

Dr. Atul Kumar Soni

Engineer, Transmission Planning and Grid Integration Studies | EEPLUS, Inc.

Ph.D. | Electrical Engineering | Indian Institute of Technology Kanpur

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Summary

I hold a Ph.D. in Electrical Engineering from the Indian Institute of Technology Kanpur, where my research focused on developing microgrid protection and control schemes using optimization techniques for non-linear mathematical models and hardware validation. Additionally, in my current role at EEPLUS Inc., I have gained valuable experience in modeling, control, and system impact analysis in power system.

Education

Ph.D. | Electrical Engineering

Indian Institute of Technology Kanpur

May 2025

CPI: 9.13/10

- **Specialization:** Power Engineering
- **Thesis:** Novel Adaptive Relaying and Protection Coordination Schemes for AC Microgrids
- **Advisors:** Prof. Abheejeet Mohapatra, Prof. S. N. Singh

M.Tech. | Electrical Engineering

National Institute of Technology Raipur

July 2017

CGPA: 8.54/10

- **Specialization:** Power System and Control
- **Thesis:** An intelligent protection scheme for combined underground cable and transmission line system
- **Advisor:** Prof. Anamika Yadav

B.E. | Electrical Engineering

Chhattisgarh Swami Vivekananda Technical University, Bhilai

July 2014

CGPA: 8.82/10

Professional Experiences

Engineer, Transmission Planning and Grid Integration Studies

EEGrid Analytics Pvt. Ltd., a wholly owned subsidiary of EEPLUS, Inc.

November 2024 – Present

Sr. Student Research Associate

Department of Electrical Engineering, Indian Institute of Technology Kanpur

October 2023 – June 2024

Work Responsibilities and Research Experiences

Engineer, Transmission Planning and Grid Integration Studies

EEGrid Analytics Pvt. Ltd., a wholly owned subsidiary of EEPLUS, Inc.

November 2024 – Present

Team Lead: Dr. Divya Vedullapalli

- Performed **load flow** and **contingency analysis** for load and generation interconnection studies using **PSS/E** following ERCOT planning guidelines for peak and off-peak cases.
- Investigated **reliability issues (thermal overloads and low voltage violations)** under base case and contingency conditions.
- Determined **curtailment requirements** for interconnecting generators and loads.
- Conducted **sensitivity analysis** (PTDF/LODF-based) to prioritize generators contributing to constraint violations.
- Evaluated **generator redispatch strategies** to alleviate post-contingency violations and improve system reliability.
- Developed and validated **Corrective Action Plans (CAPs)** including switching capacitor banks, changing generator POI modes, and VAR tuning.
- Participated in RPG (Regional Planning Group) studies, assessing the **effectiveness of proposed transmission upgrades** in mitigating pre-existing violations.
- Delivered various grid integration studies (load feasibility studies, full interconnection studies, transmission system upgrade planning), including steady-state contingency analysis and short-circuit assessment in ERCOT grid.
- Modeled renewable-based sources (solar, wind, batteries) and conventional sources for steady-state and short-circuit analyses.
- Performed load modeling for short-circuit analysis in **Aspen One Liner**.
- Performed voltage-ride through study for solar unit integration to transmission system.

Sr. Student Research Associate

UI-ASSIST Project, Department of Electrical Engineering, IIT Kanpur

October 2023 – June 2024

- Performed rigorous data analysis to identify the missing data on three real microgrid pilots (Urban, Semi-Urban, and Rural) developed by IIT Kanpur.
- Prepared project reports and presentations.

Doctoral Student Researcher

August 2018 – July 2024

Department of Electrical Engineering, IIT Kanpur

Advisors: Prof. Abheejeet Mohapatra, Prof. S. N. Singh

- Modeled and simulated modified CIGRE MV microgrid, IEEE 13-bus AC microgrid, and IEEE 34-bus AC microgrid integrated with synchronous and inverter-interfaced distributed generators (DGs) using **Real-Time Digital Simulator (RTDS)** and **MATLAB** to perform all types of faults during Grid-Connected Mode (GCM), Islanded Mode (IM), $n - 1$ contingencies due to outages of lines and DG, and variations in DGs' injections.
- Performed **Controller Hardware-In-Loop (CHIL)** simulation using the **RTDS/ RSCAD, dSPACE DS1104 DSP** and **NRDE (Numerical Relay Development Environment)**.
- Proposed **four** novel protection coordination schemes, as follows.
 - **Scheme 1:** Developed an **optimization-based** algorithm using **MATLAB** for adaptive coordination of DOCRs, which requires two trip characteristics, one each for GCM and IM, in each relay. Proposed a logical framework to choose the appropriate characteristic. (Published in **IEEE Systems Journal**).
 - **Scheme 2:** Proposed a novel **Voltage-Supervised Directional Overcurrent Relay** characteristic and developed a **constrained non-linear optimization-based** protection coordination framework using **MATLAB**. Obtained a single set of relays' settings GCM, IM, variations in DER injections, and $n - 1$ contingencies. **Zero miscoordinations** and **significant reduction in relays' operating times** in given scenarios. (Published in **IEEE Transactions on Power Delivery**).
 - **Scheme 3:** Proposed a new control variable - **pickup scaling coefficient, along with an adaptive voltage-varying threshold**, that allows the pickup setting of DOCRs to be robust and adaptive for various scenarios. Developed a **constrained non-linear optimization-based** protection coordination framework using **MATLAB**. Obtained consistent relay operating times and Coordination Time Intervals across a range of topologies, including GCM, IM, line, and DG outages and varying DGs' injections, by determining a single, optimal set of DOCR settings. (Published in **IEEE Transactions on Power Delivery**).
 - **Scheme 4:** Proposed **two-stage robust protection coordination** method for AC microgrid, significantly reducing computational burden. (Communicated and under review in **IEEE Transactions on Power Delivery**)
- Analyzed the impacts of the control parameters of inverter-based DGs during a three-phase bolted fault and obtained a relationship between the short-circuit current and the variation in current control parameters of the dq controller during GCM using **MATLAB** and validated using real-time **RTDS** simulations. (Published in **GlobConET**)
- Above research works were supported and funded by the Department of Science and Technology (DST)/Indo-US Science and Technology Forum (IUSSTF).
- Drafted the manuscripts using **LateX**.
- Developed a software tool using **MATLAB** for Distribution System Load Flow and Short-Circuit Analysis with detailed modeling of distribution system components and protection coordination.

Master Student Researcher

July 2016 – June 2017

Department of Electrical Engineering, NIT Raipur

Advisor: Prof. Anamika Yadav

- Simulated a real combined overhead line and underground cable transmission system using **Simulink/MATLAB** to perform fault analysis by implementing the eleven types of shunt faults at various locations.
- Developed an algorithm for fault detection, classification, and location using **Fuzzy Inference System** and **Arduino** microprocessor for different types of faults and fault resistances up to 200Ω .
- Co-authored one journal paper and presented at two conferences.

Research Grants

UI-ASSIST: US India Collaborative for Smart Distribution System with Storage


2017 - 2024

Principal Investigators (India Lead): Dr. Suresh C Srivastava, Dr. Santanu Mishra, Dr. Ankush Sharma, Dr. Abheejeet Mohapatra, IIT Kanpur budget - INR 2661.82 lakhs

My Role: Co-author. Developed AC microgrid protection coordination schemes. Published two journal articles and one conference proceeding. Contributed to white paper, reports, and presentations.

Publications

International Journal Articles

1. **Atul Kumar Soni**, A. Mohapatra and S. N. Singh, "Optimal Over-Current Protection Coordination in AC Microgrid via Novel Pickup Scaling Coefficient," in **IEEE Transactions on Power Delivery**, vol. 40, no. 4, pp. 2118-2130, Aug. 2025. [Link] 
2. **Atul Kumar Soni**, A. Mohapatra and S. N. Singh, "Protection Coordination in AC Microgrid via Novel Voltage-Supervised

Directional Over-Current Relays," **IEEE Transactions on Power Delivery**, vol. 39, no. 3, pp. 1549-1562, June 2024. [Link] [↗](#).

3. S. K. Maurya, **Atul Kumar Soni**, A. Mohapatra, and A. Sharma, "Optimal single settings based relay coordination in dc microgrids for line faults," **International Journal of Electrical Power & Energy Systems**, vol. 156, p. 109 708, 2024. [Link] [↗](#).
4. **Atul Kumar Soni**, A. Kumar, R. K. Panda, A. Mohapatra, and S. N. Singh, "Adaptive coordination of relays in ac micro-grid considering operational and topological changes," **IEEE Systems Journal**, vol. 17, no. 2, pp. 3071–3082, 2023. [Link] [↗](#).
5. B. K. Chaitanya, **Atul Kumar Soni**, and A. Yadav, "Communication assisted fuzzy based adaptive protective relaying scheme for microgrid," **Journal of Power Technologies**, vol. 98, no. 1, pp. 57–69, 2018. [Link] [↗](#).

Communicated (Under Review) International Journal Articles

1. **Atul Kumar Soni**, A. Tiwari, A. Mohapatra and S. N. Singh, "Robust Protection Coordination of Directional Over-Current Relays in AC Microgrids," in **IEEE Transactions on Power Delivery**, manuscript id: TPWRD-01038-2025.

Conference Proceedings and Presentations

1. **Atul Kumar Soni**, A. Mohapatra and S. N. Singh, "Protection Coordination in AC Microgrid via Novel Voltage-Supervised Directional Over-Current Relays," at the 2025 Georgia Tech Protective Relaying Conference, Atlanta, USA.
2. **Atul Kumar Soni**, A. Mohapatra and S. N. Singh, "Protection Coordination in AC Microgrid via Novel Voltage-Supervised Directional Over-Current Relays," poster presented at 2024 IEEE Power and Energy Society General Meeting, Seattle, USA.
3. **Atul Kumar Soni**, R. K. Panda, A. Kumar, A. Mohapatra, S. N. Singh, and S. C. Srivastava, "Impact of control parameters on short-circuit capacity of inverter based sources," in 2022 IEEE IAS Global Conference on Emerging Technologies (GlobConET), 2022, pp. 1113–1118. [Link] [↗](#).
4. B. Ingre, A. Yadav, and **Atul Kumar Soni**, "Decision tree based intrusion detection system for nsl-kdd dataset," in Information and Communication Technology for Intelligent Systems (ICTIS 2017), vol. 2, Springer International Publishing, 2018, pp. 207–218. [Link] [↗](#)

Awards, Grants, and Certifications

Awards

- **Outstanding Ph.D. Thesis Award**, for best Ph.D. thesis in the Electrical Engineering Department, IIT Kanpur 2025
- **Clayton Griffin Best Student Paper Award**, for the best paper in power system protection at Georgia Tech Protective Relaying Conference, Atlanta, USA (1000 USD) 2025
- **GIPSA (Grid-India Power System Award)**, for outstanding Ph.D. thesis in the Power System domain, sponsored by Grid Controller of India Limited (100000 INR) 2024
- **AWSAR (Augmenting Writing Skills for Articulating Research)**, sponsored by the Department of Science and Technology (DST), Government of India (10000 INR) 2022
- **Smart India Hackathon (SIH) - Software Edition**, sponsored by Ministry of HRD and AICTE, India (100000 INR) 2019
- **PPSA (POSOCO Power System Award)**, for outstanding Master's Thesis in Power System domain, sponsored by POSOCO, FITT, IIT Delhi (40000 INR) 2018
- **Best Video Award, India Innovation Challenge Design Contest (IICDC)**, sponsored by DST, Texas Instruments, and IIM Bangalore (50000 INR) 2016
- **Semifinalist, India Innovation Challenge Design Contest (IICDC)**, sponsored by DST, Texas Instruments, and IIM Bangalore (25000 INR) 2016

Grants

- **International Travel Grant**, from Science and Engineering Research Board (SERB), India for 2024 IEEE PES General Meeting, Seattle, USA from 21 July 2024 to 24 July 2024 (118000 INR) 2024
- **400 USD funding in IEEE PES High Performing Student Branch Chapter Program (HPSBCP)**, serving as the Chairperson of the Student Branch Chapter of IIT Kanpur Committee 2023
- **IEEE PES Region 10 SBC Training**, from IEEE PES R10 Student Chapters Committee 2022
- **MHRD fellowship**, for pursuing Ph.D.
- **MHRD fellowship**, for pursuing Master's

Certifications

- **Hands-on Machine Learning with Python & Analytics**, [Link] [↗](#) 2024

Professional Affiliations

- Member, IEEE
- Member, IEEE Power and Energy Society (PES)

- Member, IEEE Young Professionals

Services

Reviewer

- IEEE Transactions on Power Delivery
- IEEE Transactions on Smart Grid
- IEEE Transactions on Industrial Informatics
- IEEE Transactions on Industry Applications
- IEEE Systems Journal
- IEEE Industry Applications Society Annual Meeting

Volunteer

- **Mentor**, IEEE PES Student Branch Chapter IIT Kanpur 2023
- **Chairperson**, IEEE PES Student Branch Chapter IIT Kanpur 2022
- **Secretary**, IEEE PES Student Branch Chapter IIT Kanpur 2021
- **Webmaster**, IEEE PES Student Branch Chapter IIT Kanpur 2020

Events

- **Chairperson**, National Workshop - PERA22 2022
- **Secretary**, National Workshop - PERA21 2021
- **Volunteer**, IEEE PES Student Branch Chapter IIT Kanpur 2019

Skills

Languages: MATLAB, Python, C

Power System Tools: RTDS/ RSCAD, PSS/E, Aspen One Liner

Software Tools: MATLAB, Simulink, Simscape, MATLAB Optimization Toolbox, Fuzzy Logic Toolbox, Jupyter Notebook

Hardware Tools: RTDS, NRDE, dSPACE 1104, SEL421 Relay, Arduino UNO and MEGA, TI MSP430, TI DSP

Editing Tools: LaTeX, Microsoft Office (Word, Excel, PowerPoint, Visio, and Publisher), Canva, WordPress

Operating Systems: MS Windows, MacOS

Research Interests

- Modeling, control, and system impact analysis in power system
- Optimization for planning and operation of power system
- Protection and control schemes of power system with inverter-based generation, including transmission system, distribution system, and microgrids (AC, DC, Networked)
- Hardware-in-the-loop (HIL) testing to validate power system protection schemes and dynamic responses
- Distribution system modeling and distribution system short-circuit analysis
- Transmission system planning and grid integration

References

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