Dr. Arijit Guha

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Present Address
Room No. A-404, V K Hall of Residence
NIT Rourkela, Rourkela, Dist. - Sundergarh
Odisha - 769008

Permanent/Correspondance Address
H. No.- 554/6, Kasaikati, Jhapetapur
Kharagpur, Dist. - Paschim Midnapur
West Bengal - 721301

Research Interests

Batteries and Battery Packs, System Identification, Parameter and State Estimation, Fault Detection and Diagnosis, Prognosis, Battery Management System, Electric Vehicles, Control System Design, Machine Learning.

Google Scholar: `https://scholar.google.co.in/citations?user=4DBhccYAAAAJ&hl=en`

Academic Career

Doctor of Philosophy (Ph.D), 2018
Department of Electrical Engineering (Control Systems)
Indian Institute of Technology-Kharagpur, W.B, India
Thesis Title: *Fractional Order Equivalent Circuit Modeling and State of Health Estimation of Lithium-ion Batteries*
Supervisor: Prof. Amit Patra

Master of Technology (M.Tech), 2011
Branch: Control System Engineering
Department of Electrical Engineering
Indian Institute of Technology-Kharagpur, W.B, India
Thesis Title: *Controller Design and Controller Order Reduction for Continuous-Time Systems*
Supervisor: Prof. Jayanta Pal

Bachelor of Technology (B.Tech), 2008
Electronics and Instrumentation Engineering
University of Kalyani, W.B, India
Thesis Title: *Implementation of a Seven Digit Integer Calculator Based on Microprocessor (8085) used for Arithmetical Calculations*
Supervisor: Dr. Debashree Chanda (Sarkar)

Work Experience

Assistant Professor Grade-II, June 2020 - Present
Department of Electrical Engineering (Control and Automation),
National Institute of Technology-Rourkela, Odisha, India

Under-Graduate (UG) Courses Taken:

- Principles of Control Engineering (2 terms).
- Control Systems Laboratory (2 terms).
- Control and Electrical System Design (3 terms).
- Basic Electrical Engineering Laboratory (4 terms).
- Electronic Circuits Laboratory (1 term).

Post-Graduate (PG) Courses Taken:

- Digital Control (5 terms).
- System Identification and Adaptive Control (5 terms).

Senior R&D Engineer, September 2019 - May 2020
ABB Global Industries and Services Private Limited, Bengaluru, India

- Heat Exchanger fouling prediction.
- Time Series modeling.
- Estimation and filtering.
- Model calibration.
- Predictive analytics.
- System anomaly detection.

Consultant, August 2018 - September 2019
Samsung R&D Institute, Bengaluru, India

- Development of mathematical models for Li-ion batteries.
- Fault detection in Li-ion batteries.
- Advanced SoH estimation methods to extend battery life and reduce degradation.
- Adaptive charging algorithm development for battery powered applications.
- Battery Pack modeling, thermal analysis and SoH prediction.
- Li-ion cell electrochemical modeling.
- Electrical and Mechanical abuse testing on Li-ion batteries.
- Aging experiments on Li-ion batteries.

Research Associate, February 2018 - April 2018
Department of Electrical Engineering, IIT Kharagpur, India

- Development of SoC and SoH Algorithms and their coding in the battery management systems (BMS) software at Tata Motors, Pune for the Hybrid Electric Vehicle (HEV) Project sponsored by MHRD, Department of Higher Education, New Delhi.

Publications

Journals

- **A. Guha** and A. Patra, "State of Health estimation of lithium-ion batteries using capacity fade and internal resistance growth models," in *IEEE Transactions on Transportation Electrification*, vol. 4, no. 1, pp. 135-146, 2018 (**Impact factor: 7.2, Citations: 313**).
- **A. Guha** and A. Patra, "Online estimation of the electrochemical impedance spectrum and remaining useful life of lithium-ion batteries", in *IEEE Transactions on Instrumentation and Measurement*, vol. 67, no. 8, pp. 1836-1849, 2018 (**Impact factor: 5.6, Citations: 235**).

- K. Jain, **A. Guha** and A. Patra, "A Particle Filter Based Framework for the Prognosis of Atherosclerosis via Lumped Cardiovascular Modeling", *International Journal of Prognostics and Health Management*, vol. 10, no. 002, pp. 9, 2019 (**Impact Factor: 2.5, Citations: 3**).
- A. Naha, S. Han, S. Agarwal, **A. Guha** A. Khandelwal, P. Tagade, K. S. Hariharan, S. M. Kolake, J. Yoon and B. Oh, "An Incremental Voltage Difference Based Technique for Online State of Health Estimation of Li-ion Batteries", *Nature Scientific Reports*, vol. 10, no. 1, pp. 1-11, 2020 (**Impact factor: 4.9, Citations: 67**).
- K. Jain, S. Jain, **A. Guha** and A. Patra, "An approach to early stage detection of atherosclerosis using arterial blood pressure measurements" *Biomedical Signal Processing and Control*, vol. 68, pp. 102594, 2021 (**Impact factor: 4.9, Citations: 5**).
- **A. Guha**, B. Routh and N. P. Velivela, "Adaptive Extended Kalman Filtering based State-of-Charge and Voltage Estimation of a Lithium-ion Battery using a Fractional Order Model" *IEEE Sensors Journal*, vol. 24, no. 16, pp. 26225-26234, 2024 (**Impact factor: 4.3, Citations: 3**).
- A. Mallick, J. K. Pradhan, R. Pradhan, K. S. K. Achary, S. Rath and **A. Guha**, "A Gain Scheduling Control Framework for Mitigation of Time Varying Network Latency in Autonomous AC Microgrids", *IEEE Transactions on Industrial Informatics* vol. 21, no. 1, pp. 347-356, 2024 (**Impact factor: 11.7, Citations: 1**).
- B. Routh, **A. Guha**, A. Patra and S Mukhopadhyay, "Online Co-Estimation of State of Health, State of Charge and Remaining Useful Life of Li-ion Batteries using a Discrete Capacity Loss Model", *IEEE Transactions on Transportation Electrification* (in early access), 2024.

Patents

- **A. Guha**, S. S. Brahmadathan, K. S. Hariharan, P. Tagade, R. S. Patil and JO Jeonghoon, "Method and system for improving state of health of rechargeable batteries", **U.S. Patent 11,782,096**, issued October 10, 2023. (**Citations: 1**).
- M. Gottapu, **A. Guha**, S. P Adiga, D. Kim, T. Goh and Y. Ryu, "Methods and Electronic Devices for obtaining information on a Battery Pack", **U.S. Patent 11,581,585**, issued February 14, 2023. (**Citations: 2**).

Conferences

- **A. Guha** and A. Patra, "Particle Filtering based Estimation of Remaining Useful Life of Lithium-ion Batteries Employing Power Fading Data," *IEEE International Conference on Prognostics and Health Management*(ICPHM), pp. 193-198, Dallas, Texas, USA, June 19-21, 2017 (**Citations: 6**).
- **A. Guha**, A. Patra and Vaisakh K V, "Remaining Useful Life Estimation of Lithium-ion Batteries based on the Internal Resistance Growth Model," *Indian Control Conference* (ICC), *IEEE*, pp. 33-38, IIT Guwahati, India, January 4-6, 2017(**Citations: 57**).
- **A. Guha**, Vaisakh K V and A. Patra, "Remaining Useful Life Estimation of Lithium-ion Batteries based on a new Capacity Degradation Model," *IEEE Transportation Electrification Conference and Expo, Asia - Pacific* (ITEC Asia-Pacific), pp.555-560, Busan, South Korea, June 1-4, 2016(**Citations: 20**).
- B. Routh, **A. Guha**, A. Patra and S Mukhopadhyay, "Particle Filtering framework for Health Monitoring of Lithium-Ion Batteries using Ampere-hour Throughput based Semi-Empirical Model," 2021 *IEEE International Conference on Prognostics and Health Management*(ICPHM), Detroit (Romulus), MI, USA, pp. 1-7, 2021 (**Citations: 2**).

- S. Chouhan and **A. Guha**, "Incremental State-of-Charge determination of a Lithium-ion battery based on Capacity update using Particle Filtering framework," 2023 *IEEE Transportation Electrification Conference and Expo*(ITEC), Detroit, MI, USA, pp. 1-6, 2023.
- N. P. Velivela and **A. Guha**, "Improved State-of-Charge and Voltage estimation of a Lithium-ion battery based on Adaptive Extended Kalman Filter," 2023 *IEEE Transportation Electrification Conference and Expo*(ITEC), Detroit, MI, USA, pp. 1-4, 2023(**Citations: 1**).
- N. Gadkar, N. P. Velivela and **A. Guha**, "Fractional Order Modeling of a Li-ion Battery using Recursive Least Squares Approach considering the Effect of Aging and Variable Forgetting Factor," *Indian Control Conference* (ICC)*, IEEE*, Visakhapatnam, India, pp. 431-436, 2023.
- A. Ranjan, **A. Guha**, B. Routh and J.K Pradhan, Machine Learning based Battery State-of-Health Prediction using Capacity Fade and Resistance Growth," *IEEE International Conference on Prognostics and Health Management*(ICPHM), Spokane, WA, USA, pp. 308-315, 2024.
- B. Routh, V. Kumawat, **A. Guha**, S. Mukhopadhyay and A. Patra, State-of-Health Estimation of Li-ion Batteries using Multiple Linear Regression and Optimized Feature Extraction based on Principal Component Analysis," *IEEE International Conference on Prognostics and Health Management*(ICPHM), Spokane, WA, USA, pp. 348-355, 2024 .
- **A. Guha**, B. Routh, E. Rameshbabu, A. Ranjan, A. Naha and B. Mandal, Online State-of-Health Estimation of a Li-ion Battery using Incremental Voltage Difference and Ampere-Hour Throughput as Indirect Health Indicators," *2024 IEEE International Conference on Smart Power Control and Renewable Energy*(ICSPCRE), Dept. of Electrical Engineering, NIT Rourkela, pp. 1-6, 2024.

Membership of Professional Body

- IEEE

Professional Activities

- Reviewer of IEEE Transactions on Transportation Electrification.
- Reviewer of IEEE Transactions on Instrumentation and Measurement.
- Reviewer of IEEE Transactions on Power Electronics.
- Reviewer of International Journal of Energy Research.
- Reviewer of Reliability Engineering and System Safety.
- Reviewer of Journal of Energy Storage.
- Reviewer of IEEE TechSym 2016 Symposium.
- Reviewer of 7th Advances in Control and Optimization of Dynamical Systems (ACODS),IFAC-2022.

Short-Term course/Conference Organized

- Organized Online Short-Term Course (Coordinator) on Innovations in Control and Learning for Dynamical Systems (ICLDS) from 29^{th} November - 3^{rd} December, 2024 at EE Department, NIT Rourkela.
- Organized Online Short-Term Course (Coordinator) on Role of AI/ML in Electrical, Electronics and Biomedical Engineering Applications (RAEEBEA) from 7^{th} - 11^{th} November, 2024 at EE Department, NIT Rourkela.

- Organized Short-Term Course (Coordinator) on Fundamentals of Electric Vehicles (EVs) and its Modeling with Hands-on Practice from 9^{th} - 13^{th} December, 2023 at ME Department, NIT Rourkela.
- Organized Online Short-Term Course (Coordinator) on Recent Trends in Modeling and Control of Dynamical Systems (RTMCDS) from 23^{rd} - 27^{th} June, 2023 at EE Department, NIT Rourkela.

Academic Achievements and Awards

- Faculty Advisor Appreciation Award for the academic year 2021-2022 based on students feedback by Institute Counselling Services, National Institute of Technology-Rourkela.
- Among Top 5 Finalists in KPIT Shodh Awards 2019 organized by KPIT and IISER Pune for research on Energy and Mobility domain.
- Winner of the Chairman's Award (First Prize) in the Texas Instruments-Department of Science and Technology organized India Innovation Challenge 2017 for the product on Battery Management Systems.
- All India Rank 48 (99.14 percentile) in GATE-2009 Examination.

Invited Talks

- Delivered a talk on the topic, "Online Health Monitoring of Rechargeable Batteries based on Artificial Neural Network " at the online Short Term Course (STC) on "Optimization and Control Design Techniques, Innovations and Challenges (OCDT-2024)" organized by B.R Ambedkar National Institute of Technology, Jalandhar held during 25^{th} - 29^{th} January, 2024.
- Delivered a talk on the topic, "Online Health Monitoring of Rechargeable Batteries based on Artificial Neural Network" at Short-term course (STC) cum Faculty Development Programme (FDP) on "Applications of Machine Learning Techniques in Sustainable Technologies (AMLST-2024)" organized by National Institute of Technology, Rourkela held during 24^{th} - 28^{th} January, 2024.
- Delivered a talk on the topic, "Equivalent Circuit Modeling of a Lithium-ion Battery" at Short-term course on "Fundamentals of Electric Vehicles (EVs) and its Modeling with Hands-on Practice" organized by National Institute of Technology, Rourkela held during 9^{th} - 13^{th} December, 2023.
- Delivered a talk on the topic, "Equivalent Circuit Modeling of a Lithium-ion Battery" at Short-term course (Online) on "Recent Trends in Modeling and Control of Dynamical Systems (RTMCDS)" organized by National Institute of Technology, Rourkela held during 23^{rd} - 27^{th} June, 2023.
- Delivered a talk on the topic, "Modeling of a Lithium-ion battery" at Short-term course (Online) on "Energy Storage-Basics and Developments (ESBD-2022) organized by National Institute of Technology, Rourkela held during 25^{th} - 29^{th} July, 2022.
- Delivered a talk on the topic, "Identification of Dynamic Systems with an example of Lithium-ion battery modeling" at the online Short Term Course (STC) on "Optimization and Control Design Techniques, Innovations and Challenges" organized by B.R Ambedkar National Institute of Technology, Jalandhar held during 23^{th} - 27^{th} May, 2022.
- Delivered a talk on the topic, "System Identification of a Lithium-ion battery" at the AICTE Sponsored FDP (Online) on Robust and Non-linear System Dynamics and Control organized by VSSUT, Burla held during 12^{th} - 23^{th} December, 2020.

- Delivered a talk on the topic, "Modeling, estimation and diagnosis of Lithium-ion batteries" at the AICTE Training and Learning (ATAL) Academy (Online FDP) on Energy Storage for Sustainable Development organized by National Institute of Technology, Silchar held during 26^{th} - 30^{th} September, 2020.

Supervision of Students (Completed/Ongoing)

PhD Students:

1. Name: Nilima Gadkar
Research Area: *Battery Diagnostics and Prognostics (Ongoing)*
Role: Supervisor
Category: Institute Fellowship

2. Name: Swastik Acharya
Research Area: *Battery Management System (Ongoing)*
Role: Supervisor
Category: Visvesvaraya Fellowship

3. Name: Shaik Rahimpasha
Research Area: *Battery Energy Storage And Electric Vehicle (Ongoing)*
Role: Supervisor
Category: Institute Fellowship

4. Name: Girija Shankar Dixit
Research Area: *Fabrication of Ps Anode for Batteries (Ongoing)*
Role: Co-Supervisor
Category: Institute Fellowship

5. Name: Bishwa Jana Ranjan Swain
Research Area: *Multiagent control and its application to microgrid (Ongoing)*
Role: Co-Supervisor
Category: Executive Ph.D. Category

M.Tech Students:

1. Name: Shreetam Naik
Thesis Title: *Single Particle Modeling of a Lithium-ion Battery with Electrolyte and Thermal Dynamics (Graduated in 2022, presently working in Mercedes Benz R&D, Bengaluru)*
Role: Supervisor

2. Name: Eniyavan Rameshbabu
Thesis Title: *Online State of Health estimation of Lithium-ion batteries using an incremental voltage difference and Ampere-hour throughput approach (Graduated in 2022, presently working in Schneider Electric, Bengaluru)*
Role: Supervisor

3. Name: Bharath Kumar Vemula
Thesis Title: *Modeling and State of Charge estimation of a Li-ion battery for Battery Management System (Graduated in 2022, presently working in HCL, Bengaluru)*
Role: Supervisor

4. Name: Udit Gupta

Research Area: *Online Prediction of Remaining Useful Life for Li-Ion Batteries Based on Discharge Voltage Data (Graduated in 2023, presently working in Maruti Suzuki, Bengaluru)*
Role: Supervisor

5. Name: Shreyansh Chouhan
Research Area: *Lithium-Ion Batteries Health Prognosis Considering Aging Conditions (Graduated in 2023, presently working in Daimler Trucks India, Bengaluru)*
Role: Supervisor

6. Name: Sanjay Rathore
Research Area: *Model Predictive Control for Li-ion Battery Optimal Charging (Graduated in 2023)*
Role: Supervisor

7. Name: Saswat Pradhan
Research Area: *Reduced Order Model for a Lithium-ion cell with Uniform Reaction Rate Approximation (Graduated in 2023, presently working in Tata Motors, Pune)*
Role: Supervisor

8. Name: Velivela Naga Prudhvi
Research Area: *Equivalent Circuit Modeling of a Li-ion battery considering Hysteresis non-linearity and State-of-Charge (SoC) estimation based on Adaptive Extended Kalman Filter (Graduated in 2023, presently working in Collins Aerospace, Bengaluru)*
Role: Supervisor

9. Name: Amit Ranjan
Research Area: *Machine Learning-based Battery Health Prediction using Internal Resistance Growth and Incremental Capacity Analysis (Completed in 2024, presently working in ZS Group, Pune)*
Role: Supervisor

10. Name: Rachit Aggarwal
Research Area: *Model Predictive Control based Battery Health Improvement using Incremental Capacity Analysis (Completed in 2024)*
Role: Supervisor

B.Tech Students:

1. Name: Mohammad Zafar Khan
Thesis Title: *SOC Estimation of Li-ion battery pack using EKF algorithm (Graduated, 2022)*
Role: Supervisor

2. Name: Sattajit Das
Research Area: *Equivalent Circuit Modeling of a Battery (Graduated in 2023)*
Role: Supervisor

3. Name: Soumendra Pattanayak
Research Area: *Equivalent Circuit Modeling of a Battery (Graduated in 2023)*
Role: Supervisor

4. Name: Ashirbad Das
Research Area: *Modeling and State-of-Charge (SoC) Estimation of a Lithium-ion Battery Pack (Graduated in 2023)*
Role: Supervisor

5. Name: Satya Ranjan Ojha
Research Area: *Modeling and State-of-Charge (SoC) Estimation of a Lithium-ion Battery Pack (Graduated in 2023)*
Role: Supervisor

6. Name: Rohit Dubey
Research Area: *Battery Health Improvement Based on Optimal Charging using Model Predictive Control (Completed in 2024)*
Role: Supervisor

7. Name: Anil Bijarniya
Research Area: *Long-Short Term Memory Based State-of-Health Prediction of Rechargeable Batteries (Completed in 2024)*
Role: Supervisor

8. Name: Kailash Chandra Pujahari
Research Area: *Parameter Identification of a Li-ion Battery using the method of Recursive Least Squares (Completed in 2024)*
Role: Supervisor

Awards to Past and Current Students

1. Shreetam Naik (M.Tech): 2022 Institute Silver Medal for achieving the highest CGPA in M.Tech.

Responsibilities

- Professor-In-Charge of Extra Academic Activity (Physical Education) from 1st July, 2024 - present.
- Executive Member for Technology Club, NIT Rourkela (2024-2025) from 1st July, 2024 - present.
- Faculty Coordinator (Electrical Engineering department) for Training and Placement from 1st July, 2021 - present.
- Central Library Advisory Committee Member for Electrical Engineering department from 1st July, 2021 - 30th June 2023.
- Faculty Advisor for M.Tech (Control and Automation) batch 2021-2023.

Referees

Prof. Amit Patra
Director, Indian Institute of Technology, (Banaras Hindu University) Varanasi
Professor, Department of Electrical Engineering, Indian Institute of Technology, Kharagpur
West Bengal, Pin-721302, India
Email-id: amit.dir@iitbhu.ac.in

Prof. Siddhartha Sen
Former Professor, Department of Electrical Engineering
Indian Institute of Technology, Kharagpur
West Bengal, Pin-721302, India
Email-id: ssen@ee.iitkgp.ac.in

Prof. Siddhartha Mukhopadhyay
Professor, Department of Electrical Engineering
Indian Institute of Technology, Kharagpur
West Bengal, Pin-721302, India
Email-id: smukh@ee.iitkgp.ac.in

Declaration

I hereby declare that the above mentioned information is true to the best of my knowledge.

Date: 05.03.2025
Place: Rourkela

Arijit Guha
(Dr. Arijit Guha)