

Mr. Rahul Kumar

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RESEARCH INTERESTS

- Photovoltaic system performance and reliability
- Hybrid energy storage system (HESS) modelling
- Advanced control strategies for microgrids
- Renewable and sustainable energy integration
- Power electronics for energy conversion and optimization

EDUCATION

- National Institute of Technology Patna, Bihar, India — Ph.D., Electrical Engineering
Thesis title: **Analysis of Hybrid Renewable Energy System**
Feb. 2021 – Feb.2026 (Under Evaluation) (Doctor of Philosophy)
- Madan Mohan Malaviya University of Technology, Gorakhpur, UP, India — M.Tech., Power Electronics and Drives Engineering
July 2016 – June 2018 CGPA – 7.6 (Master of Technology)
- Rajkiya Engineering College, Banda, UP, India — B.Tech., Electrical Engineering
July 2010 – June 2014 Percentage – 63.36% (Bachelor of Technology)

SKILLS

- Software & Simulation Tools: MATLAB/Simulink, PVsyst, PV*Sol, Python, SCAPS-1D
- Laboratory Instruments & Equipment: OPAL-RT HIL Simulator, Solar Simulator, Digital Storage Oscilloscope (DSO), Power Analyzers

LIST OF PATENTS

1. **Rahul Kumar**, and Amitesh Kumar. "Power Control and Management of a Photovoltaic System Utilizing a Hybrid Energy Storage System with a Heuristic Approach." Indian Patent (**Published: May 2026**).
2. **Rahul Kumar**, Chinmay Bera, Rohan Kumar Gupta, and Amitesh Kumar — "Stability Enhancement in Hybrid DC Microgrids with Real-Time Hardware Verification" Indian Patent (**Filed Submission: January 2026**).
3. Rohan Kumar Gupta, **Rahul Kumar**, Chinmay Bera, and Balmukund Kumar, and Amitesh Kumar — "Sustainable Energy Optimization in Dual-Area Systems: Integrating Floating Solar with Hydroelectric Power Using hCIGWO and Advanced 2-DOF Controllers" Indian Patent (**Filed Submission: April 2026**).
4. Balmukund Kumar, **Rahul Kumar**, Chinmay Bera, and Rohan Kumar Gupta, and Amitesh Kumar — "Enhancing Solar Electric Vehicle Performance Using Advanced Optimisation Techniques" Indian Patent (**Filed Submission: April 2026**).
5. Chinmay Bera, **Rahul Kumar**, Rohan Kumar Gupta, and Balmukund Kumar, and Amitesh Kumar — "Intelligent Fault Diagnosis System for Lithium-Ion Batteries" Indian Patent (**Filed Submission: April 2026**).

JOURNAL PAPERS

1. Chinmay Bera, **Rahul Kumar**, Rohan Kumar Gupta, Rajib Kumar Mandal, Amitesh Kumar, "Experimental Validation of a Novel Memory-Embedded and Innovation-Weighted State-of-Charge Estimation of Lithium-Ion Batteries for Electric Vehicles." IEEE Transactions on Industrial Informatics (IEEE) **(Accepted, Q1, SCIE, Impact Factor: 9.9)**.
(*Contribution: Battery SoC estimation algorithm development and experimental validation.*)
2. **Rahul Kumar**, Chinmay Bera, Amitesh Kumar, Experimental verification and analysis of a novel HMRFO- AAA heuristic method utilizing Z-source DC/DC converter using HIL for DC-microgrid connected intelligent PV-hybrid energy storage systems, Journal of Energy Storage, Volume 135,2025,118270, ISSN 2352-152X, <https://doi.org/10.1016/j.est.2025.118270>.**(Q1, SCIE, Impact Factor: 9.8)**.
(*Contribution: HMRFO-AAA optimization algorithm, HIL implementation, and PV-HESS energy management.*)
3. Chinmay Bera, **Rahul Kumar**, Rohan Kumar Gupta, Rajib Mandal, Amitesh Kumar, physically interpretable and experimentally validated uncertainty-aware causal fusion network for real-time fault diagnosis and risk quantification in lithium-ion batteries for electric vehicles, Journal of Energy Storage, Volume153, PartC,2026,121054, ISSN2352-152X, <https://doi.org/10.1016/j.est.2026.121054>.**(Q1, SCIE, Impact Factor: 9.8)**.
(*Contribution: Battery fault diagnosis, uncertainty quantification, and experimental validation.*)
4. **Rahul Kumar**, Amitesh Kumar. "Effective-diode-based analysis of industrial solar photovoltaic panel by utilizing novel three-diode solar cell model against conventional single and double solar cell. Environ Sci Pollut Res 31, 25356–25372 (2024). " <https://doi.org/10.1007/s11356-024-32474-z>.**(Q1, SCIE, Impact Factor: 5.8)**.
(*Contribution: Novel three-diode PV modeling and performance analysis.*)
5. **Rahul Kumar**, and Amitesh Kumar. "A novel heuristic technique implemented with FOPI controller for dynamic power management in hybrid energy storage systems. "Engineering Research Express (IOP), 7(1), 015375. <https://doi.org/10.1088/2631-8695/adb1a0> **(eSCI, Impact Factor: 1.6)**.
(*Contribution: FOPI controller design and hybrid energy storage power management.*)
6. **Rahul Kumar**, Amitesh Kumar, "Optimal Integration of Renewable Energy an Efficient Storage in Hybrid Systems: A New Optimization and Evaluation Approach. " Soft Computing **(SCIE, Impact Factor: 2.5, Springer) (Revision Submitted)**.
(*Contribution: Optimization-based renewable energy and storage integration framework.*)
7. Rohan Kumar Gupta, **Rahul Kumar**, Chinmay Bera, Mohammad Amir, Amitesh Kumar, "Experimental Investigation of Frequency control of a Delay-Resilient Hybrid Microgrid with Multi-Type Energy Storage Systems through OPAL-RT utilizing a Novel Adaptive Swarm Foraging (ASF)-Optimized FOTIDF-PIID Controller. " Journal of Energy Storage. **(Q1, SCIE, Impact Factor: 9.8) (Elsevier), (Revision Submitted)**.
(*Contribution: Controller design, OPAL-RT validation, and hybrid microgrid frequency control analysis.*)

COMMUNICATED JOURNAL PAPERS

1. **Rahul Kumar**, Rohan Kumar Gupta, Chinmay Bera, Mohammad Amir, Amitesh Kumar, "Novel AMBO- Optimised Tilt-Integral Control Strategy for Stability Enhancement in Hybrid DC Microgrids with Real-Time Hardware Verification." Computers & Electrical Engineering **(Elsevier), (Under Review)**.
(*Contribution: Developed an AMBO-optimized tilt-integral control strategy and validated its effectiveness through real-time hardware testing of hybrid DC microgrids.*)

2. Sandeep Ojha, **Rahul Kumar** "On- Board Charger with Phase-Shifted PWM Control for Optimal Energy Flow in PV-Powered Multi-Battery Systems. " IEEE Transactions on Power Electronics (**IEEE**) (**Under Review**).
(**Contribution:** Developed phase-shifted PWM control for efficient energy management in PV-powered multi-battery charging systems.)
3. Sandeep Ojha, **Rahul Kumar** "Two-Stage Hybrid Converter with CCS-Predictive Control for AC and DC Outputs: A Unified Power Conversion Method. " Computers & Electrical Engineering (**Elsevier**), (**Under Review**). (**Contribution:** Developed CCS-based predictive control for enhanced performance of unified AC/DC power conversion systems.)
4. Sandeep Ojha, **Rahul Kumar** "Predictive Control for Passive Cell Balancing in Lithium-Ion Batteries Using Fractional Open Circuit Voltage- Based MPPT. "Scientific Reports (Springer) (Revision Submitted).
(**Contribution:** Developed a predictive control framework for battery cell balancing and MPPT-assisted energy optimization.)
5. **Rahul Kumar**, Chinmay Bera, Amitesh Kumar, "Performance Degradation in Solar Power Systems: Overview of Mitigation Methods." Renewable Energy Focus (**Elsevier**) (**Under Review**).
(**Contribution:** Conducted a comprehensive assessment of solar PV degradation mechanisms and mitigation techniques.)
6. Amit Kumar Gupta, **Rahul Kumar**, Rohan Kumar Gupta, Amitesh Kumar" Resilient Load Frequency Control in Low-Inertia Hybrid Microgrids via AI-Optimized FOPID Controller". International Journal of Ambient Energy (Taylor and Francis) (**Revision Submitted**).
(**Contribution:** AI-optimized FOPID controller design for resilient microgrid frequency control.)

CONFERENCE PAPERS

1. **Rahul Kumar**, Rohan Kumar Gupta, Anjani Kumar Prajapati, Amitesh Kumar, Rajnish Kumar, Balmukund Kumar "A Novel approach of MPPT with Soft Switching Converter Interface," 2022 2nd International Conference on Emerging Frontiers in Electrical and Electronic Technologies (ICEFEET), Patna, India, 2022, pp. 1 -6, doi: 10.1109/ICEFEET51821.2022.9848293.
2. Suneel, Pritam Kumar, **Rahul Kumar**, Rashmi Kumari, Chinmay Bera, Amitesh Kumar' 'Simulation Analysis of Single- Ended Primary-Inductor Converter," 2024 4th International Conference on Emerging Frontiers in Electrical and Electronic Technologies (ICEFEET), Patna, India, 2024, pp. 1-5, doi: 10.1109/ICEFEET64463.2024.10866807.
3. Rajnish Kumar, Prabhakar Kumar, Balmukund Kumar, Parshuram Singh, **Rahul Kumar**, Amitesh Kumar, "Design and Analysis of High performance of a BLDC Motor for Electric Vehicle," 2022 2nd International Conference on Emerging Frontiers in Electrical and Electronic Technologies (ICEFEET), Patna, India, 2022, pp. 1 -4, doi: 10.1109/ICEFEET51821.2022.9848307.
4. Balmukund Kumar, Rajnish Kumar, Prabhakar Kumar, **Rahul Kumar**, Parshuram Singh, Amitesh Kumar, "Analysis and Performance Evolution of Novel Global Modified Flower Pollination Algorithm for Photovoltaic System under Partial Shading Condition," 2022 2nd International Conference on Emerging Frontiers in Electrical and Electronic Technologies (ICEFEET), Patna, India, 2022, pp. 1-6, doi: 10.1109/ICEFEET51821.2022.9848034.
5. **Rahul Kumar**, Rohan Kumar Gupta, Suneel, Pritam Kumar, Chinmay Bera, Rashmi Kumari, Amitesh Kumar, "Optimizing SEPIC Converter Design for High-Performance Power Electronics Applications, "International conference on Recent Innovations and Trends in Electrical & Electronics Engineering and Computing (RITEEC 2025), Department of Electrical Engineering, National Institute of Technology, Patna, Bihar, India (**Accepted**).

BOOK CHAPTERS

1. **Rahul Kumar**, Anjani Kumar Prajapati, Amitesh Kumar "A Novel Technique for Reduction of Total Harmonic Distortion of Connected Hybrid Microgrid. "In: Mohapatro, S., Kimball, J. (eds) Proceedings of Symposium on Power Electronic and Renewable Energy Systems Control. Lecture Notes in Electrical Engineering, vol 616. Springer, Singapore. https://doi.org/10.1007/978-981-16-1978-6_40
2. **Rahul Kumar**, Nitesh Tiwari, Anurag Singh "Harmonics Reduction by Distributed Power Flow Control Using FACTS Devices in Power Supply."In: Kyamakya, K., Bokoro, P.N. (eds) Recent Advances in Energy Systems, Power and Related Smart Technologies. Studies in Systems, Decision and Control, vol 472. Springer, Cham. https://doi.org/10.1007/978-3-031-29586-7_9
3. Balmukund Kumar, **Rahul Kumar**, Parshuram Singh, Pritam Kumar, Chinmay Bera, Rohan Kumar Gupta, Deepak Singh, Rashmi Kumari, "Improved Energy Efficiency in Fuel Cell Electric Vehicles Through Novel Jellyfish Search Algorithm Based MPP Tracker. " International Conference on Next-Generation Adaptive Research and Innovations, NIT Patna **(Accepted),2026.**
4. Rohan Kumar Gupta, **Rahul Kumar**, Chinmay Bera, Mahesh Kumar, Balmukund Kumar, Amitesh Kumar, "Robust Frequency Control of Renewable-Rich Microgrids: Design, Analysis, and Validation." International Conference on Next-Generation Adaptive Research and Innovations, NIT Patna **(Accepted),2026.**
5. **Rahul Kumar**, Utkarsh Shukla, Rohan Kumar Gupta, Chinmay Bera, Rashmi Kumari, Sandeep Ojha, Md Inayat Ali, Pritam Kumar, Balmukund Kumar, Chandra Shekhar Singh Chandal, Amitesh Kumar, "Advanced Microgrid Energy Management Framework Integrating Hybrid Energy Storage with PI-GRO Controller." International Conference on Next-Generation Adaptive Research and Innovations, NIT Patna **(Accepted),2026.**
6. Md Inayat Ali, Chinmay bera, Amitesh Kumar, **Rahul Kumar**, "Adaptive Frequency Controlled Wireless Charging System for Electric Vehicles under Misalignment Condition." International Conference on Next-Generation Adaptive Research and Innovations, NIT Patna **(Accepted),2026.**
7. Chinmay Bera, Md Inayat Ali, **Rahul Kumar**, Rohan Kumar Gupta, Chandra Shekhar Singh Chandal, Balmukund Kumar, Pritam Kumar, Rajib Kumar Mandal, Amitesh Kumar, "Teaching Learning-Based Optimization of LSTM Networks for Enhanced Battery State of Charge Prediction." International Conference on Next-Generation Adaptive Research and Innovations, NIT Patna **(Accepted),2026.**
8. C S Singh Chandal, **Rahul Kumar**, Chinmay Bera, Amitesh Kumar, "Torque Ripple Mitigation in Four- Switch Three-Phase BLDC Motor Drives Using Auxiliary Step-Up Converter." International Conference on Next-Generation Adaptive Research and Innovations, NIT Patna **(Accepted),2026.**
9. Pritam Kumar, Rashmi Kumari, Parshuram Singh, Deepak Singh, Balmukund Kumar, **Rahul Kumar**, Chinmay Bera, Milind Kumar and Amitesh Kumar, "Performance Investigation of High-Efficiency Perovskite Solar Cell with Eco-Viable CsGeI₃ Absorber." International Conference on Next-Generation Adaptive Research and Innovations, NIT Patna **(Accepted),2026.**

POSITIONS OF RESPONSIBILITY / PROFESSIONAL MEMBERSHIP

- Reviewer, Journal of Energy Storage (Elsevier) (Q1, SCIE, IF: 9.8)
- Reviewer, Plos one journal (Q1, SCIE, IF: 2.6)
- Conference Coordinator and Reviewer, International Conference on Next-Generation Adaptive Research and Innovations (ICNARI-2026),, NIT Patna, India
- Reviewer, 2025 IEEE 4th International Conference on Smart Technologies for Power, Energy and Control (STPEC-2025), NIT Goa, India (December 10–13, 2025)
- Reviewer, International Conference on Electrical and Electronics Engineering (ICE3-2024), jointly organized by MMMUT Gorakhpur and ABV-IIITM Gwalior
- Reviewer, International Conference on Energy Transition and Innovation in Green Technology (ICETIGT-2024), jointly organized by MMMUT Gorakhpur and AIT Thailand
- Student Member, IEEE Industry Applications Society (IAS), 2025 – Present

REFERENCES

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