

Rajat Agrawal | Curriculum Vitae

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Innovative mechanical engineer and published researcher in autonomous systems, specializing in real-time navigation, multi-agent coordination, and robotics. With multiple IEEE publications on adaptive sampling and persistent monitoring for autonomous vehicles, I have led the development of intelligent systems for environmental monitoring, precision agriculture, and marine exploration. Skilled in robotic system frameworks, precision CAD design, advanced finite element analysis, and high-level data modeling, I bring rigorous technical expertise to developing resilient autonomous systems for complex environments.

Technical skills

○ Robotics & Autonomous Systems:

- **Frameworks:** Extensive experience with ROS for robotic automation, alongside ArduPilot and PX4 for UGV, ASV & UAV control systems.
- **Navigation & Sensor Integration:** Strong foundation in real-time navigation and sensor fusion, including object detection with RGB and thermal cameras.

○ Simulation & Computational Modeling:

- **Finite Element Analysis (FEA):** Significant experience with Ansys Mechanical for structural, thermal, and fatigue analysis, particularly for high-pressure turbine components and autonomous systems.
- **Simulation Tools:** Competent in computational modelling for environmental and mechanical simulations relevant to autonomous systems.

○ CAD & Mechanical Design:

- **3D Modeling:** Extensive practice with Creo, SolidWorks, and AutoCAD for high-precision mechanical designs, dimensional analysis, and tolerance studies.
- **Prototyping & Fabrication:** Well-versed in 3D printing technologies (FDM, SLA) and precision fabrication techniques for iterative prototype testing and custom mechanical assemblies.

○ Programming & Data Analysis:

- **Languages:** Practical experience with Python, particularly for data analysis and visualization (using libraries like NumPy, Pandas, Matplotlib) and Arduino programming for hardware integration.
- **Data Analysis:** Applied knowledge in data processing and visualization for engineering datasets, focusing on interpreting sensor data and conducting basic analyses.

○ Technical Documentation:

- **Documentation & Reporting:** Experienced in generating CAD drawings, FEA reports, and technical documentation, ensuring clarity and alignment with regulatory standards.

Work Experience

- **Bharat Heavy Electricals Ltd. (BHEL)** **Haridwar, India**
○ *Fixed-Tenure Engineer (FTE)* *March 2025 –Present*
- Working with the Turbine-Mech Calculations team in the Steam Turbine Engineering (STE) Department on the "Advanced Ultra Supercritical (AUSC) 800MW Steam Turbine" project.
- **CSIR – Central Scientific Instruments Organisation (CSIO)** **Chandigarh, India**
○ *Project Associate-II* *December 2024 –February 2025*
- Designed and developed a detailed 3D engineering model for a system to replicate nano/micro-scale structures using Roll-to-Roll Nanoimprint Lithography (R2R NIL), incorporating a thorough analysis of operational parameters to optimize precision, cost-efficiency, and scalability for applications in flexible electronics, optics, and biomedical devices.
 - Developed a scalable fluidic shaping method to produce optical lenses with nanometer-level smoothness by controlling lens curvature through energy minimization under neutral buoyancy conditions.
- **Indian Institute of Science Education and Research Bhopal** **Bhopal, India**
○ *Sr. Project Associate* *August 2023–March 2024*
- Worked on developing an autonomous river bodyboard with a rudder-controlled navigation system and water-flow propulsion to achieve real-time monitoring of river health and environmental data collection.
 - Successfully designed and developed a drone (UAV) equipped with thermal and multispectral cameras for agricultural applications, specifically targeting precision farming
 - Successfully completed a SERB-funded project entitled "Design and Development of Autonomous Surface Vehicle for Bathymetry Applications" under the supervision of Dr. Sujit P.B.
 - Object Detection and Decision Making on 4-Legged Unitree Go 1 Robot using RGB and Thermal Camera.
 - Successfully designed and developed an autonomous electric rickshaw to promote sustainable and eco-friendly transportation in urban India.
- **Indian Institute of Science Education and Research Bhopal** **Bhopal, India**
○ *Project Associate-I* *August 2021–July 2023*
- Designed and manufactured precise wafer probes for micro-level examination of flexible integrated circuits with minimal negative impact on the device under test (DUT) by utilizing 3D printing, tungsten pins, and a customized mechanical structure.
 - Worked with the Central Institute of Agriculture Engineering, Bhopal (CIAE) to create an Autonomous Weeder that uses AI, sensors, and cameras to detect and remove weeds from crops without damaging them by employing advanced algorithms and precision tools.
 - Set-up an agile and low-cost indoor autonomous swarm test-bed with multiple quad-copters to facilitate the testing of algorithms for autonomous guidance strategies.
 - Deployed BlueROV2, an underwater Remotely Operated Vehicle (ROV) from Blue Robotics to inspect and monitor ports, harbours and vessels, inspect pipelines, locate underwater targets, and explore the depths of water bodies.
 - Built and improved an autonomous off-road rover named 'Hound' by establishing electrical connections, addressing mechanical issues, and integrating computer vision sensors.

- Indian Institute of Science Education and Research Bhopal** **Bhopal, India**

 - *Project Associate—* *December 2020–April 2021*
 - Prototyped a portable, low-cost Oxygen Concentrator device as a part of IISER Bhopal's efforts towards handling COVID-19.
 - 3D model optimization and slicing for 3D print production with 3D printer hardware including FDM, SLA technologies.

- Bharat Heavy Electricals Ltd.** **Haridwar, India**

 - *Contract Design Engineer* *December 2019–December 2020, March 2019–May 2019*

Worked in association with the Indian Mission Project of the "Advanced Ultra Supercritical (AUSC) 800MW Steam Turbine" in the Research and Development group of Steam Turbine Engineering (STE) Department.

 - Carried out Fatigue Analysis (Low Cycle Fatigue) of High Pressure (HP) turbine based on Alloy 625 and GX12 Materials with operating Parameters of 710 °C Temp. and 300 Bar Pressure in Ansys Mechanical.
 - Created the Dimensional Drawings, Main Assembly drawings, Part Drawings and the complete Bill of Materials for Turbine Casings, Pedestals and their assembly components in PTC Creo and Autodesk AutoCAD.
 - Designed 3D CAD digitization of Turbine Casings, Bearings, Pedestals and their assembly components.
 - Carried out Tolerance Analysis of HP turbine Inlet Connection in Ansys Mechanical.

- Bharat Heavy Electricals Ltd.** **Haridwar, India**

 - *Graduate Apprentice Trainee* *March 2018–Feb 2019*

Underwent Apprenticeship Training for one year where I was associated with the Indian Mission Project of "Advanced Ultra Supercritical (AUSC) 800MW steam turbine" in the Research and Development group of the Steam Turbine Engineering Department (STE).

 - Carried out Coupled Structural and Thermal FEA in Steady-State and Transient Conditions on Turbine Equipment such as Inner Casing, IP Inlet Connections etc. and to optimize the generated results.
 - Managed all phases of the design process for a multitude of products, components, parts, assemblies and sub-assemblies, including drafting, dimensioning, tolerance, prototyping and documenting results.

Publications

- **Rajat Agrawal**, Vinod Mishra. "Machine-free Optics Manufacturing and its Replication by Fluidic Shaping", presented at the 2025 Optica Design and Fabrication Congress, Denver, Colorado, USA.
- Abhijit Khadatkar, P.B. Sujit, **Rajat Agrawal**, Kasi Vishwanath, C.P. Sawant, A.P. Magar, and V.P. Chaudhary . "WeeRo: Design, development, and application of a remotely controlled robotic weeder for mechanical weeding in row crops for sustainable crop production", published in Elsevier, Results in Engineering). DOI:[10.1016/j.rineng.2025.105202](https://doi.org/10.1016/j.rineng.2025.105202).
- **Rajat Agrawal**, K. Nambiar, B. Chhaglani, M. Chitre, and Sujit PB. "OAS-GPUCB: On-the-way Adaptive Sampling Using GPUCB for Bathymetry Mapping", at 2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp.1265 - 1270, Abu Dhabi, United Arab Emirates.
DOI: <https://doi.org/10.1109/IROS58592.2024.10801947>
- **Rajat Agrawal**, K. Nambiar, M. Chitre and Sujit PB. "Multi-Agent Adaptive Sampling for Bathymetry Mapping". (Extended abstract presented at the 40th Anniversary of the IEEE Conference on Robotics and Automation ICRA@40).
- Manav Mishra, Prithvi Poddar, **Rajat Agrawal**, Jingxi Chen, Pratap Tokekar and P.B. Sujit. "Multi-Agent Deep Reinforcement Learning for Persistent Monitoring with Sensing, Communication, and Localization Constraints", published in IEEE Transactions on Automation Science and Engineering.
DOI: <https://doi.org/10.1109/TASE.2024.3385412>

- P. Anand, P. Niturkar, A. P. Aguiar, **R. Agarwal**, M. Mishra, and P. B. Sujit, "Finite-Time Standoff Target Tracking in the Presence of Wind," 2023 European Conference on Mobile Robots (ECMR), Coimbra, Portugal, 2023, pp. 1-6. DOI:10.1109/ECMR59166.2023.10256384.
- Raghav Thakar, **Rajat Agrawal** and Sujit PB. "A COLREGs-Compliant Conflict Resolution Strategy for Autonomous Surface Vehicles". DOI:**10.48550/arXiv.2312.08549**.

Patents

- **"Multi-pin Probe Connector for IC Testing at Wafer Level"**
Patent Application No. 202421037855, filed on 14/05/2024, at the Intellectual Property Office, India.
Inventor(s): Rajat Agrawal, Suyash Srivastava, Dr. Pydi Ganga M. Bahubalindruni, and Dr. P. B. Sujit.

Education

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| ○ Dr A.P.J. Abdul Kalam Technical University, Uttar Pradesh | Lucknow, India |
| ○ <i>Bachelor of Technology in Mechanical Engineering , 68.66 %</i> | <i>2012-2016</i> |
| ○ Amarnath Vidyashram Sr. Sec. School | Mathura, India |
| ○ <i>AISSE, CBSE, Class XII, 69.16%</i> | <i>2012</i> |
| ○ St. Dominic's Sr. Sec. School | Mathura, India |
| ○ <i>AISSE, CBSE, Class X, C.G.P.A 6.6</i> | <i>2010</i> |

Projects

- **B.Tech Project:** '*Analysis of Advance Aerodynamics Changes (GENERIC BUMP) in Aerospace Industry Using CFD'*
I was part of a team studying the use of generic bumps on fighter aircraft as boundary layer diverters (BLDs) and compression surfaces for Diverterless Supersonic Inlets (DSIs). Our objective was to prevent boundary layer flow into the inlet, focusing on parameters like pressure recovery, boundary layer diversion, surface flow, Mach number changes, and mass flow.

[Link to the Project Presentation](#)

References

- **Dr. Vinod Mishra**
Senior Technical Officer, CSIR-Central Scientific Instruments Organization, Chandigarh, India
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- **Dr. Sujit Pedda Baliyarasimhuni**
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