Sagar Bhatt

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Education

Doctor of Philosophy
Mechanical Engineering *Rensselaer Polytechnic Institute* 2017-2022
Advisor: Antoinette M. Maniatty
Dissertation: Computational Modelling of Ti-6Al-4V Microstructure Evolution During Thermomechanical Processing

Master of Science
Mechanical Engineering *University at Buffalo, State University of New York* 2015-2017

Bachelor of Technology
Mechanical Engineering *Vellore Institute of Technology* 2010-2014

Experience

Mechanical Engineer 2025 -
Argonne National Laboratory
- Predictive modeling of material behavior in harsh environments using physics-based models.

Postdoctoral Appointee 2023 - 2025
Argonne National Laboratory
- Worked in the Thermal and Structural Materials Modeling and Simulations Group in the Applied Materials Division on modeling creep deformation in diffusion-bonded and additively manufactured microstructures.

Research and Teaching Assistant 2017 - 2022
Rensselaer Polytechnic Institute
- TA for courses Introduction to Engineering Design, Engineering Graphics & CAD and Engineering Dynamics.
- Worked on modeling microstructure evolution under thermomechanical load using Monte-Carlo grain growth model and Crystal Plasticity Finite Element method.

Grader and Tutor 2016
University at Buffalo, State University of New York
- Grader for Thermodynamics class.
- Tutored Math, Physics and Mechanical Engineering courses at the Academic resource center.

Intern, R&D, Automotive Sector 2014
Greaves Cotton Ltd.
- Increased low-end torque by 24% and enabled engine start without excess fuel while satisfying the emissions standards.

Intern 2012
Mahindra and Mahindra Ltd.
- Managed materials to ensure lower material loss and faster prototype development - reduced lead time by 67%.

Skills

Programming: C++, C, Matlab, Python, MPI, OpenMP, Bash Scripting

Software: MOOSE, PETSc, Cubit, Simmetrix, ANSYS, Abaqus, Siemens NX, SolidWorks

Miscellaneous: Git, Paraview, LaTeX

Areas of Interest

Computational Solid Mechanics	Finite Element Methods
Crystal Plasticity	High Performance Computing.

Funding

- **Program Development Fund**, *Materials for Harsh Environments Department*: Explaining creep rupture mechanisms in MAX Phase materials using Experiments and Crystal Plasticity Modeling - $12.5K 2024

Awards

- **American Academy of Mechanics Early Career Presenter Fellowship** 2026
- **NSF Travel Grant for Early Career US-based Researchers for NUMIFORM 2019** 2019

Publications

- **S. Bhatt**, Tianchen Hu, and Mark Messner. "Modeling the Impact of Grain Morphology and Porosity on Creep Anisotropy in Laser Powder Bed Fusion Materials". In: *Integrating Materials and Manufacturing Innovation* (July 2026). ISSN: 2193-9772. DOI: 10.1007/s40192-026-00457-2.
- **S. Bhatt** and M. C. Messner. *Simulation of Creep Deformation and Failure in Graded AM Microstructures*. Tech. rep. ANL-AMMT-022. Argonne National Laboratory (ANL), Argonne, IL (United States), 2025.
- R. Wang, P. Wang, **S. Bhatt**, M. H. Ovi, H. Lee, J. Stubbins, M. C. Messner, L. H. Desorcy, I. Jentz, et al. "Phase-field modeling of diffusion bonding in 316H stainless steel: Impact of processing conditions on grain morphology and bonding quality". In: *Materials Science and Engineering: A* (2025), p. 149051.
- **S. Bhatt**, S. Baweja, Z. Zeng, and M. C. Messner. *Simulating the effect of grain structure and porosity on creep for powder bed fusion 316H*. Tech. rep. ANL-AMMT-016. Argonne National Laboratory (ANL), Argonne, IL (United States), 2024.
- **S. Bhatt**, M. C. Messner, R. Wang, and F. Gao. "Microstructural Models for the Creep Strength and Ductility of Diffusion-Bonded 316H Steel". In: *Advances in Materials Technology for Power Plants*. Vol. 84871. ASM International. 2024, pp. 750–759.
- R. Wang, P. Wang, T. R. Allen, F. Gao, **S. Bhatt**, M. C. Messner, and I. W. Jentz. "Phase-Field Modeling of Diffusion Bonding in 316H Stainless Steel for Nuclear Engineering Applications". In: *Advances in Materials Technology for Power Plants*. Vol. 84871. ASM International. 2024, pp. 1138–1148.
- T. Chen, **S. Bhatt**, H. Deng, M. C. Messner, S. Pitts, A. Jokisaari, K Dang, and L. Capolungo. *Preliminary prediction of long-term aging and creep behavior of AM 316 SS*. Tech. rep. ANL-AMMT-011. Argonne National Laboratory (ANL), Argonne, IL (United States), 2023.
- **S. Bhatt**, A. Baskaran, D. Lewis, and A. Maniatty. "Numerical modeling of Ti-6Al-4V microstructure evolution for thermomechanical process control". In: *Proceedings of NUMIFORM 2019: The 13th International Conference on Numerical Methods in Industrial Forming Processes*. 2019, pp. 401–404.

Conference Talks and Posters

- **S. Bhatt** and M. C. Messner. *Impact of Secondary Phase Particles on Creep Behavior in Diffusion Bonded Microstructures*. 155th TMS Annual Meeting & Exhibition. Mar. 2026.
- **S. Bhatt** and M. C. Messner. *Vacancy diffusion mediated creep and cavitation modeling using CPFEM*. 20th U.S. National Congress on Theoretical and Applied Mechanics. June 2026.
- **S. Bhatt** and M. C. Messner. *Modeling creep anisotropy in LPBF microstructures using CPFEM: the role of texture representation*. 18th U.S. National Congress on Computational Mechanics. July 2025.

- **S. Bhatt** and M. C. Messner. *Modeling the impact of morphological features of complex microstructures using MOOSE based Crystal Plasticity Finite Element Model*. MOOSE International Workshop. Mar. 2025.
- **S. Bhatt**, R. Wang, F. Gao, and M. C. Messner. *Modeling Process-Structure-Property Relationship in Diffusion Bonded 316H Stainless Steel Microstructure using Phase-Field and Crystal Plasticity Methods*. 154th TMS Annual Meeting & Exhibition. Mar. 2025.
- **S. Bhatt**. *Modeling the long-term, high-temperature reliability of metals using the Crystal Plasticity Finite Element Method*. Applied Materials Division Seminar, Argonne National Laboratory. Apr. 2024.
- **S. Bhatt** and M. C. Messner. *Crystal Plasticity Finite Element Creep Modeling of Powder Bed Fused 316H Stainless Steel*. 16th World Congress on Computational Mechanics and 4th Pan American Congress on Computational Mechanics. July 2024.
- **S. Bhatt** and M. C. Messner. *Modeling Creep Deformation in Diffusion Bonded 316H Stainless Steel Microstructure*. 153rd TMS Annual Meeting & Exhibition. Mar. 2024.
- **S. Bhatt** and A. Maniatty. *Modeling and Simulation of Deformation Caused by Phase Transformation from beta to alpha in Ti-6Al-4V during Processing*. 19th U.S. National Congress on Theoretical and Applied Mechanics. June 2022.
- M. Allahua, A. Baskaran, **S. Bhatt**, G. Kane, A. Kekre, R. Hull, D. Lewis, A. Maniatty, and J. Wen. *Poster: Adaptive Control of Ti-6Al-4V Evolution during Thermomechanical Processing*. CMDIS Annual Research Symposium, Center for Materials, Devices, and Integrated Systems, Rensselaer Polytechnic Institute. 2019.
- A. Kekre, A. Baskaran, **S. Bhatt**, G. Kane, M. Allahua, D. Lewis, A. Maniatty, J. Wen, and Hull R. *Poster: Towards integrating multiscale modeling methods with adaptive control of Ti-6Al-4V microstructure during thermomechanical processing*. New York Manufacturing Conference 2019, Center for Automation Technologies and Systems, Rensselaer Polytechnic Institute. 2019.
- **S. Bhatt**, A. Baskaran, D. Lewis, and A. Maniatty. *Numerical Modeling of Ti-6Al-4V Microstructure Evolution for Thermomechanical Process Control*. NUMIFORM 2019: The 13th International Conference on Numerical Methods in Industrial Forming Processes. 2019.
- **S. Bhatt** and A. Maniatty. *Numerical Modeling of Columnar Grained Nickel Microstructure Deformation Near Triple Junctions*. CMDIS Annual Research Symposium, Center for Materials, Devices, and Integrated Systems, Rensselaer Polytechnic Institute. 2019.
- **S. Bhatt** and A. Maniatty. *Numerical Modeling of Ti-6Al-4V Microstructure Evolution for Thermomechanical Process Control*. SCOREC CSE Seminar Series, Rensselaer Polytechnic Institute. 2019.
- A. Baskaran, **S. Bhatt**, G. Kane, M. Allahua, Z. Huang, D. Lewis, A. Maniatty, J. Wen, and Hull R. *Poster: Adaptive Control of Ti-6Al-4V using adaptive microscale simulator techniques*. CMDIS Annual Research Symposium, Center for Materials, Devices, and Integrated Systems, Rensselaer Polytechnic Institute. 2018.
- **S. Bhatt**. *Physical System modeling and simulation using HPC*. CMDIS Annual Research Symposium, Center for Materials, Devices, and Integrated Systems, Rensselaer Polytechnic Institute. 2017.

Projects

Research

- **Effect of warm deformation on grain growth of Ti-6Al-4V microstructure:** 2022
  - Simulated deformation of $\alpha + \beta$ Ti-6Al-4V microstructure at 800 ℃ under 15% compressive strain using Finite Element Crystal Plasticity.
  - Applied Monte Carlo method to simulate grain growth below β-transus with stored energy from deformation to model the impact of warm working on α/β grain growth.
- **Modeling deformation caused by Phase Transformation from β to α in Ti-6Al-4V:** 2022
  Manuscript under preparation

- Developed and implemented a Finite Element Crystal Plasticity method to model deformation caused by phase transformation from BCC β to HCP α during thermal processing in Ti-6Al-4V.
- Studied the impact of plastic relaxation on driving energy of phase transformation and found it results in an order of magnitude lower strain energy when compared to purely elastic analysis.
- Demonstrated that current models of phase transformation need to account for plastic relaxation for more accurate results.

- **Finite element modeling of nickel microstructure deformation near triple junctions:** 2018
  - Used Finite Element Crystal Plasticity to simulate 2% tensile strain on a columnar grained Nickel microstructure.
  - Accurately predicted slip activity and deformation fields at the triple junctions, that were compared to the experimental observations.

- **Hybrid Potts-Phase field model to simulate microstructure evolution:** 2018
  - Implemented a hybrid Monte-Carlo (Potts)-Phase field model to simulate coupled grain growth and phase change in a microstructure.
  - Produced results consistent with prior studies on similar work with efficient parallel code achieving speed up of 92X at 72% strong scaling efficiency for 8.2K MPI ranks.

Academic

- **Handwritten digit classification using various Machine Learning techniques:** 2018
  - Linear model with 8th order polynomial transform and regularization selected by cross validation (CV) achieving a test error (E_{test}) of 0.038.
  - k-Nearest neighbor rule with k selected by CV with E_{test} of 0.054.
  - Radial basis function network with Gaussian kernel with centers selected by CV with E_{test} of 0.066.
  - Neural Network with 10 hidden units with E_{test} of 0.048.
  - Support Vector Machine with 8th order polynomial kernel with E_{test} of 0.045.

- **Optimization of temperature profile of billet in extrusion process:** 2017
  - Optimized initial temperature profile for a billet that will result in uniform grain size in the microstructure after extrusion.
  - Implemented it using Matlab's optimization toolbox, coupled to a parallel Monte-Carlo grain growth framework resulting in a 77.5% reduction in standard deviation of the grain size after optimization.

- **Parallel preconditioned conjugate gradient solver with compressed row storage:** 2016
  - Implemented a conjugate gradient Krylov solver with Jacobi preconditioning, compressed row storage and its matrix-vector product computational kernel to store and operate on large sparse matrices.
  - Decomposed the domain into well-balanced chunks and performed scalability study showing speedup of 115X and scaling efficiency of 87% on 132 processes.

Professional Service

Journal Reviewer

- *Integrating Materials and Manufacturing Innovation*
- *npj Advanced Manufacturing*

Minisymposium Organizer, *USNC/TAM'26* 2026

- Lead organizer of the minisymposium titled "Microstructure-informed modeling of advanced manufactured materials" at the 20th U.S. National Congress of Theoretical and Applied Mechanics.

Postdoc Research Symposium Organizing Committee, *Argonne National Laboratory* 2023

- Coordinated planning for the 2023 symposium showcasing postdoctoral research across Argonne.
- Organized and moderated a career panel as part of the invited speakers subcommittee.

GRS Assistant, Graduate Research Symposium, *Rensselaer Polytechnic Institute* 2021

- Evaluated student presentations and facilitated technical sessions.
- Chaired the symposium networking event.

Vice President, Graduate Council, *Rensselaer Polytechnic Institute* 2019 - 2021

- Elected vice president of the 15 person graduate student council representing 1,366 graduate students.
- Served on the Student Union Executive Board.
- Partnered with institute leadership to resolve graduate academic and TA/RA concerns, ensuring smooth transition to remote research.
- Organized programming addressing academic policy, mental health, public safety, and international student support.

Professional Affiliations

The Minerals, Metals & Materials Society (TMS) 2023–
Technical committee membership:

- Additive Manufacturing Committee
- Computational Materials Science and Engineering Committee

U.S. Association for Computational Mechanics (USACM) 2025–
Technical thrust area membership:

- Mathematical Methods in Computational Engineering and Sciences
- Manufacturing and Materials Processing