

# Dhruv Patel

## Curriculum Vitae

Stanford University, CA  
✉ [dvpatel@stanford.edu](mailto:dvpatel@stanford.edu)  
📁 [dhruvpatel108.github.io](https://github.com/dhruvpatel108)  
🐙 [dhruvpatel108](https://github.com/dhruvpatel108)

### Research Skills

Scientific machine learning, Deep generative modeling, Computational mechanics, Inverse problems, Bayesian inference, Uncertainty quantification, Computer vision, Probabilistic sequence modeling, PDE-constrained optimization, Multi-fidelity modeling, Sustainability, Medical imaging.

### Computer Skills

Programming Languages Python, C, C++, Fortran, MATLAB, Bash scripting.

Scientific tools and libraries PyTorch, JAX, TensorFlow, TensorFlow Probability, LangChain, FEniCS, MPI, OpenMP, data analysis packages in python (Scikit-learn, pandas, Scipy), ParaView, Ansys, NX, Creo, L<sup>A</sup>T<sub>E</sub>X, version control with GitHub.

### Research and Academic Experience

2021 – Present **Timoshenko Distinguished Postdoctoral Fellow**,  
*Stanford University*, Stanford, USA.

2016 – 2021 **PhD, Mechanical Engineering (Computational Mechanics)**,  
*University of Southern California (USC)*, Los Angeles, USA.  
Thesis: Physics-based data-driven inference.

2014 – 2016 : **MTech, Applied Mechanics**,  
*Indian Institute of Technology - Delhi*, New Delhi, India.

2009 – 2013 : **BE, Mechanical Engineering**,  
*L. D. College of Engineering (LDCE)*, Ahmedabad, India.

### Selected Honours & Awards

- 2022 Best Dissertation Award, Department of Mechanical Engineering, USC.
- 2022 Runner up of the William F. Ballhaus Jr. Award for Best Dissertation in Viterbi School of Engineering, USC.
- 2021 **Stephen Timoshenko Distinguished Postdoctoral Fellowship**, Stanford University. [[USC Blog post](#)]
- 2019 The Honourable Mention of **2019 Karel Urbanek Award** for Best Student Paper, SPIE Advanced Lithography, San Jose, CA (2<sup>nd</sup> place).
- 2018 Finalist of the best student poster competition, 13<sup>th</sup> World Congress on Computational Mechanics, New York City, NY.
- 2018 9<sup>th</sup> Gene Golub SIAM summer school on inverse problems and uncertainty quantification scholarship, Breckenridge, CO.
- 2016 **Prof. Karunes Memorial Award** for *Best Master's Thesis* - Applied Mechanics department, IIT Delhi.
- 2015 Ministry of Human Resource and Development, Government of India fellowship - M.Tech., IIT Delhi.
- 2009 – 2013 Ministry of Human Resource and Development, Government of India, national merit scholarship, B.E., LDCE.

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## Publications [\[Google Scholar Profile\]](#)

### Journal Articles

- [1] **D. Patel**, R. Tibrewala, A. Vega, L. Dong, N. Hugenberg, A. Oberai "Circumventing the solution of inverse problems in mechanics through deep learning: Application to elasticity imaging", *Journal of Computer Methods in Applied Mechanics and Engineering (CMAME)*. [\[Link\]](#)  
◦ Selected media highlights: [1](#), [2](#), [3](#), [4](#), [5](#)
- [2] **D. Patel**, R. Bonam, A. Oberai "Deep learning-based detection, classification, and localization of defects in semiconductor processes", *Journal of Micro/nanolithography, MEMS, and MOEMS*. [\[Link\]](#)  
◦ Selected media highlights: [1](#), [2](#)
- [3] **D. Patel**, V. Kher, B. Desai, L. Xiaomeng, S. Cen, N. Nanda, A. Gholamrezanezhad, V. Duddalwar, B. Varghese, A. Oberai "Machine learning-based predictors for COVID-19 disease severity", *Scientific Reports*. [\[Link\]](#)
- [4] **D. Patel**, A. Oberai "GAN-based priors for quantifying uncertainty in supervised learning" *SIAM/ASA Journal of Uncertainty Quantification*. [\[Link\]](#)
- [5] **D. Patel**, D. Ray, A. Oberai, "Solution of physics-based Bayesian inverse problems with deep generative priors", *Journal of Computer Methods in Applied Mechanics and Engineering (CMAME)*. [\[Link\]](#)
- [6] R. Raad, **D. Patel**, C. Hsu, D. Ray, B. Varghese, S. Cen, D. Hwang, I. Gill, V. Duddalwar, A. Oberai "Probabilistic medical image imputation via deep adversarial learning", *Journal of Engineering with Computers*. [\[Link\]](#)
- [7] D. Ray, H. Ramaswamy, **D. Patel**, A. Oberai "The efficacy and generalizability of conditional GANs for posterior inference in physics-based inverse problems", *Numerical Algebra Control and Optimization special issue on Inverse problems*. [\[Link\]](#)
- [8] G. Cacciamani, Y. Xue, U. Durairaj, S. Roberts, **D. Patel**, R. Raad, G. Miranda, S. Sadeghi, A. Hung, I. Gill, M. Desai, P. Kuhn, J. Mason, A. Oberai "Machine learning framework-based prognostic classifier for predicting recurrence-free survival for patients undergoing radical cystectomy for urothelial bladder cancer", *Journal of Clinical Oncology*. [\[Link\]](#)
- [9] **D. Patel**, D. Ray, M. Abdelmalik, T. Hughes, A. Oberai "Variationally mimetic operator networks", *Journal of Computer Methods in Applied Mechanics and Engineering (CMAME)*. [\[Link\]](#)
- [10] A. Dasgupta, **D. Patel**, D. Ray, E. Johnson, A. Oberai "A dimension-reduced variational approach for solving physics-based inverse problems using generative adversarial network priors and normalizing flows", *Journal of Computer Methods in Applied Mechanics and Engineering (CMAME)*. [\[Link\]](#)
- [11] **D. Patel**, J. Lee, M. Farthing, P. Kitanidis, E. Darve "Multi-fidelity Hamiltonian Monte Carlo", (in review). [\[Link\]](#)
- [12] **D. Patel**, J. Lee, M. Farthing, P. Kitanidis, E. Darve "High-dimensional Bayesian inversion with black-box simulators", (in review). [\[Link\]](#)

### Book chapter

- [1] **D. Patel**, J. Lee, P. Kitanidis, E. Darve "Bayesian Inference in Geo-mechanics", in a book on Machine Learning in Geo-mechanics. (in press)

### Peer-reviewed Conference and Workshop Articles

- [1] **D. Patel**, R. Bonam, A. Oberai "Engineering neural networks for improved defect detection and classification", *Proc. SPIE 10959, Metrology, Inspection, and Process Control for Microlithography XXXIII, SPIE Advanced Lithography, San Jose, CA, 2020*. [\[Link\]](#)

- [2] **D. Patel**, A. Oberai "Generative Adversarial Network priors for Bayesian inference", *Deep inverse workshop, 33<sup>rd</sup> conference on Neural Information Processing System (NeurIPS)*, Vancouver, BC, 2019. [[Link](#)]
- [3] **D. Patel**, D. Ray, H. Ramaswamy, A. Oberai "Bayesian inference in physics-driven problems with adversarial priors", *Deep inverse workshop, 34<sup>th</sup> conference on Neural Information Processing System (NeurIPS)*, virtual, 2020. [[Link](#)]
- [4] **D. Patel**, C. Hsu, B. Varghese, S. Cen, D. Hwang, I. Gill, V. Duddalwar, A. Oberai "Probabilistic recovery of missing phase images in contrast-enhanced CT", *Medical imaging workshop, 34<sup>th</sup> conference on Neural Information Processing System (NeurIPS)*, virtual, 2020. [[Link](#)]
- [5] D. Ray, **D. Patel**, H. Ramaswamy, A. Oberai "Efficient posterior inference and generalization in physics-based Bayesian inference with conditional GANs", *Deep inverse workshop, 35<sup>th</sup> conference on Neural Information Processing System (NeurIPS)*, virtual, 2021. [[Link](#)]
- [6] **D. Patel**, J. Lee, M. Forghani, M. Farthing, T. Hesser, P. Kitanidis, E. Darve "Multi-Fidelity Hamiltonian Monte Carlo Method with Deep Learning-based Surrogate", *Second symposium on science-guided AI, AAAI Fall Symposium Series (FSS)*, virtual, 2021. [[Link](#)]
- [7] A. Dasgupta, **D. Patel**, D. Ray, E. Johnson, A. Oberai "GAN-Flow: A dimension-reduced variational framework for physics-based inverse problems", *Machine Learning and the Physical sciences workshop, 36<sup>th</sup> conference on Neural Information Processing System (NeurIPS)*, New Orleans, LA, 2022. [[Link](#)]
- [8] **D. Patel**, J. Lee, M. Farthing, T. Hesser, P. Kitanidis, E. Darve "Improved Black-box Variational Inference for High-dimensional Bayesian Inversion involving Black-box Simulators", *Deep inverse workshop, 37<sup>th</sup> conference on Neural Information Processing System (NeurIPS)*, New Orleans, LA, 2023. [[Link](#)].

#### Selected Recent Talks

- [1] **D. Patel** "Efficient, Scalable, and Accurate Bayesian Inference with Deep Generative Multi-fidelity Modeling", *Pacific Northwest National Laboratory (PNNL)*, 2024 (**Invited talk**).
- [2] **D. Patel** "Efficient, Scalable, and Accurate Bayesian Inference with Deep Generative Multi-fidelity Modeling", *Lawrence Berkeley National Laboratory (LBNL)*, 2024 (**Invited talk**).
- [3] **D. Patel** "Bayesian inference and scientific computing in the era of Generative AI", 5<sup>th</sup> *International Conference on Mathematical Techniques and Applications (ICMTA)*, Chennai, India, 2024 (**Invited talk**).
- [4] **D. Patel**, J. Lee, P. Kitanidis, E. Darve "High-dimensional Bayesian inversion with black-box solvers", *Stanford Thermal Fluids Science Affiliate Conference*, 2024 (**Invited talk**).
- [5] **D. Patel**, J. Lee, P. Kitanidis, E. Darve "Overcoming challenges of practical Bayesian inference", *Advances in Computational Mechanics (ACM)*, Austin, TX, 2023 (**Invited talk**).
- [6] **D. Patel**, J. Lee, P. Kitanidis, E. Darve "Improved black-box variational inference for high-dimensional Bayesian inversion", 17<sup>th</sup> *U. S. National Congress on Computational Mechanics*, Albuquerque, New Mexico, NM, 2023
- [7] **D. Patel**, J. Lee, P. Kitanidis, E. Darve "Multi-fidelity Hamiltonian Monte Carlo", *SIAM MDS*, San Diego, CA, 2022.
- [8] **D. Patel**, J. Lee, P. Kitanidis, E. Darve "Multi-fidelity Hamiltonian Monte Carlo", *USACM thematic conference on UQ for ML-integrated Physical Modeling*, Crystal City, VA, 2022 (**Invited talk**).
- [9] **D. Patel** "Accelerating Scientific Machine Learning via Multi-fidelity Modeling", *Stanford ICME Xpo*, Stanford, CA, 2022 (**Invited talk**).
- [10] **D. Patel** "Efficient Bayesian Inference using Deep Generative Priors and Multi-fidelity Modeling", *Energy Resources Engineering (ERE) graduate seminar series*, Stanford, CA, 2021 - virtual (**Invited talk**). [[Link](#)]

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## Teaching Experience

- Winter 2023 **ME 343/CME 216: Machine Learning in Computational Engineering**, *Stanford*, [Instructor and course developer].
- Winter 2024
- Designed and taught a graduate level course on Machine Learning for students with computational engineering and applied mathematics background.
  - Designed homework assignments and conducted office hours.
- Fall 2020 **AME 599: Machine Learning and Computational Physics**, *USC*, [Lead TA and course co-developer].
- Assisted my advisor in preparing course material for the first offering of this graduate level course and delivered guest lectures on deep generative modeling and uncertainty quantification.
  - Conducted office hours and graded assignments.
- Spring 2017 **ENGR 2050: Introduction to Engineering Design**, *RPI*, [TA].
- Conducted studio sessions and assisted students in conceptual and detailed design of the project for this project-based undergraduate course.
- Fall 2016 **ENGR 1200: Engineering graphics and CAD**, *RPI*, [Lead TA].
- Conducted lab sessions as a lead TA for the undergraduate course with 250+ students.
  - Conducted office hours, graded assignments, and assisted 50+ students with final CAD project.
- Spring 2016 **Advanced Solid Mechanics**, *IIT Delhi*, [TA].
- Conducted office hours and tutorials.
- Spring 2015 **Experimental Methods for Solids and Fluids**, *IIT Delhi*, [TA].
- Conducted lab sessions and graded assignments in this experiment-focused undergraduate course.

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## Research Advising

### MS candidates

- Fall 2019 – *Chiao-Chih Hsu (USC)*
- Fall 2020 Implementing learning-based models to infer missing phase image of renal lesions from partially visible Contrast-Enhanced Computed Tomography (CECT) data.
- Fall 2018 – *Vijay Kothapalli (USC)*
- Summer 2019 Designed and developed deep learning-based models for time series data with application to Contrast-Enhanced Ultrasound (CEUS) imaging.

### Undergraduate candidates

- Summer 2020 *Vikram Kher (USC)*
- Fall 2020 Developing ML-based tools for prediction of clinical prognosis and disease severity in COVID-19 patients. **Winner:** Best USC Viterbi summer undergraduate research project.
- Summer 2019 *Eeshan Gupta (USC)*
- Developed software tools for solving physics-driven Bayesian inverse problems using GAN priors.
- Summer 2017 *Adriana Vega, Raghav Tibrewala (RPI)*
- Developed deep learning-based elasticity imaging workflow to classify breast tumors based on its mechanical properties.

### High-school student

- Summer 2018 *Jacqueline Wang (USC)*
- Developed data processing and visualization pipeline for the tumor classification project.

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## Service and Outreach Activities

### Organizer

- Mini-symposium on ML-driven model order reduction and inverse problems, SIAM Mathematics of Data Science (MDS), San Diego, CA, Sept. 2022.
- Mini-symposium on Recent developments in Operator Networks, USNCCM, Albuquerque, NM, 2023.

### Reviewer

International Conference on Learning Representation (ICLR); Neural Information Processing System (NeurIPS); AAAI conference on Artificial Intelligence; Journal of Computer Methods in Applied Mechanics and Engineering (CMAME); Journal of Computational Physics (JCP); International Journal for Numerical Methods in Engineering (IJNME); International Journal for Uncertainty Quantification (IJUQ); Journal of Computational Statistics and Data Analysis (CSDA); Journal of Geosciences; Journal of Numerical Algebra, Control, and Optimization (NACO); Journal of Hydrology; Journal of Geoenergy Science and Engineering.

### K-12 STEM Outreach

Mentor of Summer High School Intensive in Next-Generation Engineering (SHINE) program at USC.

### Placement Coordinator

Orchestrated successful on-campus recruitment drives at IIT Delhi, fostering robust industry connections, and ensuring seamless execution of placement operations, leading to high employment rates for my classmates.