Emma Lejeune

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Current Position

Tenure-Track Assistant Professor 1/2020 - Present
David R. Dalton Career Development Assistant Professorship
Department of Mechanical Engineering
Boston University

Research Experience

Research Assistant Professor 9/2019 - 12/2019
Department of Mechanical Engineering
Boston University

Peter O'Donnell, Jr. Postdoctoral Fellow 9/2018 - 8/2019
The Oden Institute for Computational Engineering and Sciences
The University of Texas at Austin
Advisor: Michael Sacks

Graduate Research Fellow 9/2013 - 8/2018
The Department of Civil and Environmental Engineering
Stanford University
Advisor: Christian Linder

Education

Stanford University 3/2015 - 9/2018
Ph.D. in Civil & Environmental Engineering,
Thesis: Numerical modeling of mechanically driven emergent behavior in biological systems
Advisor: Christian Linder
Additional Committee Members: Ronaldo Borja, Ellen Kuhl

Stanford University 9/2013 - 3/2015
M.S. in Civil & Environmental Engineering, Structural Engineering and Geomechanics
Advisor: Christian Linder

Cornell University 8/2009 - 5/2013
B.S. in Civil Engineering, *magna cum laude*

Journal Publications

J27. Yuan, L., Park, H. S., & **Lejeune, E.** (*under review*). Towards out of distribution generalization for problems in mechanics. arXiv preprint arXiv:2206.14917.

J26. Das, S., Sutherland, B., **Lejeune, E.**, Eyckmans, E., and Chen, C.S. (*under review*). Mechanical response of cardiac microtissues to acute localized injury.

J25. Kakaletsis, S., **Lejeune, E.**, & Rausch, M.K. (*under review*). Can machine learning accelerate soft material parameter identification from complex mechanical test data?

J24. Kobeissi, H., Mohammadzadeh, S., & **Lejeune, E.** (*in press* 2022). Enhancing Mechanical Metamodels with a Generative Model-Based Augmented Training Dataset. Journal of Biomechanical Engineering.

J23. Prachaseree, P., & **Lejeune, E.** (*in press* 2022). Learning Mechanically Driven Emergent Behavior with Message Passing Neural Networks. Computers & Structures, 270, 106825.

J22. Lohr, M.J., Sugerman, G.P., Kakaletsis, S., **Lejeune, E.**, & Rausch, M.K. (*in press* 2022). An Introduction to the Ogden Model in Biomechanics – Benefits, Implementation Tools, and Limitations. Philosophical Transactions of the Royal Society A.

J21. Mohammadzadeh, S., & **Lejeune, E.** (2022). Predicting mechanically driven full-field quantities of interest with deep learning-based metamodels. Extreme Mechanics Letters, 50, 101566.

J20. Zhao, B., Zhang, K., Chen, C. S., & **Lejeune, E.** (2021). Sarc-Graph: Automated segmentation, tracking, and analysis of sarcomeres in hiPSC-derived cardiomyocytes. PLOS Computational Biology, 7(10), e1009443.

J19. Khang, A., **Lejeune, E.**, Abbaspour, A., Howsmon, D. P., & Sacks, M. S. (2021). On the Three-Dimensional Correlation Between Myofibroblast Shape and Contraction. Journal of Biomechanical Engineering, 143(9), 094503.

J18. Das, S. L., Bose, P., **Lejeune, E.**, Reich, D. H., Chen, C., & Eyckmans, J. (2021). Extracellular Matrix Alignment Directs Provisional Matrix Assembly and Three Dimensional Fibrous Tissue Closure. Tissue Engineering Part A, 27(23-24), 1447-1457.

J17. Kakaletsis, S., Meador, W., Mathur, M., Sugerman, G. P., Jazwiec, T., Malinowski, M., **Lejeune, E.**, Timek, T.A. & Rausch, M. K. (2021). Right Ventricular Myocardial Mechanics: Multi-Modal Deformation, Microstructure, and Modeling. Acta Biomateriala, 123, 154-166.

J16. **Lejeune, E.**, & Zhao, B. (2021). Exploring the potential of transfer learning for metamodels of heterogeneous material deformation. Journal of the Mechanical Behavior of Biomedical Materials, 104276.

J15. **Lejeune, E.** (2021). Geometric Stability Classification: Datasets, Metamodels, and Adversarial Attacks. Computer-Aided Design, 131, 102948.

J14. **Lejeune, E.** (2020). Mechanical MNIST: A benchmark dataset for mechanical metamodels. Extreme Mechanics Letters, 100659.

J13. **Lejeune, E.**, Khang, A., Sansom, J., & Sacks, M. S. (2020). FM-Track: A fiducial marker tracking software for studying cell mechanics in a three-dimensional environment. SoftwareX, 11, 100417.

J12. **Lejeune, E.**, & Linder, C. (2020). Interpreting stochastic agent-based models of cell death. Computer Methods in Applied Mechanics and Engineering, 360, 112700.

J11. Khang, A., Rodriguez, A. G., Schroeder, M. E., Sansom, J., **Lejeune, E.**, Anseth, K. S., & Sacks, M. S. (2019). Quantifying heart valve interstitial cell contractile state using highly tunable poly (ethylene glycol) hydrogels. Acta biomaterialia, 96, 354-367.

J10. **Lejeune, E.**, & Sacks, M. S. (2019). Analyzing valve interstitial cell mechanics and geometry with spatial statistics. Journal of biomechanics, 93, 159-166.

J9. **Lejeune, E.**, Dortdivanlioglu, B., Kuhl, E., & Linder, C. (2019). Understanding the mechanical link between oriented cell division and cerebellar morphogenesis. Soft matter, 15(10), 2204-2215.

J8. **Lejeune, E.**, & Linder, C. (2018). Understanding the relationship between cell death and tissue shrinkage via a stochastic agent-based model. Journal of biomechanics, 73, 9-17.

J7. **Lejeune, E.**, & Linder, C. (2018). Modeling mechanical inhomogeneities in small populations of proliferating monolayers and spheroids. Biomechanics and modeling in mechanobiology, 17(3), 727-743.

J6. **Lejeune, E.**, & Linder, C. (2017) Quantifying the relationship between cell division angle and morphogenesis through computational modeling. Journal of Theoretical Biology, 418, 1-7.

J5. **Lejeune, E.**, & Linder, C. (2017) Modeling tumor growth with peridynamics. Biomechanics and Modeling in Mechanobiology, 16(4), 1141-1157.

J4. **Lejeune, E.**, Javili, A., Weickenmeier, J., Kuhl, E., & Linder, C. (2016). Tri-layer wrinkling as a mechanism for anchoring center initiation in the developing cerebellum. Soft Matter, 12(25), 5613-5620.

J3. **Lejeune, E.**, Javili, A., & Linder, C. (2016). An algorithmic approach to multi-layer wrinkling. Extreme Mechanics Letters, 7, 10-17.

J2. **Lejeune, E.**, Javili, A., & Linder, C. (2016). Understanding geometric instabilities in thin films via a multi-layer model. Soft Matter, 12(3), 806-816.

J1. Rivera, J. P., Josipovic, G., **Lejeune, E.**, Luna, B. N., & Whittaker, A. S. (2015). Automated detection and measurement of cracks in reinforced concrete components. ACI Structural Journal, 112(3), 397.

Software and Datasets

SD6. Asymmetric Buckling Columns Datasets (2022) `https://open.bu.edu/handle/2144/43730`

SD5. Sarc-Graph: Segmentation, Tracking, and Analysis of hiPSC-CMs (2021) `https://github.com/elejeune11/Sarc-Graph`

SD4. Right Ventricular Myocardial Mechanics Dataset · Collaboration with M.K. Rausch (2020) `https://dataverse.tdl.org/dataverse/RVMechanics`

SD3. Buckling Instability Classification Datasets (2020) `https://open.bu.edu/handle/2144/40085`

SD2. Mechanical MNIST Datasets (2020) `https://open.bu.edu/handle/2144/39371`

SD1. FM-Track: Fiducial Marker Tracking Software (2020) `https://github.com/elejeune11/FM-Track`

Book Chapters

C2. **Lejeune, E.**, & Linder, C. (2021). Modeling biological materials with peridynamics. In Peridynamic Modeling, Numerical Techniques, and Applications (pp. 249-273). Elsevier.

C1. Khang, A., Howsmon, D. P., **Lejeune, E.**, & Sacks, M. S. (2020). Multi-scale modeling of the heart valve interstitial cell. In Multi-scale Extracellular Matrix Mechanics and Mechanobiology (pp. 21-53). Springer, Cham.

Invited Talks

T9. **Lejeune, E.** Open Access Benchmark Datasets and Metamodels for Predicting the Mechanical Behavior of Heterogeneous Materials. NEW.Mech, Massachusetts Institute of Technology. May 2022.

T8. **Lejeune, E.** Metamodeling Strategies for Predicting Single and Full Field Quantities of Interest in Heterogeneous Materials. Computing in Engineering Forum University of Wisconsin-Madison. September 2021.

T7. **Lejeune, E.** Benchmark Datasets and Metamodeling Strategies for Predicting the Behavior of Heterogeneous Materials. Northern Arizona University. September 2021.

T6. **Lejeune, E.** Methods for computational modeling and computation based discovery of spatially heterogeneous biological materials. Pontificia Universidad Católica de Chile. June 2021.

T5. **Lejeune, E.** Modeling heterogeneous materials: benchmark datasets, metamodels, and experimental characterization. Michigan Institute for Computational Discovery & Engineering. University of Michigan. February 2021.

T4. **Lejeune, E.** Benchmark datasets for mechanical metamodels. Machine Learning in Science and Engineering (MLSE), Mechanical Engineering, Engineering Mechanics, and Civil Engineering Track. Columbia University Data Science Institute. December 2020.

T3. **Lejeune, E.**, Khang, A., & Sacks, M.S. Multiscale mechanical modeling of biological systems. Biophysical Society Meeting, Bioengineering Subgroup Saturday. February 2020.

T2. **Lejeune, E.** Multi-scale mechanical modeling of biological systems. Joint Solid Mechanics and Materials Seminar Series at Brown University. November 2019.

T1. **Lejeune, E.**, Khang, A., West, N., Sansom, J., & Sacks, M.S.. Keynote: Multiscale modeling of valve interstitial cells in a three-dimensional hydrogel environment. The Society of Engineering Sciences. St. Louis, MO. October 2019.

Honors and Awards

Mechanical Engineering "Professor of the Year" Award for Teaching Excellence	2022
American Heart Association Career Development Award	2021
David R. Dalton Career Development Professorship	2020-2023
Haythornthwaite Foundation Research Initiation Grant ASME Applied Mechanics Division	2020

Junior Faculty Fellow 2020
Rafik B. Hariri Institute for Computing and Computational Science & Engineering

Biophysical Society Bioengineering Subgroup Early Career Research Award 2020

The Oden Institute Peter O'Donnell, Jr. Postdoctoral Fellowship 2018-2019

NSF Graduate Research Fellowship 2014-2017

Stanford School of Engineering Graduate Fellowship 2013-2014

Cornell Merrill Presidential Scholar, Top 1% of Graduating Seniors 2013

Teaching Experience

Instructor of Record 2020-22
EK 301: Engineering Mechanics I *Boston University*

Fundamental statics of particles, rigid bodies, trusses, frames, virtual work, distributed forces, uni-axial stress and strain, shear and bending moment diagrams, application of vector analysis, and introduction to engineering design.

Academic Service

Open Access Mechanics Datasets Website 2021-Present
Website with links to open access datasets designed as a community resource
`https://elejeune11.github.io/`

iMechanica Journal Club Leader May 2022
Machine Learning in Mechanics: Curating datasets and defining challenge problems
`https://imechanica.org/node/25935`

Lead Organizer 2021-2022
A Closer Look: Open Journal Club in Biomechanics, 32 speakers to date

Minisymposium Organizer 2021
U.S. National Congress on Computational Mechanics

NSF Panel Reviewer 2020-22

Abstract Reviewer and Student Presentation Competition Judge 2020-22
Summer Biomechanics, Bioengineering, and Biotransport Conference

Minisymposium Organizer 2019, 2022
Society of Engineering Sciences

Manuscript Reviewer: Acta Biomaterialia, Biophysical Reviews, Computational Materials Science, Computer-Aided Design, Computer Methods in Applied Mechanics and Engineering, Computer Methods in Biomechanics and Biomedical Engineering, Engineering with Computers, International Journal for Numerical Methods in Biomedical Engineering, International Journal of Solids and Structures, Journal of Biomechanical Engineering, Journal of Engineering Mechanics, Journal of the Mechanical Behavior of Biomedical Materials, Journal of the Mechanics and

Physics of Solids, Journal of the Royal Society Interface, Nature Computational Science, Nature Scientific Reports, Proceedings of the National Academy of Sciences, Soft Matter, Numerical Methods in Biomedical Engineering, Theoretical and Applied Fracture Mechanics.

Outreach

Undergraduate Student Mentor Summer 2021 & 2022
CELL-MET NSF Engineering Research Center REU Program *Boston University*

Provided research guidance and mentorship to a community college student participating in the CELL-MET REU, a program for exposing students from diverse backgrounds to research.

High School Student Mentor Summer 2016
Raising Interest in Science and Engineering (RISE) program *Stanford University*

Provided research guidance and mentorship for a high school student participating in RISE, a program designed for bright low income students who will be the first in their family to attend college.

High School Teacher Mentor Summer 2016
Research Experience for Teachers (RET) program *Stanford University*

Provided research guidance and collaborated with a high school teacher participating in RET, a program designed to give teachers a research experience that they can transfer to their high school classroom.

Mechanics Simulation Tutorial Spring 2015
Eastside College Preparatory School *East Palo Alto, CA*

Taught an interactive lesson on simulating structural materials at a high school focused on providing opportunities to students traditionally underrepresented in higher education.