# 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, LaTeX

**Computational** Git, PyTorch, TensorFlow, PETSc, Deal.II, P4est, VTK, High Performance Computing (OpenMP, MPI)

## Professional Appointments — 3+ Y.O.E.

### Siemens Corporate Technology

*Princeton, NJ*

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

- Focus on developing AI-assisted simulations tools in the field of materials science and mechanics of materials. Languages: C++ and Python.
- Develop and implement Physics-Informed Neural Networks to solve nonlinear differential equations to accelerate battery design.

### 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 data 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

### Carngie 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*

## 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

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|---|---|---|
| 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

**A unification of finite deformation $J_2$ Von-Mises plasticity and quantitative dislocation mechanics**

R. Arora, A. Acharya

*Journal of the Mechanics and Physics of Solids* p. 104050. Elsevier, 2020

**Dislocation pattern formation in finite deformation crystal plasticity**

R. Arora, A. Acharya

*International Journal of Solids and Structures* 184 pp. 114–135. Elsevier, 2020

**Finite element approximation of finite deformation dislocation mechanics**

R. Arora, X. Zhang, A. Acharya

*Computer Methods in Applied Mechanics and Engineering* 367 p. 113076. Elsevier, 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* 28.7 p. 075009. IOP Publishing, 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*