SAGAR BHATT

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EDUCATION

- **Rensselaer Polytechnic Institute**   Troy, NY
  Doctor of Philosophy in Mechanical Engineering   *Aug 2022(Expected)*
  Advisor: Antoinette M. Maniatty

- **University at Buffalo, State University of New York**   Buffalo, NY
  Master of Science in Mechanical Engineering   *Feb 2017*

- **Vellore Institute of Technology**   Vellore, India
  Bachelor of Technology in Mechanical Engineering   *May 2014*

PROJECTS

Research

- **Effect of warm deformation on grain growth of Ti-6Al-4V microstructure:**   *July 2022*
  - Modeling deformation of $\alpha + \beta$ Ti-6Al-4V microstructure 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:**   *Feb 2022*
  - 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:**   *May 2020*
  - 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:**   *May 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.

- **Particulate matter measurement of a two-stage boiler:**   *Aug 2016*
  - Designed, fabricated apparatus and carried out experiments to extract particulate matter from the flue gas of a two-stage wood fired boiler.
  - Developed a methodology to correctly estimate the mass of PM 2.5 particles in the collected residue, taking into account moisture and adsorption of water on carbon particles.

Academic

- **Handwritten digit classification using various Machine Learning techniques:**   *Nov 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:**   *Dec 2017*
  - Formulated an optimization problem to compute an initial temperature profile for a billet that will result in uniform grain size after extrusion.
  - Implemented it using Matlab's optimization toolbox, coupled it with a parallel Monte-Carlo grain growth framework.
  - Final microstructure resulted in a 77.5% reduction in standard deviation of the grain size after optimization.

- **Parallel preconditioned conjugate gradient solver with compressed row storage:** *Dec 2016*
  - Implemented a conjugate gradient Krylov solver with Jacobi preconditioning.
  - Used compressed row storage and its matrix-vector product computational kernel to store and operate on large sparse matrices. When applied to Laplace equation in a 1000×1000 grid, this reduced matrix storage requirement from 7.2 TB to 60.76 MB.
  - Decomposed the domain into well-balanced chunks and performed scalability study showing speedup of 115X and scaling efficiency of 87% on 132 processes.
- **Finite element code for simulating deformation in an isotropic elastostatic body:** *Dec 2016*
  - Developed 3D finite element code using Matlab for 8-node hexahedron elements and a 2D code for constant strain triangle, 4-noded and 8-noded quadrilateral elements.
  - Performed convergence study based on the energy norm and compared the results with ABAQUS for a rectangular beam and I-beam with maximum displacement within 1% of those predicted by ABAQUS.
- **Simulation of steady, laminar flow over a backward-facing step:** *May 2016*
  - Developed a Navier-Stokes solver using a three-point, second order finite differencing scheme to discretize the convective and viscous fluxes in conjunction with scalar, fourth-difference, third-order artificial dissipation for stability.
  - Implemented dual time-stepping with a second-order backward scheme in time and four stage Runge-Kutta time stepping for pseudo time. Demonstrated reasonable agreement with experimental and computational results from literature.

Skills

- **Programming:** C++, C, Matlab, Python, MPI, OpenMP, Bash Scripting, Julia
- **Software:** PETSc, Simmetrix, ANSYS, Abaqus, Siemens NX, SolidWorks, CATIA, Autodesk Fusion 360
- **Miscellaneous:** Git, Paraview, LaTeX

Publications

- **S. Bhatt** and A. Maniatty. Modeling and simulation of deformation caused by phase transformation from beta to alpha in Ti-6Al-4V during processing (accepted). In *19th U.S. National Congress on Theoretical and Applied Mechanics*, 2022
- **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*, pages 401–404, 2019

Presentations and Posters

- **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
- 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
- **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. 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
- 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

Awards

- **Argonne Training Program on Extreme Scale Computing (ATPESC):** Selected to participate in a competitive program that provided intensive two-week training on tools and approaches to computational science applications on current and future leadership class computing systems. *Aug 2021*
- **NSF Travel Grant for Early Career US-based Researchers:** Among selected number of people awarded this grant which covered the costs associated with attending the NUMIFORM 2019 conference. *May 2019*

Experience

- **Rensselaer Polytechnic Institute** — Troy, NY
  Research and Teaching Assistant — *Aug 2017 - Present*

  - TA for courses Introduction to Engineering Design, Engineering Graphics & CAD and Engineering Dynamics.
  - Working as a RA in Prof. Antoinette M. Maniatty's research group on simulating microstructure evolution under thermomechanical loading.

- **University at Buffalo, State University of New York** — Buffalo, NY
  Grader and Tutor — *July 2016 - Dec 2016*

  - Grader for Thermodynamics class.
  - Tutored Math, Physics and Mechanical Engineering courses at the Academic resource center.

- **Greaves Cotton Ltd. (Automotive Sector, R&D)** — Aurangabad, India
  Intern — *Jan 2014 – June 2014*
  - Carried out a series of experiments to identify root cause of startability issues and torque deficiency in low RPM range
  - Increased low-end torque by 24% and enabled engine start without excess fuel while satisfying the emissions standards.

- **Mahindra and Mahindra Ltd.(CDMM Department)** — Mumbai, India
  Intern — *June 2012 – July 2012*

  - Inspected and adjusted dimensions /tolerances in CAD of new parts to make them manufacturable with existing equipment.
  - Managed materials to ensure lower material loss and faster prototype development - reduced lead time by 67%.

Leadership Roles

- **GRS Assistant, Graduate Research Symposium**, *Rensselaer Polytechnic Institute* — *May 2021*

  - Judged presentations, organized and facilitated sessions at the research symposium organized by graduate students at RPI.
  - Chair and Organizer of the networking event component of the symposium.

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

  - Elected Vice President of the 15 person graduate student council representing 1366 graduate students at RPI.
  - Served as an Executive Board member in the Student Union.
  - Worked with the institute to address issues related to graduate academics, Teaching and Research Assistants, ensuring smooth transition to remote research.
  - Organized various online programs to address student issues ranging from mental health to public safety to international student concerns apart from the usual fun events.