Rajat **Arora**

Research Scientist · Software Development

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Education

Carnegie Mellon University (CMU)

Pittsburgh, PA

Ph.D. in Computational Mechanics, GPA: 4.0 — *Jul. 2015 - Feb. 2019*

- Dissertation: Computational Approximation of Mesoscale Field Dislocation Mechanics (MFDM) at Finite Deformation
- Advisor: Prof. Amit Acharya

M.S. in Computational Mechanics, GPA: 4.0 — *Jul. 2015 - Dec. 2017*

Indian Institute of Technology (IIT) Kanpur

Kanpur, India

M.Tech. in Mechanical Engineering, GPA: 9.7/10 — *Jan. 2013 - Oct. 2014*

- Dissertation: Shape Evolution of Precipitates using Extended Finite Element Method Coupled with Level Set Method
- Advisor: Prof. Anurag Gupta

B.Tech. in Mechanical Engineering, GPA: 8.2/10 — *Jul. 2009 - Oct. 2014*

Skills

Programming	C/C++, Python, MATLAB
Computational	Git, PyTorch, TensorFlow, High Performance Computing (OpenMP, MPI, CUDA)
Software	Autodesk Inventor, SolidWorks, ANSYS Mechanical, Abaqus

Professional Appointments — 3+ Y.O.E.

Siemens Corporation, Technology

Princeton, NJ

Research Scientist: Applied Mathematics — *Aug. 2020 - Present*

- Develop C++ based software framework to model Lithium metal behaviour for use in manufacturing of Lithium-ion batteries
- Develop Physics-Informed Neural Network models to speed-up scientific computing to accelerate battery design. Languages: C++ and Python.

Ansys, Inc.

Pittsburgh, PA

Research & Development Engineer II — *Mar. 2019 - Jul. 2020*

- Lead developer (C++) of the digital twin development framework used for generating cross-platform digital twins.
- Develop and maintain core solver (C++) for physics-based, high-fidelity, circuit and system simulation software.
  - Added support for multiple linear algebra solvers to improve simulation convergence and speed.
  - Enabled multi-threaded output of high volume complex data collection to improve simulation speed and reduce file size.

Eaton Technologies Pvt. Ltd.

Pune, India

Engineer — *Aug. 2014 - Jan. 2015*

- Performed bearing analysis using ROMAX software to optimize bearing life for various parameters: lubrication, clearance, misalignment

Academic Appointments

Carnegie Mellon University

Pittsburgh, PA

Graduate Research Assistant — *Jun. 2015 - Feb. 2019*

- Developed (C++) a massively parallel finite element based theoretical-computational framework for modeling elasto-plastic deformation in metals
- The theory fundamentally accounts for static and dynamic (stress and energy) fields of dislocation distributions and their non-uniform spatio-temporal evolution at finite strain.

Indian Institute of Technology Kanpur *Kanpur, India*

Graduate Research Assistant *Jan. 2013 - Oct. 2014*

- Developed framework in C++ to analyze morphological evolution of arbitrarily shaped precipitates coherently embedded in a matrix.
- The approach involved coupling Extended Finite Element Method (XFEM) with PDE based Level Set Method (LSM) to capture interfacial motion.

Independent Projects

- Optimized code for parallel and distributed programming models to run on Bridges supercomputer to obtain *3X* improvement in performance.
- Employed Automatic Differentiation using Sacado to solve a non-linear minimal surface equation
- Learned and Implemented Isogeometric Analysis to solve Laplace equation in a $2d$ domain
- Contributed to development of open source FEM package *Deal.ii*

Honors & Awards

2018	**Fenves Travel Grant,** Civil Engineering Department, CMU	*Pittsburgh, PA*
2015	**Dean's Fellowship,** Civil Engineering Department, CMU	*Pittsburgh, PA*
2014	**Inclusion & Diversity Council Member,** Eaton	*Pune, India*
2012	**Boeing Research Scholarship,** IIT Kanpur	*Kanpur, India*
2012	**5th Place,** Robotics Competition, IIT Bombay	*Mumbai, India*
2010	**3rd Award,** Robotics Competition, IIT Kanpur	*Kanpur, India*
2010	**3rd Award,** Electronics Competition, IIT Kanpur	*Kanpur, India*
2009	**Rank 761,** IIT Joint Entrance Examination among over 0.4 million aspirants	*India*
2009	**99.42 percentile,** All India Engineering Entrance Exam (AIEEE) among over 1 million aspirants	*India*
2008	**Rank 671,** Uttar Pradesh State Entrance Examination (UPSEE) among over 0.25 million aspirants	*India*

Journal Articles

Machine Learning

- **Physics-Informed Neural Networks for elastic-viscoplastic loading**
  R. Arora, P. Kakkar, B. Dey, A. Chakrabarty. *In Preparation, 2021.*
- **Super-resolution in computational solid mechanics without high resolution labels. Part I: Hyperelasticity**
  R. Arora. *In Preparation, 2021.*

Mechanics of Materials

- **Confronting modeling and simulation with a critical experimental test of strain gradient plasticity**
  A. Arora, R. Arora, A. Acharya. *In Preparation, 2021.*
- **Dislocation pattern formation in finite deformation crystal plasticity**
  R. Arora, A. Acharya. *International Journal of Solids and Structures, 2020.*
- **Finite element approximation of finite deformation dislocation mechanics**
  R. Arora, X. Zhang, A. Acharya. *Computer Methods in Applied Mechanics and Engineering, 2020.*
- **Equilibrium shape of misfitting precipitates with anisotropic elasticity and anisotropic interfacial energy**
  T. Joshi, R. Arora, A. Basak, A. Gupta. *Modelling and Simulation in Materials Science and Engineering, 2020.*
- **A unification of finite deformation J_2 Von-Mises plasticity and quantitative dislocation mechanics.**
  A. Arora, A. Acharya. *Journal of the Mechanics and Physics of Solids, 2020.*

Workshops

- One day **OpenMP** workshop organized by *XSEDE HPC* *Oct. 2016*
- Two day training session on **Scientific Visualization** organized by *XSEDE HPC* *Oct. 2016*
- Two day workshop on **MPI** conducted by *XSEDE HPC* *Sept. 2015*