Rajat **Arora**

Senior member of technical staff, AMD · Software Development

(+1) 412-616-5365 | rajat.arora9464@gmail.com | www.rajatarora.in | sairajat | rajatarora9464

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), Data Visualization, Cloud Deployment
Software	Autodesk Inventor, SolidWorks, ANSYS Mechanical, Abaqus

Professional Appointments — 3+ Y.O.E.

Siemens Corporation, Technology

Princeton, NJ

Research Scientist: Physics Aware Artificial Intelligence — *Aug. 2020 - Feb. 2022*

- Develop physics-informed neural network to study elastic-viscoplastic behaviour of metals under different temperature and loading rate conditions.
  - The work aims to accelerate scientific computing and battery design. Research paper in preparation.
- Develop physics-informed super-resolution framework to reconstruct high-resolution solutions from low-resolution noisy solution on coarse mesh.
  - Research published in 1st Annual ***AAAI*** Workshop on AI to Accelerate Science and Engineering (AI2ASE).
  - Research published in 3rd Workshop on Artificial Intelligence and Machine Learning for Scientific Applications in conjunction with ***SC'22***.

Ansys, Inc.

Pittsburgh, PA

Research & Development Engineer II: Ansys Twin Builder Solver — *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: Mechanics, Materials, and Computing Research — *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 spatio-temporal resolution enhancement for computational elastodynamics**
  R. Arora, A. Shrivastava. *In Preparation, 2022.*
- **Physics-Informed Neural Networks for modeling rate- and temperature-dependent plasticity**
  R. Arora, P. Kakkar, B. Dey, A. Chakraborty. *Submitted, 2021.*
- **PhySRNet: Physics informed super-resolution network for application in computational solid mechanics**
  R. Arora. *3rd Workshop on Artificial Intelligence and Machine Learning for Scientific Applications in conjunction with **SC'22**.*
- **Machine learning-accelerated computational solid mechanics: Application to linear elasticity**
  R. Arora. *1st Annual **AAAI** Workshop on AI to Accelerate Science and Engineering (AI2ASE).*

Mechanics of Materials

- **Self-fields for disconnections with disclination, dislocation and step character**
  E. Zegpi, R. Arora, A. Acharya, J. Hirth. *In preparation, 2022.*
- **Modeling of experimentally observed topological defects inside bulk polycrystals**
  S. Singh, H. Liu, R. Arora, R. Suter, A. Acharya. *In preparation, 2022.*
- **Mechanics of micropillar confined thin film plasticity**
  A. Arora, R. Arora, A. Acharya. *Acta Materialia, 2022.*
- **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*