

SADIA ALI

PhD Candidate in Automotive Engineering for Intelligent Mobility — University of Bologna, Italy
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ABOUT ME

PhD candidate in Automotive Engineering for Intelligent Mobility (University of Bologna, Italy), specialized in data-driven modelling and State-of-Charge (SoC) estimation across diverse machine learning techniques (reinforcement learning, LSTM, Gaussian Process Regression, gradient boosting) and energy storage systems. Expertise in signal analysis, CC-CV/ EIS based estimation techniques and embedded deployment on STM32 microcontrollers and FPGA. Strong track record of translating advanced research into hardware-validated, real-time mobility and energy storage solutions, with 8+ peer-reviewed publications. Brings 9+ years of prior hands-on engineering experience in electrical systems, automation, control, laboratory testing, and instrumentation.

Research Areas: Energy storage devices | Battery management system | Electro-mobility | Energy management | Artificial intelligence | Control and optimization.

EDUCATION AND TRAINING

PhD – Automotive Engineering for Intelligent Mobility

University of Bologna, Italy/ University of Parma, Italy

[11/2023 – 11/2026: tentative]

<https://www.unibo.it/>, <https://www.unipr.it/>

Field of study: **Energy Systems, Powertrains, Vehicle Performance.**

MS – Electrical Engineering

COMSATS University, Islamabad, Pakistan

[02/2015 – 06/2018]

<https://www.comsats.edu.pk/>

Field of study: **Automation & Control**

Final grade: 3.71/4.0 (on the scale of 4.0)

Thesis: Application of Non-Linear Control Techniques for the Speed Control of a Three Phase Induction Motor

BS – Electrical Engineering

University of Engineering & Technology, Taxila, Pakistan

[09/2009 – 09/2013]

<https://web.uettaxila.edu.pk/>

Final grade: 3.61/4.0 (on the scale of 4.0)

Final Year Project: Electronic Voting Machine using Fingerprint recognition Technique

WORK EXPERIENCE

Laboratory Engineer

Department of Electrical & Computer Engineering, International Islamic University, Islamabad, Pakistan

[05/2014 – 10/2023]

<https://www.iiu.edu.pk/>

Teaching Responsibilities:

- Designed and Conducted **laboratory experiments** for the following modules:
 - Power electronics
 - Electrical machines
 - Engineering physics
 - Workshop practice
 - Linear control systems
 - Digital logic design
 - Signals & Systems
 - Electronic Circuit Design
 - Power Generation
 - Wireless communication
 - Micro-controllers & Micro-processors
 - Antenna & Wave Propagation
- Worked on state-of-the-art lab **equipment** such as
 - LabVolt electric power technology training systems
 - Hardware in the loop (HIL) architecture: Servomotor bench, Ball & beam system.
 - PID (proportional-integral-derivative) control trainers
 - Electrical Machines Trainers (YL-1152A)
 - Antenna Measurement system (AMS)
 - ST2132 Mobile Phone Trainers
 - AC/DC machinery
- Supervised interns in the design (hardware + software) of **power converters** laboratory kits i.e. buck converter, boostconverter, inverter, and controlled rectifier.
- Co-supervised the following undergraduate final year projects: **Intelligent Peltier water dispenser, Sign language translator for vocally disabled.**

LANGUAGE SKILLS

English (IELTS): LISTENING: C2 (8.5) READING: C2 (9.0) WRITING: C1 (7.5) SPOKEN: C1 (8.0) OVERALL BAND SCORE: C2 (8.5)

PUBLICATIONS

- S. Ali, V. Bianchi, G. Patrizi, L. Ciani, and I. De Munari, "State of Charge Estimation of Energy Storage Systems using a Flexible Reward based Reinforcement Learning Approach," accepted for presentation at the 20th IMEKO TC10 Conference, Lisbon, Portugal, Sep. 28–29, 2026.
- S. Ali, V. Bianchi, and I. De Munari, "Reinforcement Learning based State of Charge Estimation of a Lithium Ion Battery," presented at the IEEE International Workshop on Metrology for Automotive (MetroAutomotive), Brescia, Italy, Jun. 17–19, 2026.
- S. Ali, G. Patrizi, L. Ciani, I. De Munari, and V. Bianchi, "Signal-to-Noise Ratio Analysis for a Reinforcement Learning based State of Charge Estimation of a Hybrid Supercapacitor," presented at IEEE International Instrumentation and Measurement Technology Conference (I2MTC), 2026.
- G. Patrizi, S. Ali, L. Ciani, F. Canzanella, I. De Munari, and V. Bianchi, "A Fast Approach for in situ SoC Estimation of a Supercapacitor based on Gaussian Process Regression and Electrochemical Impedance Spectroscopy," IEEE Transactions on Instrumentation and Measurement, 2026, doi: [10.1109/TIM.2026.3667312](https://doi.org/10.1109/TIM.2026.3667312).
- S. Ali, V. Bianchi, and I. De Munari, "A Microcontroller Based Optimized Framework for the State of Charge Estimation of a Lithium Ion Battery," in Proc. IEEE International Workshop Metrology for Automotive (MetroAutomotive), Jun. 2025, pp. 257–261, doi: [10.1109/MetroAutomotive64646.2025.11119267](https://doi.org/10.1109/MetroAutomotive64646.2025.11119267).
- V. Bianchi, F. Canzanella, S. Ali, I. De Munari, L. Ciani, and G. Patrizi, "A single-point EIS measurement for SOC estimation of supercapacitor," 2025 IEEE International Instrumentation and Measurement Technology Conference (I2MTC), pp. 1–6, May 2025, doi: [10.1109/I2MTC62753.2025.11078988](https://doi.org/10.1109/I2MTC62753.2025.11078988).
- S. Ali, M. Stighezza, G. Chiorboli, I. De Munari, and V. Bianchi, "An Optimized Long Short Term Memory and Gaussian Process Regression Based Framework for State of Charge Estimation," 2024 IEEE International Workshop on Metrology for Automotive (MetroAutomotive), pp. 94–99, Jun. 2024, doi: [10.1109/MetroAutomotive61329.2024.10615514](https://doi.org/10.1109/MetroAutomotive61329.2024.10615514).
- R. Afifa, S. Ali, M. Pervaiz, and J. Iqbal, "Adaptive Backstepping Integral Sliding Mode Control of a MIMO Separately Excited DC Motor," Robotics, vol. 12, no. 4, p. 105, Jul. 2023, doi: <https://doi.org/10.3390/robotics12040105>.
- S. Riaz, C.-W. Yin, R. Qi, B. Li, S. Ali, and K. Shehzad, "Design of Predefined Time Convergent Sliding Mode Control for a Nonlinear PMLM Position System," Electronics, vol. 12, no. 4, p. 813, Feb. 2023, doi: <https://doi.org/10.3390/electronics12040813>.
- S. Ali, A. Prado, and M. Pervaiz, "Hybrid Backstepping-Super Twisting Algorithm for Robust Speed Control of a Three-Phase Induction Motor," Electronics, vol. 12, no. 3, p. 681, Jan. 2023, doi: <https://doi.org/10.3390/electronics12030681>.

CONFERENCES AND SEMINARS

Participant:

- 2026 IEEE International Workshop on **Metrology for Automotive** - Brescia, Italy (virtual attendance, IEEE WIE session) [2026]
- 2025 IEEE International Workshop on **Metrology for Automotive** – Parma, Italy [2025]
- 2024 IEEE International Workshop on **Metrology for Automotive** – Bologna, Italy [2024]
- Continuous Professional Development Seminar on '**Renewable Energy, Planning and demands**' – Pakistan [2022]
- Continuous Professional Development Seminar on '**Outcome based Education**' – Pakistan [2022]
- Seminar on '**4G Communication Technology, Standards and Safety Procedures**' – Pakistan [2022]
- HEC 18th Master Trainers–Faculty Development Program Cascading Workshop – Pakistan [2014]

Organizer:

- Continuous Professional Development Seminar on '**Smart grids**' [2022]
- Session on '**Swappable Batteries for Electric Vehicles – Push Towards Technology Driven Manufacturing**' [2022]
- Introduction to **IEEE** and membership procedure [2021]
- Strike the Engineering Intellect (STEI' 18) [2018]
 - Workshop on 'Arduino'
 - C++ Programming Competition
 - Seminar on 'Career Counseling & CV making'
 - Project Exhibition
- Seminar on '**National Engineering Robotics Contest**' [2017]
- National Workshop **Power Electronics & Renewable Integration** – Pakistan [2014]

PROJECTS/RESEARCH EXPERIENCE

State of charge (SoC) estimation of energy storage systems (EES)

[11/2023 – Ongoing]

- Developed real-time multiple SoC estimation frameworks for lithium-ion batteries and hybrid supercapacitors using Gaussian Process Regression, LSTM neural networks, reinforcement learning (TD3), and gradient-boosted (LSB) residual correction. Incorporated single-point Electrochemical Impedance Spectroscopy (EIS) measurements and fast in-situ SoC estimation methods.
- Deployed SoC estimation frameworks on dual embedded targets namely STM32F411RE microcontroller and Artix-7 FPGA (Nexys A7-100T), achieving microsecond-level inference suitable for low-cost automotive hardware.
- Built full HDL pipelines in MATLAB HDL Coder for neural network and boosting models, resolving fixed-point arithmetic and feedback-loop challenges for FPGA deployment.
- Incorporated single-point Electrochemical Impedance Spectroscopy (EIS) measurements with Gaussian Process Regression for fast in-situ SoC estimation of a hybrid supercapacitor.
- Conducted reinforcement-learning-based signal-to-noise ratio (SNR) analysis for estimation robustness through simulation-based studies.
- Published 8+ papers in reputed journals and conferences (majority first-author), demonstrating improved SoC accuracy and embedded system efficiency.

Application of Non-Linear Control Techniques for the Speed Control of a Three Phase Induction Motor

[01/2017 – 06/2018]

- Designed and simulated non-linear and hybrid control strategies in MATLAB/Simulink for robust speed control of induction motors.
- Developed a hybrid back-stepping + super twisting controller to handle load torque uncertainties and reduce input discontinuities.
- Evaluated performance across start-stop, normal operation, and disturbance rejection scenarios using regression analysis metrics.

Electronic Voting Machine using Fingerprint recognition Technique (final year project)

[08/2012 – 06/2013]

- Designed a GUI-based electronic voting system in MATLAB/Simulink with integrated fingerprint verification.
- Reduced fingerprint recognition error to 4% using image segmentation, enhancement, minutiae extraction, and matching techniques.
- Developed a complete prototype for secure and accurate voting verification.

HONORS & AWARDS

- Online Certification: ‘**Electric Cars: Technology**’ (Delft University of Technology) [02/2023 – 04/2023]
- Online Certification: ‘**Computing in Python**’ (Georgia Institute of Technology) [01/2021 – 04/2021]
- Awarded 3rd Prize for Undergraduate **Final year project** (University of Engineering & Technology, Taxila) [2013]

DIGITAL SKILLS

- **Programming:** Python (Basic) | MATLAB (Proficient)
- **Antenna Design:** CST Microwave Studio (CST MWS)
- **Electronics:** Mentor Modelsim | Proteus and Multisim: Tools for Circuit designing
- **Embedded & Hardware:** STM32F411RE | FPGA (Artix-7) | Xilinx Vivado | HDL Coder | Embedded Coder | fixed-point arithmetic
- **Misc.:** Microsoft Office | Organizational and planning skills | Technical Written and Verbal skills | Analytical skills

ACADEMIC REFERENCES

Dr. Valentina Bianchi

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University of Parma, Italy
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Dr. Ilaria De Munari

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