Rajat **Arora**

💼 SENIOR MEMBER OF TECHNICAL STAFF, AMD · 🖳 SOFTWARE DEVELOPMENT

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Experience ──────────────────────────────────── 6+ Y.O.E.

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

SENIOR MEMBER OF TECHNICAL STAFF SOFTWARE SYSTEM DESIGN   *Feb. 2022 - Present*

- Research and Implement complex solutions, showcasing a sophisticated approach to overcoming challenges in designing high-quality and high-performance software to run on AMD GPUs.
- Develop, and optimize high-performance computing software to run on AMD computing platforms (CPUs/GPUs).
- Successfully executed projects involving multiple engineers, demonstrating a strong command of leadership skills and the ability to coordinate with cross-functional teams to achieve project goals.
- Actively collaborate with product management and internal/external customers, providing valuable technical insights that contribute to the development of technical roadmaps for hardware (architecture) and software (libraries).
- Author of several blog posts showcasing best practices for porting and optimizing HPC and ML applications targeting AMD GPUs [Link]

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.

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

Skills ──

Programming	C/C++, Python, MATLAB, CUDA
Computational	Git, PyTorch, TensorFlow, High Performance Computing (OpenMP, MPI, CUDA), Data Visualization, Cloud Deployment

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*

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.

Teaching Experience

Carnegie Mellon University   *Pittsburgh, PA*
- Introduction to Civil Engineering   *Spring 2017 & 2018*
- Engineering Mechanics   *Spring 2016*

Indian Institute of Technology Kanpur   *Kanpur, India*
- Design of Machine Elements   *Spring 2014*
- Experiments in Solid Mechanics   *Fall 2013*

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 (IIT-JEE) among over 0.40 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*

Professional Service Activities

- Member of PhD committee for a PhD student at Carnegie Mellon University
- Active **contributor** to the Deal.II repository, an open-source Finite Element library   *2015 - Present*
- **Reviewer** for the following journals and conferences: *2019 - Present*
  - Materials Science and Technology
  - Computational Mechanics
  - International Journal for Multiscale Computational Engineering
  - Mechanics of Materials
  - Modelling and Simulation in Materials Science and Engineering
  - AAAI Conference on Artificial Intelligence
  - Annual AAAI Workshop on AI to Accelerate Science and Engineering
  - Conference on Neural Information Processing Systems
  - International Conference on Machine Learning
  - Journal of the Brazilian Society of Mechanical Sciences and Engineering
  - Journal of Physics: Condensed Matter

Patents

- **Systems and methods for deep learning for discontinuous data**

  R. Arora, N. Malaya. Patent filed with USPTO.

Publications

Preprints

- **Deep Learning Framework for Solving Hyperbolic Partial Differential Equations: Part I**

  R. Arora. In preparation.

Machine Learning

- **Spatio-Temporal Super-Resolution of Dynamical Systems using Physics-Informed Deep-Learning**

  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

- **An experimentally informed grain boundary 2D model: addressing triple junctions, mobility and invariance of misorientation**

  S. Ansari, A. Acharya, R. Arora, A. Alankar. In preparation.

- **Self-fields for disconnections with disclination, dislocation and step character**

  E. Zegpi, R. Arora, A. Acharya. In preparation.

- **Modeling of experimentally observed topological defects inside bulk polycrystals**

  S. Singh, H. Liu, R. Arora, R. Suter, A. Acharya. Under Review at Modelling and Simulation in Materials Science and Engineering, 2023.

- **Interface-Dominated Plasticity and Kink Bands in Metallic Nanolaminates**

  A. Arora, R. Arora, A. Acharya. Crystals, 2023.

- **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.

Technical Publications

Master's Thesis

- **Shape Evolution of Precipitates using Extended Finite Element Method Coupled with Level Set Method**.

  Indian Institute of Technology Kanpur, Department of Mechanical Engineering, Kanpur, India. 2014.

Ph.D. Thesis

- **Computational Approximation of Mesoscale Field Dislocation Mechanics at Finite Deformation**.

  Carnegie Mellon University, Department of Civil & Environmental Engineering, Pittsburgh, PA. 2019.

Technical Presentations

1. **Interface-dominated plasticity and kink bands in metallic nanolaminates**
   17th U. S. National Congress on Computational Mechanics, Albuquerque, Jul. 2023
2. **Mechanics of Micropillar Confined Thin Film Plasticity**
   The 10th International Conference on Multiscale Materials Modeling, Baltimore, Oct. 2022
3. **Accelerated Battery Design using Physics-Informed Machine Learning**
   1st IACM Conference on Mechanistic Machine Learning and Digital Twins for Computational Science, Engineering & Technology, San Diego, Sept. 2021
4. **Field Dislocation Mechanics**
   Mechanical Engg. Dept. Colloquium, IIT Bombay, Mumbai, India, Nov. 2019
5. **Finite Deformation Mesoscale Field Dislocation Mechanics**
   International Mechanical Engineering Congress & Exposition 2019, Salt Lake City, Utah, Nov. 2019
6. **Dislocation patterning in Finite Deformation Dislocation Mechanics and toward plasticity without phenomenological assumptions**
   Dislocations 2019, Haifa, Israel, Sept. 2019
7. **Finite Deformation Mesoscale Field Dislocation Mechanics**
   XV Conference on Computational Plasticity, Fundamentals and Applications, Barcelona, Spain, Sept. 2019
8. **Finite Deformation Mesoscale Field Dislocation Mechanics**
   Multiscale Materials Modeling, Osaka, Japan, Oct. 2018
9. **Computational Approximation of Mesoscale Field Dislocation Mechanics (MFDM) at Finite Deformation**
   World Congress of Computational Mechanics (WCCM), New York, NY, Jul. 2018
10. **Computational Approximation of Mesoscale Field Dislocation Mechanics (MFDM) at Finite Deformation**
    Society of Industrial and Applied Mathematics, Portland, OR, Jul. 2018
11. **Finite Deformation Mesoscale Field Dislocation Mechanics**
    Physics and Mechanics of Random Structures: From morphology to material properties, Conference in honor of Dominique Jeulin, Peninsula of Olèron, France, Jun. 2018
12. **Finite Deformation Mesoscale Field Dislocation Mechanics**
    Euromech symposium on Micromechanics of Defects, Sevilla, Spain, Jun. 2018
13. **Towards modeling longitudinally propagating shear bands**
    Nonconvexity, Nonlocality and Incompatibility: From Materials to Biology, Pittsburgh, PA, May. 2017

Invited Talks

1. **Machine Learning Accelerated Computational Solid Mechanics**
   Advanced Micro Devices, Austin, TX, Oct. 2021
2. **Computational Approximation of Mesoscale Field Dislocation Mechanics at Finite Deformation**
   Siemens Corporate Technology, Princeton, NJ, Feb. 2020
3. **Computational Approximation of Mesoscale Field Dislocation Mechanics at Finite Deformation**
   Ansys, Inc., Canonsburg, PA, Dec. 2018

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*