

# Avirup Mandal, Ph.D.

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## Education

- 2018 – 23 ♦ **IIT Bombay**, Mumbai, India.  
*Ph.D.*, Electrical Engineering, CGPA: 9.33/10.0.  
Dissertation: *Fast Remeshing-Free Methods for Complex Cutting and Fracture Simulation*.  
Advisors: Prof. Subhasis Chaudhuri and Prof. Parag Chaudhuri.
- 2016 – 18 ♦ **IIT Bombay**, Mumbai, India.  
*M.Tech.*, Electrical Engineering, CGPA: 9.48/10.0.  
Thesis: *Haptic Rendering of Submerged Objects*.  
Advisor: Prof. Subhasis Chaudhuri.
- 2011 – 15 ♦ **Jadavpur University**, Kolkata, India.  
*B.E.*, Electronics & Telecommunication Engineering, CGPA: 9.03/10.0.

## Research Interests

I am broadly interested in developing *fast, efficient* and *robust* algorithms for **physics-based animation**. I have worked on the following projects.

- Developed *remeshing-free graph-based Finite Element Method* for fracture simulation.
- Proposed *probabilistic damage mechanics* for impurity induced random fracture.
- Built an *interactive framework with haptic feedback* for virtual sculpting.
- Devised an algorithm for *non-linear Monte Carlo ray tracing* using General Relativity.
- Developed a *Smooth Particle Hydrodynamics-based* interactive framework for underwater haptic rendering.

I am also interested in *differential geometry* and *machine learning* applied to dynamic physical Systems.

## Research Articles

### Journals/Conferences

1. **A. Mandal**, P. Chaudhuri, and S. Chaudhuri. *Remeshing-Free Graph-Based Finite Element Method for Fracture Simulation*. Computer Graphics Forum. 2023.
2. **A. Mandal**, P. Chaudhuri, and S. Chaudhuri. *Simulating Fracture in Anisotropic Materials Containing Impurities*. ACM SIGGRAPH Conference on Motion, Interaction and Games - MIG. Guanajuato, Mexico. November 2022.
3. **A. Mandal**, P. Chaudhuri, and S. Chaudhuri. *Interactive Physics-Based Virtual Sculpting with Haptic Feedback*. ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games - I3D. Virtual event. May 2022. (Journal version appeared in Proceedings of the ACM on Computer Graphics and Interactive Techniques).
4. **A. Mandal**, P. Chaudhuri, and S. Chaudhuri. *Real-time Physics-based mesh deformation with haptic feedback and material anisotropy*. International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications - GRAPP. Lisbon, Portugal. February 2023.
5. **A. Mandal\***, K. Ayush\*, and P. Chaudhuri. *Non-linear Monte Carlo Ray Tracing for Visualizing Warped Spacetime*. International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications - IVAPP. Virtual event. February 2021. (Joint first authors).
6. **A. Mandal**, D. Sardar, and S. Chaudhuri. *Haptic Rendering of Solid Object Submerged in Flowing Fluid with Environment Dependent Texture*. EuroHaptics. Pisa, Italy. June 2018.

### Patent

1. T. Kundu, K. Lahiri, **A. Mandal**, A. Mukherjee, M. K. Naskar, and S. Sinha. *Generic Data Compression for Heart Diagnosis*. U.S. Patent 9477701 B1 2016.

## Posters

1. **A. Mandal**, P. Chaudhuri, and S. Chaudhuri. *Artist Controlled Fracture Design Using Impurity Maps*. SIGGRAPH Posters. Vancouver, BC, Canada. August 2022.
2. **A. Mandal**, P. Chaudhuri, and S. Chaudhuri. *Scalable Visual Simulation of Ductile and Brittle Fracture*. SIGGRAPH Posters. Virtual event. August 2021.

## Awards and Achievements

- 2022 ♦ **Qualcomm Innovation Fellowship** *Super-Winner*, India.
- ♦ **ACM Student Research Competition** *Semi-Finalist*, SIGGRAPH.
- 2021 ♦ **Qualcomm Innovation Fellowship** *Winner*, India.
- ♦ **Best Paper Award** *Finalist*, IVAPP.
- ♦ **Best Teaching Assistant Award** (awarded twice), IIT Bombay.
- 2016 ♦ **All India Rank 113** out of 152k candidates in *GATE* with *ECE* specialization.
- 2011 ♦ **State Rank 94** out of 125k candidates in *West Bengal Joint Entrance Examination*.

## Skills

- Languages ♦ Strong reading, writing and speaking competencies for English, Bengali.
- Coding ♦ C++, C, Python, Java, OpenGL, CUDA, OpenHaptics,  $\text{\LaTeX}$ .
- Tools ♦ MATLAB, Houdini, Visual Studio, Eclipse, Android Studio, MeshLab.
- Web Dev ♦ HTML, CSS.

## Experience as Teaching Assistant

- 2016 – 21 ♦ Digital Signal Processing (EE 603), Digital Communications (EE 328), Computer Vision (EE 702), Digital Signal Processing System Design and Implementation Lab (EE 750).

## Research Experience

- 2014 ♦ **Indian Statistical Institute**, Kolkata, India.  
*Research Intern*, Electronics and Communication Sciences Unit.  
Topic: *Object Detection and Tracking in Variable Background using Fuzzy Kalman Filter*.  
Mentor: Prof. Kumar Sankar Ray.

## Relevant Courses

- Graphics ♦ Computer Graphics, Advanced Computer Graphics.
- Mathematics ♦ Applied Linear Algebra, Statistical Signal Analysis, Optimization Techniques, Engineering Statistics, Advanced Probability and Random Processes for Engineers.
- Signal Processing ♦ Digital Signal Processing, Recent Topics in Analytical Signal Processing.
- Image Processing ♦ Image Processing, Computer Vision, Digital Image Processing of Remotely Sensed Data.
- Machine Learning ♦ Foundations of Machine Learning, Deep Learning - Theory and Practice.
- Computer Science ♦ Digital Logic Design, Operating Systems, Computer Organization and Architecture.

## Extracurricular

- Reading ♦ Novels, Short stories, Popular science books.
- Interests ♦ Astrophysics, Special and General Relativity, Topology, Differential Geometry.
- Administrator ♦ Vision and Image Processing Lab, Department of EE, IIT Bombay (2018 – 2022).
- Organiser ♦ Department of ETCE alumni meet (SANJOG '13) at Jadavpur University.

## References

- **Subhasis Chaudhuri**, Director of IIT Bombay & K. N. Bajaj Chair Professor of Electrical Engineering, IIT Bombay. [sc@ee.iitb.ac.in](mailto:sc@ee.iitb.ac.in)
- **Parag Chaudhuri**, Professor of Computer Science and Engineering, IIT Bombay. [paragc@cse.iitb.ac.in](mailto:paragc@cse.iitb.ac.in)
- **Abhishek Gupta**, Assistant Professor of Mechanical Engineering, IIT Bombay. [abhi.gupta@iitb.ac.in](mailto:abhi.gupta@iitb.ac.in)