Suo, "Fatigue of Hydrogels". *European Journal of Mechanics - A/Solids*, 2019.
- M. Sun, R. Bai, X. Yang, J. Song, Z. Suo, X. He, "Hydrogel Interferometry for Ultrasensitive and Highly Selective Chemical Detection". *Advanced Materials*, 2018.
- X. P. Morelle, W. R. Illeperuma, K. Tian, R. Bai, Z. Suo, J. Vlassak, "Highly Stretchable and Tough Hydrogels Below Water Freezing Temperature". *Advanced Materials*, 2018.
- Z. Wang, J. Tang, R. Bai, W. Zhang, T. Lian, T. Lu, T. Wang, "A Phenomenological Model for Shakedown of Tough Hydrogels under Cyclic Loads". *Journal of Applied Mechanics*, 2018.
- J. Yang, R. Bai, Z. Suo, "Topological Adhesion of Wet Materials". *Advanced Materials*, 2018.
- E. Zhang, R. Bai, X. P. Morelle, Z. Suo, "Fatigue Fracture of Nearly Elastic Hydrogels". *Soft Matter*, 2018.
- M. Qin, M. Sun, R. Bai, Y. Mao, X. Qian, D. Sikka, Y. Zhao, H. J. Qi, Z. Suo, X. He, "Bioinspired Hydrogel Interferometer for Adaptive Coloration and Chemical Sensing". *Advanced Materials*, 2018.
- R. Bai, J. Yang, X. P. Morelle, C. Yang, Z. Suo, "Fatigue Fracture of Self-Recovery Hydrogels". *ACS Macro Letters*, 2018.
- X. P. Morelle, R. Bai, Z. Suo, "Localized Deformation in Plastic Liquids on Elastomers". *Journal of Applied Mechanics*, 2017.
- R. Bai, Q. Yang, J. Tang, X. P. Morelle, J. Vlassak, Z. Suo, "Fatigue Fracture of Tough Hydrogels". *Extreme Mechanics Letters*, 2017.
- R. Bai, Z. Suo, "Optomechanics of Soft Materials". *Journal of Applied Mechanics*, 2015.
- Y. Liu, P. Lv, J. Ma, R. Bai, H. L. Duan, "Stress Fields in Hollow Core-Shell Spherical Electrodes of Lithium Ion Batteries". *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Science*, 2014.

## BOOK CHAPTERS

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- J. Yang, R. Bai, "Mechanics of Wet Adhesion". *Mechanics of Flexible and Stretchable Electronics*, edited by Yong Zhu and Nanshu Lu, Wiley-VCH GmbH, in press.

## PATENTS

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- Ruobing Bai, Qianfeng Yin, Yichen Wan, "Thermo-Switchable Pressure-Sensitive Adhesives". US Provisional Patent App. 63/617,185, 2023.

2. Jiawei Yang, Ruobing Bai, Zhigang Suo, “Topological Adhesion of Materials”. US Patent App. 17/048,803, 2021.

## AWARDS AND HONORS

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- *Doctoral New Investigator grant*  
American Chemical Society (ACS) Petroleum Research Fund 2024
- *EML Young Investigator Award*  
Extreme Mechanics Letters 2022
- *Haythornthwaite Research Initiation Award*  
Applied Mechanics Division of American Society of Mechanical Engineers (ASME) 2022
- *Best Poster Award*  
New England Workshop on the Mechanics of Materials and Structures, Massachusetts Institute of Technology, Cambridge, MA 2017
- *Haythornthwaite Student Travel Grants*  
American Society of Mechanical Engineers International Mechanical Engineering Congress & Exposition, Phoenix, AZ 2016
- *Chun-Tsung Scholar*  
Peking University, Beijing, China 2010
- *National Scholarship of China*  
Peking University, Beijing, China 2009
- *Pacemaker to Merit Student*  
Peking University, Beijing, China 2009

## PRESENTATIONS

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### Invited Seminars and Keynote Presentations

- *Interfacial Fatigue and Switchable Adhesion of Soft Sticky Adhesives*  
Fracture of Soft Materials Symposium, UT Austin, Austin, Texas May 2024
- *Mechanics of physically intelligent soft materials*  
Brown University, Providence, RI Apr 2024
- *Mechanics of physically intelligent soft materials*  
Tufts University, Medford, MA Mar 2024
- *Embedding Physical Intelligence in Soft Active Materials: from Actuation of Liquid Crystal Elastomers to Switchable Pressure-Sensitive Adhesives*  
Extreme Mechanics Letters Webinar, virtual Sep 2023
- *Fracture, fatigue, and adhesion of soft active materials*  
Adhesion Community of Practice, Dow, virtual Jun 2023
- *Embedding Physical Intelligence in Soft Active Materials through Stimuli-Responsive Phase Transformation: from Photomechanical Actuation to Thermo-switchable Adhesion*  
University of Connecticut, Mansfield, CT Mar 2023
- *Photomechanical Coupling in Photoactive Molecular Crystals and Liquid Crystal Elastomers*  
UMass Dartmouth, Dartmouth, MA Nov 2022
- *Mesoscale Photomechanical Coupling in Photoactive Materials*  
New England Workshop on the Mechanics of Materials and Structures (NEW MECH), MIT, Cambridge, MA May 2022
- *Fatigue of Hydrogels and What We Have Learned So Far*  
Prospects of Soft Matter Symposium, CU Boulder, virtual Apr 2022
- *Liquid Crystal Elastomers: from Optics to Novel Mechanics*  
Display Materials Technology Symposium, KLA Instruments, virtual Feb 2022
- *Mesoscale Photomechanical Coupling in Photoactive Materials*  
Engineering and Applied Science Forum Webinar, virtual Jan 2022
- *Mechanics of Soft Active Materials: Characterization, Design, and Functionalization*  
California Institute of Technology, Pasadena, CA May 2020

- *Soft Active Materials towards Soft Machines: Characterization, Design, and Functionalization*  
University of Houston, Houston, TX Feb 2020
- *Mechanics of Soft Active Materials: Characterization, Design, and Functionalization*  
Southern Methodist University, Dallas, TX Feb 2020
- *Mechanics of Soft Active Materials: Characterization, Design, and Functionalization*  
Northeastern University, Boston, MA Feb 2020
- *Mechanics of Soft Active Materials: Characterization, Design, and Functionalization*  
University at Buffalo, Buffalo, NY Nov 2019

### Conference Presentations

- *American Physical Society (APS) March Meeting*: 2024 (Minneapolis, MN), 2023 (Las Vegas, NV)
- *Adhesion Society Annual Meeting*: 2024 (Savannah, GA), 2023 (Orlando, FL)
- *National Congress for Theoretical and Applied Mechanics (USNC-TAM)*: 2022 (Austin, TX), 2018 (Chicago, IL)
- *Society of Engineering Science (SES)*: 2024 (Hangzhou, China), 2023 (Minneapolis, MN), 2022 (College Station, TX), 2019 (St. Louis, MO)
- *Materials Research Society (MRS) Fall*: 2022 (Boston, MA), 2019 (Boston, MA)
- *International Mechanical Engineering Congress & Exposition (ASME-IMECE)*: 2023 (New Orleans, LA), 2021 (virtual), 2016 (Phoenix, AZ)
- *New England Workshop on the Mechanics of Materials and Structures (NEW MECH)*: 2023 (Boston, MA), 2022 (Cambridge, MA), 2017 (Cambridge, MA)

## COURSES

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### Undergraduate Courses

ME2355, <i>Mechanics of Materials</i> , Instructor, Northeastern University	Fall 2022
ME2340/2341, <i>Introduction to Materials Science</i> , Instructor, Northeastern University	Spring 2021-2024
ES 181, <i>Engineering Thermodynamics</i> , Teaching Fellow, Harvard University	Fall 2015
ES 120, <i>Introduction to the Mechanics of Solids</i> , Teaching Fellow, Harvard University	Spring 2015

### Graduate Courses

ME6320, <i>Mechanics of Soft Materials</i> , Instructor, Northeastern University	Fall 2023
AM/ME 165, <i>Finite Elasticity</i> , Guest Lecturer, California Institute of Technology	Winter 2019
ES 240, <i>Solid Mechanics</i> , Teaching Fellow, Harvard University	Fall 2013

## ACADEMIC SERVICES

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### Ongoing External Services

- Editor, ASME technical committee, *Mechanics of Soft Materials*, Applied Mechanics Division, 2024-2025
- Editor, iMechanica Journal Club, 2024-2025
- Extreme Mechanics Letters (EML) Early Career Advisory Board, 2023-2025
- Moderator, iMechanica.org, world's largest web of mechanics and mechanicians
- Reviewer for: *ACS Macro Letters*, *Advanced Materials*, *Advanced Functional Materials*, *Applied Physics Letters*, *Engineering Fracture Mechanics*, *European Journal of Mechanics / A Solids*, *European Polymer Journal*, *Extreme Mechanics Letters*, *International Journal of Fracture*, *International Journal of Mechanical Sciences*, *International Journal of Solids and Structures*, *iScience*, *Journal of Applied Mechanics*, *Journal of Applied Physics*, *Journal of the Mechanics and Physics of Solids*, *Macromolecules*, *Materials Science & Engineering C*, *Materials Today*, *Mechanics of Materials*, *Mechanics of Soft Materials*, *Molecules*, *Nano Letters*, *npj Computational Materials*, *Proceedings of the Royal Society A*, *Physical Review Applied*, *Physical Review E*, *Physical Review Letters*, *Physical Review Materials*, *Physical Review X*, *PNAS*, *RSC Advances*, *Science*, *Science Advances*, *Soft Matter*, etc.

### Past External Services

- Review panel, National Science Foundation (NSF), 2024, 2022
- Session chair, *Fracture of Soft Materials*, AmeriMech Symposium, UT Austin, 2024
- Reviewer, NASA, 2024
- Session chair, *Reversible Adhesion/Adhesives & 3D Printing*, Adhesion Society Annual Meeting, Savannah, 2024
- Minisymposium chair, *Adhesion, Friction, and Fracture at Soft Interfaces: Theory, Simulation, and Experiment*, Society of Engineering Science (SES) Annual Meeting, Westlake University, 2024
- Minisymposium chair, *EML 10th Anniversary Symposium (Invitation Only)*, Society of Engineering Science (SES) Annual Meeting, Westlake University, 2024
- Organizer, New England Workshop on the Mechanics of Materials and Structures (NEW.Mech), Northeastern University, 2023
- Minisymposium chair, *Elastomeric Fracture*, Society of Engineering Science (SES) Annual meeting, University of Minnesota, 2023
- Minisymposium chair, *Adhesion, Friction, and Fracture at Soft Interfaces: Theory, Simulation, and Experiment*, Society of Engineering Science (SES) Annual meeting, University of Minnesota, 2023
- Reviewer, American Society for Engineering Education (ASEE) eFellows (Engineering Postdoctoral Fellowship) by National Science Foundation (NSF), 2022
- Minisymposium chair, *Mechanics of Liquid Crystal Elastomers*, U.S. National Congress on Theoretical and Applied Mechanics (USNC/TAM), UT Austin, 2022
- Review editor, *Frontiers in Materials - Smart Materials & Soft Robotics*, 2022
- Session chair, *Mechanics of Smart and Tough Gels*, International Union of Theoretical and Applied Mechanics (IUTAM) Symposium, UT Austin, 2021
- Guest editor, *Frontiers in Robotics and AI - Soft Robotics*, Research Topic *Extreme Mechanics of Soft Active Materials for Soft Robotics*, 2020-2021
- Discussion leader, iMechanica Journal Club, *Fatigue of hydrogels*, 2019