David L. Henann

James R. Rice Associate Professor of Solid Mechanics
School of Engineering
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Education

Ph.D. Mechanical Engineering, MIT — June 2011
Thesis: Aspects of the mechanics of metallic glasses

S.M. Mechanical Engineering, MIT — June 2008
Thesis: A constitutive theory for the mechanical response of amorphous metals at high temperatures spanning the glass transition temperature: application to microscale thermoplastic forming of $Zr_{41.2}Ti_{13.8}Cu_{12.5}Ni_{10}Be_{22.5}$

B.S. Mechanical Engineering, State University of New York at Binghamton — May 2006
Honors: Summa Cum Laude

Professional Appointments

James R. Rice Associate Professor of Solid Mechanics — July 2020 – Present
Associate Professor of Engineering
Brown University, School of Engineering

James R. Rice Assistant Professor of Solid Mechanics — July 2016 – June 2020
Assistant Professor of Engineering — September 2013 – June 2020
Brown University, School of Engineering

Postdoctoral Associate — July 2011 – June 2013
Harvard University, School of Engineering and Applied Sciences

Postdoctoral Associate — July 2011 – June 2013
MIT, Department of Mechanical Engineering

Completed Publications

Refereed Journal Articles

Michael Jandron* and David L. Henann. Electromechanical instabilities in periodic dielectric elastomer composites. *Int. J. Solids Struct.* **191** (2020) 220–242.

Lauren Mancia, Eli Vlaisavljevich, Nyousha Yousefi, Mauro Rodriguez, Timothy Ziemlewicz, Fred Lee Jr, David L. Henann, Christian Franck, Zhen Xu, and Eric Johnsen. Modeling tissue-selective cavitation. *Physics in Medicine and Biology* **64** (2019) 225001.

Alexander K. Landauer†, Xiuqi Li†*, Christian Franck, and David L. Henann. Experimental characterization and hyperelastic constitutive modeling of open-cell elastomeric foams. *J. Mech. Phys. Solids* **133** (2019) 103701.

†Co-first authors.

Shihong Li* and David L. Henann. Material stability and instability in nonlocal continuum models for dense granular materials. *J. Fluid Mech.* **871** (2019) 799–830.

*Is/was a member of the Henann Group at Brown University

Chad T. Wilson, Timothy L. Hall, Eric Johnsen, Lauren Mancia, Mauro Rodriguez, Jonathan E. Lundt, Tim Colonius, David L. Henann, Christian Franck, Zhen Xu, and Jonathan R. Sukovich. Comparative study of the dynamics of laser and acoustically generated bubbles in viscoelastic media. *Phys. Rev. E* **99** (2019) 043103.

Daren Liu* and David L. Henann. Size-dependence of the flow threshold in dense granular materials. *Soft Matter* **14** (2018) 5294–5305.

Michael Jandron* and David L. Henann. A numerical simulation capability for electroelastic wave propagation in dielectric elastomer composites: Application to tunable soft phononic crystals. *Int. J. Solids Struct.* **150** (2018) 1–21.

Alexander K. Landauer, Mohak Patel, David L. Henann, and Christian Franck. A q-factor-based digital image correlation algorithm (qDIC) for resolving finite deformations with degenerate speckle patterns. *Experimental Mechanics* **58** (2018) 815–830.

Jonathan B. Estrada, Carlos Barajas, David L. Henann, Eric Johnsen, and Christian Franck. High strain-rate soft material characterization via inertial cavitation. *J. Mech. Phys. Solids* **112** (2018) 291–317.

Daren Liu* and David L. Henann. Nonlocal continuum modeling of steady, dense granular heap flows. *J. Fluid Mech.* **831** (2017) 212–227.

Yuhao Wang* and David L. Henann. Finite-element modeling of soft solids with liquid inclusions. *Extreme Mechanics Letters* **9** (2016) 147–157.

Shuolun Wang, Martina Decker, David L. Henann, and Shawn A. Chester. Modeling of dielectric viscoelastomers with application to electromechanical instabilities. *J. Mech. Phys. Solids* **95** (2016) 213–229.

David L. Henann and Ken Kamrin. A finite-element implementation of the nonlocal granular rheology. *Int. J. Numer. Meth. Engng.* **108** (2016) 273–302.

Ken Kamrin and David L. Henann. Nonlocal modeling of granular flows down inclines. *Soft Matter* **11** (2015) 179–185.

David L. Henann and Ken Kamrin. Continuum modeling of secondary rheology in dense granular materials. *Phys. Rev. Lett.* **113** (2014) 178001.

Jennet Toyjanova, Erin Hannen, Eyal Bar-Kochba, Eric M. Darling, David L. Henann, and Christian Franck. 3D viscoelastic traction force microscopy. *Soft Matter* **10** (2014) 8095–8106.

David L. Henann and Ken Kamrin. Continuum thermomechanics of the nonlocal granular rheology. *Int. J. Plasticity* **60** (2014) 145–162.

David L. Henann and Katia Bertoldi. Modeling of elasto-capillary phenomena. *Soft Matter* **10** (2014) 709–717.

David L. Henann, John J. Valenza II, David L. Johnson, and Ken Kamrin. Small-amplitude acoustics in bulk granular media. *Phys. Rev. E* **88** (2013) 281–302.

David L. Henann, Shawn A. Chester, and Katia Bertoldi. Modeling of dielectric elastomers: Design of actuators and energy harvesting devices. *J. Mech. Phys. Solids* **61** (2013) 2047–2066.

David L. Henann and Ken Kamrin. A predictive, size-dependent continuum model for dense granular flows. *P. Natl. Acad. Sci. USA* **110** (2013) 6730–6735.

David L. Henann and Lallit Anand. A large strain isotropic elasticity model based on molecular dynamics simulations of a metallic glass. *J. Elasticity* **104** (2011) 281–302.

David L. Henann and Lallit Anand. Surface tension-driven shape-recovery of micro/nanometer-scale surface features in a $Pt_{57.5}Ni_{5.3}Cu_{14.7}P_{22.5}$ metallic glass in the supercooled liquid region: A numerical modeling capability. *J. Mech. Phys. Solids* **58** (2010) 1947–1962.

David L. Henann, Vikas Srivastava, Hayden K. Taylor, Melinda R. Hale, David E. Hardt, and Lallit Anand. Metallic glasses: viable tool materials for the production of surface microstructures in amorphous polymers by micro-hot-embossing. *J. Micromech. Microeng.* **19** (2009) 115030.

David L. Henann and Lallit Anand. Fracture of metallic glasses at notches: Effects of notch-root radius and the ratio of the elastic shear modulus to the bulk modulus on toughness. *Acta Mater.* **57** (2009) 6057–6074.

David L. Henann and Lallit Anand. A large deformation theory for rate-dependent elastic-plastic materials with combined isotropic and kinematic hardening. *Int. J. Plasticity* **25** (2009) 1833–1878.

David Henann and Lallit Anand. A constitutive theory for the mechanical response of amorphous metals at high temperatures spanning the glass transition temperature: Application to microscale thermoplastic forming. *Acta Mater.* **56** (2008) 3290–3305.

Edwin R. Fuller, David L. Henann, and Li Ma. Theta-like specimens for measuring mechanical properties at the small-scale: effects of non-ideal loading. *Int. J. Mater. Res.* **98** (2007) 729–734.

Invited Lectures

Sandia National Laboratories	May 21, 2019
MIT, Department of Mechanical Engineering	February 26, 2019
UMass Dartmouth, Department of Mechanical Engineering	March 30, 2018
Worcester Polytechnic Institute, Civil, Environmental & Architectural Engineering	October 25, 2017
James K. Knowles Lectures and Caltech Solid Mechanics Symposium	February 13, 2017
Gordon Research Conference – Granular Matter, Stonehill College	July 26, 2016
University of Sydney, School of Civil Engineering	June 6, 2016
Yale University, Department of Mechanical Engineering and Materials Science	January 11, 2016
13th Annual Northeastern Granular Materials Workshop, Clark University	June 12, 2015
Clark University, Physics Department Colloquium	September 24, 2014
Harvard University, School of Public Health	December 4, 2013
University of Utah, Department of Mechanical Engineering	March 25, 2013
Johns Hopkins University, Hopkins Extreme Materials Institute	March 18, 2013
North Carolina State University, Department of Civil, Construction, and Environmental Engineering	March 13, 2013
University of Rhode Island, Department of Mechanical, Industrial and Systems Engineering	March 7, 2013
Brown University, School of Engineering	March 1, 2013
Kansas State University, Department of Mechanical and Nuclear Engineering	February 22, 2013
MIT, Department of Civil and Environmental Engineering	February 23, 2012

Brown University, School of Engineering March 2, 2011

Research Grants

Current Grants

NSF CAREER (PI): A continuum model for simultaneous prediction of granular flow and size segregation in general geometries ($500,000) 2016–2020.

Office of Naval Research Broad Research Challenge (PI: Christian Franck; Co-PI: David Henann + 3 others): An Integrated Experimental-Computational Approach for Developing a Multiscale Theory for Cavitation in Complex Soft Materials ($394,410, $3.2M total) 2017-2020.

Completed Grants

Reebok (PI) ($50,000) 2018–2020.

Army Research Office (PI; Co-PI: Christian Franck): Nonlinear constitutive modeling of viscoelastic foams: Application to impact protection ($430,367) 2016–2019.

Solomon Faculty Research Award (PI): Predictive modeling of size-segregation in dense granular flows ($15,000) 2015–2017.

Haythornthwaite Research Initiation Grant (PI): Toward predictive models of real-world granular flows ($20,000) 2014–2016.

Army Research Office (sub-award; PI: Ken Kamrin, MIT): Toward accurate models of wet granular media in nature ($12,000) 2015–2016.

AGAR Machining & Welding, Inc. (PI) ($6,000) 2016.

Service

To the University

Graduate Representative for Solid Mechanics,
Committee for Graduate Studies, School of Engineering 2014–Present

To the Profession

Co-Organizer, Symposium on Mechanics of Granular Media,
SES Technical Meeting 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020

Organizer, New England Workshop on the Mechanics of Materials and Structures (NEW.Mech) 2018

Co-Organizer, Prager Medal Symposium to honor Prof. Lallit Anand,
SES Technical Meeting 2018

Co-Organizer, Focus Session on Continuum Descriptions of Particulate Media,
APS March Meeting 2013, 2014, 2015, 2016, 2017, 2018

iMechanica Journal Club, Discussion and Theme Leader August 2015

Co-Organizer, Drucker Medalist Symposium,
ASME International Mechanical Engineering Congress & Exposition 2014

Organizer, 12th Annual Northeastern Granular Materials Workshop 2014

Co-Organizer, Symposium Honoring Professor Lallit Anand on the Occasion of
his 65th Birthday, U.S. National Congress on Theoretical & Applied Mechanics 2014

Co-Organizer, Symposium on Amorphous Solids: Modeling, Computation, and Experiment, ASME International Mechanical Engineering Congress & Exposition 2012

Member, American Society of Mechanical Engineers, Society of Engineering Science, American Physical Society.

Member, ASME mechanics of soft materials technical committee 2012–present

Ad Hoc Reviewer for: *Journal of the Mechanics and Physics of Solids, International Journal of Solids and Structures, Journal of Applied Mechanics, Computer Methods in Applied Mechanics and Engineering, Extreme Mechanics Letters, Mechanics of Materials, International Journal of Plasticity, Applied Mechanics Reviews, European Journal of Mechanics - A/Solids, Journal of Fluid Mechanics, Soft Matter, Physical Review Letters, Physical Review E, Physical Review Fluids, European Physical Journal E, Granular Matter, Computational Particle Mechanics, Acta Materialia, Journal of Materials Research, Proceedings of the Royal Society A, Comptes Rendus Physique, Scientific Reports, US Army Research Office*.

Review Panel: National Science Foundation (3)

Honors and Awards

James R. Rice Assistant Professor of Solid Mechanics July 2016 – Present

Pi Tau Sigma Gold Medal, ASME 2016

School of Engineering Dedicated Faculty Award, Brown University Tau Beta Pi 2016

NSF Early Faculty Career Development (CAREER) Award 2016

Richard B. Salomon Faculty Research Award, Brown University 2015

Haythornthwaite Research Initiation Grant, ASME Applied Mechanics Division 2014

Wunsch Foundation Silent Hoist and Crane Award, Outstanding TA: Mechanics and Materials II 2009

Tau Beta Pi Fellowship 2006

Dupont Presidential Fellowship, MIT 2006

Chancellor's Award for Student Excellence, State University of New York 2006

Tau Beta Pi, Tau of New York 2004

Pi Tau Sigma, New York Alpha Eta 2004

Binghamton University Scholars Program 2002-2006

Teaching

Brown Courses

ENGN 2220, Mechanics of Solids, (enrollment: 10 students) Spring 2020
Course effectiveness: 4.89; Instructor effectiveness: 4.89

ENGN 2980 S71, Independent study, (enrollment: 3 students) Spring 2020

ENGN 0310, Mechanics of Solids and Structures, (enrollment: 34 students) Fall 2019
Course effectiveness: 4.87; Instructor effectiveness: 4.97
Note: Starting in Fall 2019, the highest rating in the course feedback system is 5.

ENGN 2980 S71, Independent study, (enrollment: 2 students) Fall 2019

ENGN 2980 S71, Independent study, (enrollment: 3 students) Spring 2019

ENGN 0310, Mechanics of Solids and Structures, (enrollment: 44 students) Fall 2018
Course effectiveness: 1.38; Instructor effectiveness: 1.15

ENGN 2980 S71, Independent study, (enrollment: 2 students) Fall 2018

ENGN 2290, Plasticity, (enrollment: 8 students) Spring 2018
Course effectiveness: 1.00; Instructor effectiveness: 1.00

ENGN 2980 S71, Independent study, (enrollment: 4 students) Spring 2018

ENGN 0310, Mechanics of Solids and Structures, Fall 2017
(enrollment: 36 students; co-taught with P. Guduru)

ENGN 2980 S71, Independent study, (enrollment: 2 students) Fall 2017

ENGN 2220, Mechanics of Solids, (enrollment: 10 students) Spring 2017
Course effectiveness: 1.13; Instructor effectiveness: 1.11

ENGN 2980 S71, Independent study, (enrollment: 1 student) Spring 2017

ENGN 1750, Advanced Mechanics of Solids, (enrollment: 38 students) Fall 2016
Course effectiveness: 1.37; Instructor effectiveness: 1.23

ENGN 2980 S71, Independent study, (enrollment: 1 student) Fall 2016

ENGN 2290, Plasticity, (enrollment: 12 students) Spring 2016
Course effectiveness: 1.18; Instructor effectiveness: 1.18

ENGN 2980 S71, Independent study, (enrollment: 2 students) Spring 2016

ENGN 1750, Advanced Mechanics of Solids, (enrollment: 32 students) Fall 2015
Course effectiveness: 1.22; Instructor effectiveness: 1.15

ENGN 2980 S71, Independent study, (enrollment: 1 student) Fall 2015

ENGN 2220, Mechanics of Solids, (enrollment: 18 students) Spring 2015
Course effectiveness: 1.00; Instructor effectiveness: 1.00

ENGN 2980 S71, Independent study, (enrollment: 3 students) Spring 2015

ENGN 1750, Advanced Mechanics of Solids, (enrollment: 27 students) Fall 2014
Course effectiveness: 1.30; Instructor effectiveness: 1.17

ENGN 2290, Plasticity, (enrollment: 17 students) Spring 2014
Course effectiveness: 1.38; Instructor effectiveness: 1.08

ENGN 1750, Advanced Mechanics of Solids, Fall 2013
(enrollment: 21 students; co-taught with P. Guduru)

Ph.D., Sc.M., and Honors theses directed

Daren Liu (2014–2019, Ph.D. 2019); Michael Jandron (2014–2019, Ph.D. 2019); Shihong Li (2015–2020, Ph.D. 2020); Xiuqi Li (2016–present, Ph.D. candidate); Anastasia Tzoumaka (2017–present, Ph.D. candidate); Harkirat Singh (2018–present, Ph.D. candidate); Yuhao Wang (2014–2016, Sc.M. 2016); Thanin Kovitchindachai (2015–2016, Honors thesis 2016); Matthew Petersen (2015–2017, Honors thesis 2017)

Academic advising

Four Ph.D. students, six Sc.M. students,
two sophomores, and seven first-years 2019 – 2020

Six Ph.D. students, seven Sc.M. students, two concentrators, and six sophomores	2018 – 2019
Five Ph.D. students, five Sc.M. students, four concentrators, six sophomores, and six first-years	2017 – 2018
Four Ph.D. students, six Sc.M. students, seven concentrators, six sophomores, and six first-years	2016 – 2017
Participant in Team Enhanced Advising and Mentoring (TEAM) program	2016 – 2017
Three Ph.D. students, nine Sc.M. students, seven concentrators, six sophomores, and six first-years	2015 – 2016
Two Ph.D. students, six Sc.M. students, two sophomores, and six first-years	2014 – 2015