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, CUDA
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.

Advanced Micro Devices, Inc. (AMD) — *Austin, TX*

Senior Member of Technical Staff Software System Design — *Feb. 2022 - Present*

- Develop, port, and optimize high-performance computing software and applications for use on AMD computing platforms (CPUs/GPUs).
- Research, implement, and optimize parallel methods on GPU accelerators in distributed memory systems with MPI, CUDA, HIP, OpenMP, etc.

Siemens Corporation — *Princeton, NJ*

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

- Work In interdisciplinary group of scientists, engineers, and sottware developers to perform research in the confluence of classical numerical methods in science and engineering and the emerging Data Analytics and Machine learning.
- Develop physics-informed neural network to model *real-time* Lithium metal behavior under different battery operating conditions - temperature and loading rates.
- The research aims to accelerate scientific computing and battery design process.
- Research paper under review.

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

- Developed physics-informed super-resolution framework to reconstruct high-resolution solutions from low-resolution noisy data on coarse mesh.
  - Research published in 1st Annual ***AAAI*** Workshop on AI to Accelerate Science and Engineering (AI2ASE).
  - Research published in ***IEEE/ACM*** International Workshop on Artificial Intelligence and Machine Learning for Scientific Applications.
- Optimized code for parallel and distributed programming models to run on Bridges supercomputer to obtain *3X* improvement in performance.
- 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. 2nd Annual ***AAAI*** Workshop on AI to Accelerate Science and Engineering (AI2ASE).
- **Physics-Informed Neural Networks for modeling rate- and temperature-dependent plasticity**
  R. Arora, P. Kakkar, B. Dey, A. Chakraborty. Machine Learning and the Physical Sciences workshop at ***NeurIPS*** 2022.
- **PhySRNet: Physics informed super-resolution network for application in computational solid mechanics**
  R. Arora. ***IEEE/ACM*** International 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*