

Akshay Joshi

Curriculum Vitae

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Current address: Room 108,
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Education

- 2018–2021 **Ph.D. Aeronautics**, California Institute of Technology.
○ **Thesis:** "*A shock compression investigation of failure-waves and phase transition in soda-lime glass*", Advisor: Prof. G. Ravichandran
- 2017–2018 **M.S. in Aeronautics**, GPA: 4/4, California Institute of Technology, Pasadena, CA, USA.
- 2013–2017 **B.Tech. Aerospace Engineering**, GPA: 9.31/10, Indian Institute of Technology - Madras.
○ **Thesis:** "*Taylor impact of copper - FEA simulations*", Advisor: Prof. R. Velmurugan

Areas of Interest

- **Mechanics of materials**
- **Machine learning and materials**
- **Shock physics**
- **Computational mechanics**
- **Fracture and fatigue**
- **Mechanobiology and Biomechanics**

Related Courses

- Ae 102 abc, Mechanics of structures and materials
- Ae 160b, Continuum Mechanics, (Kaushik Bhattacharya)
- Ae 214a, Computational Mechanics, (Michael Ortiz)
- Ae 214b, Computational Mechanics, (Laurent Stainier)
- ACM 107, Linear Analysis, (Andrew Stuart)
- ACM 101a, Methods of Applied Mathematics, (Oscar Bruno)

Honors & Awards

- HAL Prize, Silver Medal (2017) for graduating with best academic record in the Aerospace Engineering Department, IIT-Madras
- The Donald Coles Prize for Ph.D. thesis with best design of experiment, GALCIT, Caltech

Internships

April 2015–
June 2015 **National Aerospace Laboratories**, *Bangalore*, India.

- Worked at the Rotordynamics department performing FEM simulations to obtain natural frequency of rotor shafts.

March 2016–
May 2016 **Singapore Technologies Aerospace**, *Singapore*.

- Worked at the Structural Analysis group to analyze load-bearing capacity of strut components of Airbus A320 aircraft, as a part of a broader feasibility study of passenger-to-freighter conversion for the aircraft.

Research Experiences

2018–2019 **Research Assistant**, Caltech.

- **In-situ x-ray diffraction of molybdenum single crystal shock compressed to high pressures**

Developed code to simulate x-ray diffraction on detector screen as seen at the Dynamic Compression Sector at Argonne National Labs.

2019–2021 **Research Assistant**, Caltech.

- **Comprehensive investigation of failure-waves and phase-transition in soda-lime glass.**

Designed and performed plate impact experiments on soda-lime glass. Developed constitutive models for soda-lime glass including the release behavior at high pressures. Used LS-Dyna and VUMAT subroutines in Abaqus for modelling of soda-lime glass to gain further insights into the material's behavior.

2021–2022 **Postdoctoral Scientist**, Delft University of Technology, with Prof. Sid Kumar.

- **Unsupervised discovery of material properties using Bayesian regression and Neural Networks.**

Applied hierarchical Bayesian regression and Neural networks to discover constitutive laws of hyperelastic materials from experiments. Presently working on extending this unsupervised framework to plasticity and viscoelasticity problems using Recurrent Neural Networks.

2022–Jan
2024 **Postdoctoral Scientist**, University of Cambridge, with prof. Vikram Deshpande.

- **X-ray tomography and Digital Volume Correlation of homogeneous hyperelastic materials to obtain deformation gradient field in the material.**

Used x-ray tomography and digital volume correlation to track material deformation in Lagrangian frame, and thus created a first-of-its-kind technique to compute deformation gradient at every material point of a homogeneous material. This lays the foundation for validating and applying unsupervised machine learning frameworks to real-world force-displacement data.

Apr 2024–Present **Assistant Professor** , *Department of Mechanical Engineering*, Indian Institute of Science.

Publications

- A. Joshi, S. Ravindran, V. Gandhi, G. Ravichandran, Probing the properties and mechanisms of failure waves in soda-lime glass, *Journal of Applied Physics*, Vol. 129, Accepted: April 17th 2021, <https://doi.org/10.1063/5.0047950>
- A. Joshi, S. Ravindran, V. Gandhi, G. Ravichandran, “An investigation of shock-induced phase transition in soda-lime glass”, *Journal of Applied Physics*, Vol. 131, 205902 (2022) <https://doi.org/10.1063/5.0086627>
- A. Joshi, P. Thakolkaran, Y. Zheng, M. Escande, M. Flaschel, L. de Lorenzis, S. Kumar, Bayesian-EUCLID: discovering hyperelastic material laws with uncertainties, *Computer Methods in Applied Mechanics and Engineering*, <https://doi.org/10.1016/j.cma.2022.115225>
- P. Thakolkaran, A. Joshi, Y. Zheng, M. Escande, M. Flaschel, L. de Lorenzis, S. Kumar, NN-EUCLID: deep-learning hyperelasticity without stress data, *Journal of the Mechanics and Physics of Solids*, <https://doi.org/10.1016/j.jmps.2022.105076>
- S. Ravindran, V. Gandhi, A. Joshi, and G. Ravichandran , “Three-dimensional full-field velocity measurements in shock compression experiments using stereo digital image correlation”, *Review of Scientific Instruments* 94, 025107 (2023) <https://doi.org/10.1063/5.0131590>
- Z. Wang, A. Joshi, A.J.D. Shaikeea, and V.S. Deshpande , “Non-Speckle-based DVC for Measuring Large Deformations in Homogeneous Solids using Laboratory X-ray CT”, Arxiv preprint (2023) <https://arxiv.org/abs/2304.05785>
- V. Gandhi, S. Ravindran, A. Joshi, and G. Ravichandran , Real-Time Characterization of Dislocation Slip and Twinning of Shock Compressed Molybdenum Single Crystals, *Phys. Rev. Mats.* (2023), <https://doi.org/10.1103/PhysRevMaterials.7.073601>
- Z. Wang, A. Joshi, S. Das, A.J.D. Shaikeea, and V.S. Deshpande , “3D observations discover a new paradigm in rubber elasticity”, Accepted for publication in PNAS, Arxiv preprint (2024) <https://arxiv.org/abs/2312.16994>

Teaching Experiences

- April-June 2019 **Teaching Assistant**, Ae 102c Mechanics of structures and solids, Caltech, Instructor: Prof. G. Ravichandran.
- October-December 2019 **Teaching Assistant**, ME 12a Mechanics of materials, Caltech, Instructor: Prof. M. Mello.
- January-March 2020 **Teaching Assistant**, Ae 160b Continuum Mechanics, Caltech, Instructor: Prof. M. Ortiz.
- April-June 2020 **Teaching Assistant**, Ae 215 Dynamic behavior of materials, Caltech, Instructor: Prof. G. Ravichandran.

October- **Teaching Assistant**, ME 12a Mechanics of materials, Caltech, Instructor: Prof.
December M. Mello.
2020

January- **Teaching Assistant**, Ae 102b Mechanics of structures and solids, Caltech,
March Instructor: Prof. A. J. Rosakis.
2021

Presentations

- Society for Experimental Mechanics, XIV International Conference, 2020. *Dynamic Behavior of Materials: Experimental investigation of failure-waves in soda-lime glass.*
- Institute of Physics, Physics Enhancing Machine Learning in Applied Solid Mechanics, 2022. *Learning hyperelastic material models without stress data.*

Skills

- **Programming languages:**
FORTRAN 77, C, C++, Java, MATLAB, Python
- **Software:**
ABAQUS, SOLIDWORKS , LS-DYNA, LAMMPS, PARAVIEW