

Muhammad Zarkab Farooqi

Nationality: Indian

Age: 28 Years

EMAIL: Zarkab@gmail.com , Zarkab@ee.iitd.ac.in
HOME PAGE: <https://zarkab.github.io/>
CONTACT: +91-7006484936
ORCID ID: [0000-0001-9686-322X](https://orcid.org/0000-0001-9686-322X)
WoS ID: [GVU-3424-2022](https://www.scopus.com/authid/detail.uri?authorid=GVU-3424-2022)

EDUCATION

- [2019(Jan) - 2023(Dec)] Doctor of Philosophy in Electrical Engineering
Department of Electrical Engineering, Indian Institute of Technology, New Delhi, India
Advisors: [Prof. BHIM SINGH](#), [Prof. B.K.PANIGRAHI](#)
Thesis Title: **Power Electronics based Solutions for Electric Vehicle charging and Solar PV Infrastructure**
CGPA: 8.750/10
- [2014 - 2018] Bachelor of Technology in ELECTRICAL ENGINEERING
Department of Electrical Engineering, National Institute of Technology, Srinagar, India
Advisors: [Dr. TABISH NAZIR MIR](#), [Prof. ABDUL HAMID BHAT](#)
Thesis Title: **Comparative Analysis Of Modulation Strategies For Three-Phase Voltage Source Converters**
CGPA: 8.605/10 (4th Position)

RESEARCH INTEREST

Electronic Capacitors, Wide-bandgap Semiconductor based Soft-switched Converters, Integrated Chargers, Non-linear Planar Inductors, and Advance Control Techniques in PE Converters

WORK EXPERIENCE

OCT 2021 ONGOING	TEACHING ASSISTANT Department of Electrical Engineering IIT Delhi, Delhi, India
DEC 2018 OCT 2021	RESEARCH FELLOW Department of Science and Technology (DST), and IIT Delhi- (Project Code: RP03631)
JAN 2019 ONGOING	TECHNICAL ASSISTANT PGML Lab IIT Delhi, Delhi, India
AUG 2018- DEC 2018	ASST. MANAGER Tata Projects Ltd., Noida, U.P, India

PROFESSIONAL EXPERIENCE

- **POWER ELECTRONICS BASED CAPACITORS FOR POWER DENSITY IMPROVEMENT IN EV CHARGERS)-PGML Lab, IIT Delhi**
In this work, issue pertaining to use of high valued DC-link capacitors in single-phase EV chargers was investigated. Electronic capacitor power loss reduction using soft-switching, was the prime research focus. For hardware implementation 1kW SiC based VSC has been developed and the micro-controller employed is Texas Instruments' TMS320f28379D.
- **MULTI-FUNCTIONAL INTEGRATED ON-BOARD CHARGER-PGML Lab, IIT Delhi**
To achieve higher gravimetric and volumetric power density, on-board integrated chargers are employed in EV's, where the drivetrain components are re-utilized for charging purposes. An improved control and modulation was derived for input power quality and EMI improvement for proposed integrated charger.
- **COOPERATIVE ISOLATED RENEWABLE ENERGY SYSTEMS FOR ENHANCING RELIABILITY (DST PROJECT: RP03631)-PGML Lab, IIT Delhi**
An easy-to-implement, reliable and voltage sensorless active power decoupling control based on model predictive control (MPC) scheme for buck-based APD circuit was implemented. Due to voltage-vector oriented based modulated model predictive control (MMPC) scheme and decoupling voltage sensor elimination, the execution time of the processor is reduced, which provides a provision to approach high switching frequency. The MMPC control was implemented with 300W IGBT based 3-Leg VSI.

- COMPARISON OF DIFFERENT MODULATION STRATEGIES FOR 3-PHASE VOLTAGE SOURCE CONVERTER (PE LAB)-**Power Electronics Lab, NIT SRINAGAR**
Various modulation techniques of a three-phase voltage source converter were compared, analyzed and examined for their performance in generation for a sinusoidal output. Modulation techniques include Sine-PWM, Space-vector PWM, Delta-Sigma, Model Predictive Control and Modulated Model Predictive Control. MATLAB/Simulink and Hardware implementation of different modulation techniques was verified on 1kW IGBT based 3-Phase VSI using D-Space(RTI 1104).

PATENTS

- B. Singh, B.K.Panigrahi **M. Z. Farooqi**, *Single phase single stage isolated bidirectional converter for dc-link capacitor reduction*, Indian Patent Application No. 202111058797.

PUBLICATIONS

Selected Publications

- [J1] **M. Z. Farooqi**, Bhim Singh, B. K. Panigrahi, "Reduced Sensor-Based Model Predictive Control of Power Decoupling Circuit for On-Board EV Charger," in *IEEE Transactions on Transportation Electrification*, vol. 9, no. 2, pp. 2104-2114, June 2023. (IF:7.0). [Link](#)
- [J2] **M. Z. Farooqi**, Bhim Singh, B. K. Panigrahi, "Performance Enhancement of Single-Phase Two-stage AC-DC Converter with Reduced DC-link Capacitance," in *IEEE Transactions on Industry Applications*, Early Access. (IF:4.4) [Link](#)
- [C1] **M. Z. Farooqi**, Bhim Singh, B. K. Panigrahi, "Model Predictive Control for Modular Electric Vehicle Charger," in *2020 IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES)*, Jaipur, India, 2020, pp. 1-6.(Citations: 4). [Link](#)
- [C2] **M. Z. Farooqi**, Bhim Singh, B. K. Panigrahi, "Input Power Quality Control of Integrated On-Board Charger with Reduced DC-link Capacitance," in *2021 IEEE Energy Conversion Congress and Exposition (ECCE)*, Vancouver, BC, Canada, 2021, pp. 1669-1674(Citations: 2). [Link](#)

Journal papers

- [J3] **M. Z. Farooqi**, Bhim Singh, B. K. Panigrahi, Low-Cost, "Robust Control for Enhanced Dynamic Performance of CRM based Active Power Decoupling Circuit", in *IEEE Transactions Industrial Informatics*. (IF:12.3) (Under Review: TII-23-0368.R1)
- [J4] **M. Z. Farooqi**, Bhim Singh, B. K. Panigrahi, "Enhanced Control and Modulation of On-Board Integrated EV Charger with Active Power Decoupling Capability," in *IEEE Transactions on Transportation Electrification*. (IF:7.0)(Under Review: TTE-Reg-2023-03-0514)

Conferences Papers

- [C3] **M. Z. Farooqi**, Bhim Singh, B. K. Panigrahi, "A Multiport EV-Fleet Charging Station Based on Modular Multilevel Converter," in *2021 IEEE 12th Energy Conversion Congress & Exposition - Asia (ECCE-Asia)*, Singapore, Singapore, 2021, pp. 1765-1770. [Link](#)
- [C4] **M. Z. Farooqi**, Bhim Singh, B. K. Panigrahi, "Bi-Directional Isolated EV Charger with Reduced Switch Count and DC-link Capacitance," in *2021 IEEE 6th International Conference on Computing, Communication and Automation (ICCCA)*, Arad, Romania, 2021, pp. 189-194. [Link](#)

- [C5] **M. Z. Farooqi**, Bhim Singh, B. K. Panigrahi, “Modified MPC Approach to Single-Phase Two-Stage AC-DC Converter for Reduced DC-link Capacitance,” in *2022 IEEE Global Conference on Computing, Power and Communication Technologies (GlobConPT)*, New Delhi, India, 2022, pp. 1-6. [Link](#)
- [C6] **M. Z. Farooqi**, Bhim Singh, B. K. Panigrahi, Rohit Kumar, “Single-Stage Isolated Bidirectional Soft-Switched AC-to-DC Converter with Active Power Decoupling,” in *14th IEEE Energy Conversion Congress and Exposition (ECCE)*, Nashville, TN, USA, 2023, (Accepted-Oral Presentation).
- [C7] **M. Z. Farooqi**, Bhim Singh, B. K. Panigrahi, Rohit Kumar, “Active Power Decoupling in Cascaded H-Bridge Converter using Secondary-Stage Isolated DC-DC Converters,” in *IEEE IAS Annual Meeting 2023 (IASAM)*, Omni Nashville, TN, USA, 2023, (Accepted-Oral Presentation).
- [C8] J. Gupta, Bhim Singh, **M. Z. Farooqi**, “A Transformerless Bidirectional Charger for Light Electric Vehicles,” in *2021 IEEE Energy Conversion Congress and Exposition (ECCE)*, Vancouver, BC, Canada, 2021, pp. 1205-1210. [Link](#)
- [C9] S. Chakraborty, G. Modi, Bhim Singh, B. K. Panigrahi, **M. Z. Farooqi**, “An NIHOC-GI-FLL Control With Seasonal ToU Tariff Based Economic Power Regulation for a Weak Grid Tied Optimally Sized SPV-BES System,” in *IEEE IAS Annual Meeting 2023 (IASAM)*, Omni Nashville, TN, USA, 2023, (Accepted-Oral Presentation).

COURSES TAKEN

- Digital Control of Power Electronics [Spring 2019]
- Switched-Mode Power Conversion [Spring 2019]
- Computer-Aided Design of Electric Machines [Spring 2019]
- Dynamic Modelling and Control of Grid Connected Converters [Spring 2019]
- High Power Converters [Fall 2019]
- Selected Topics in Power Electronics [Fall 2019]
- Selected Topics in Control Systems [Fall 2019]
- Soft-Switching Converters [Spring 2020]
- Resonant Power Conversion and Wireless Power Transfer [Fall 2023]

COURSE PROJECTS

- **HARDWARE IMPLEMENTATION AND ASSOCIATED CONTROL OF SOLAR PV BASED SINGLE-PHASE GRID CONNECTED DC-AC INVERTER [2019]**
Hardware Design, and Micro-controller Coding of wide-band based 2kW DC-AC Grid Connected Inverter with improved performance under weak grid conditions
Advisor: Prof. Ramkrishan Maheshwari,
- **COMPARISON OF DIFFERENT MODULATION STRATEGIES FOR ENHANCED DC UTILIZATION [2018]**
Different modulation techniques such as SPWM, SVM PWM, Hysteresis modulation technique, 3rd harmonic injection, Delta Sigma Modulation, Predictive Control Modulation & Modified Predictive Control Modulation implementation and verification on 1 kW IGBT based hardware prototype.
Advisor: Prof. T.N.Mir
- **ANALYSIS & DESIGN OF INTERLEAVED BOOST CONVERTER FOR ELECTRIC VEHICLE CHARGING [2019]**
Controller Design of 10kW EV charger operating at 100kHz in discrete-time domain
Advisor: Prof. S.S. Nag

TEACHING EXPERIENCE

- Introduction to Electrical Engineering (ELL101)
- Introduction to Electrical Engineering Lab (ELP101)
- Electromechanics Lab (ELP203)
- Electric Drive Systems (ELL752)
- Electrical Machines Lab (ELP850)
- Electric Drives Lab (ELP852)

AFFILIATIONS

- IEEE *Member*
- IEEE IAS *Member*
- IEEE PES *Member*
- IEEE Young Professional *Member*
- Reviewer *IEEE Transactions on Power Electronics*
- Reviewer *IEEE Transactions on Industrial Electronics*
- Reviewer *IEEE Transactions on Industry Applications*
- Reviewer *IET Power Electronics*
- Reviewer for Conferences: *APEC-2022, ITEC-2023, ECCE-2022-23.*

TALKS AND SEMINARS

- April, 2023 *Invited talk at JNTU, Kakinada, AP* on Implementation and Design of Isolated DC-DC Converters.
- Feb, 2023 *Invited talk at JNTU, Kakinada, AP* on Design and Implementation of Digital Controller for DC-DC & AC-DC Converters.
- Oct, 2022 *Invited talk at NITTTR, Chandigarh* on Control and Stability Analysis of Switched Mode Power Converters.
- Oct, 2021 *Paper Presentation at IEEE ECCE-US 2021* on Reducing DC-Link Capacitance in EV Chargers (Online).
- May, 2021 *Paper Presentation at IEEE ECCE-Asia 2021* on Isolated Multilevel EV Chargers (Online).

TECHNICAL SKILLS

SILICON CARBIDE BASED PE CONVERTERS	<i>Single-phase PFC based AC-DC Converter for bidirectional Power Flow Dual-Active Bridge for EV Charging Power Electronics based Capacitors Soft-switching in DC-DC Converters for Improved Efficiency</i>
GATE DRIVER DESIGN	<i>Gate Driver Design with De-saturation, and Over-current Protection Triggering 5kW SiC based Converter with 100kHz Switching Frequency</i>
DSP, FPGA & DSPACE	<i>Implementation of advance techniques for controlling PE converters</i>
CURRENT/VOLTAGE SENSOR	<i>Isolated Sensors with 1MHz bandwidth for controlling PE Converters</i>
MODELLING AND DESIGN	Multiphysics modelling ANSYS MAXWELL PEMag and RMXprt for interfacing Mathamatica and MATLAB
CIRCUIT AND PCB	Circuit designing in Simplis, and LT-spice PCB designing in KiCad and Design Spark
PROGRAMMING	Proficient in C, C++

REFERENCES

- **Prof. Bhim Singh (Ph.D. Supervisor)**
[bsingh\[at\]ee.iitd.ac.in](mailto:bsingh[at]ee.iitd.ac.in)
Department of Electrical Engineering
Indian Institute of Technology Delhi
- **Prof. Bijaya Ketan Panigrahi (Ph.D. Supervisor)**
[bkpanigrahi\[at\]ee.iitd.ac.in](mailto:bkpanigrahi[at]ee.iitd.ac.in)
HOD, Centre for Automotive Research and Tribology
Indian Institute of Technology Delhi
- **Dr. Tabish Nazir Mir**
[Tabish.Mir\[at\]nottingham.ac.uk](mailto:Tabish.Mir[at]nottingham.ac.uk)
Department of Electrical and Electronic Engineering
University of Nottingham
- **Dr. Abdul Saleem Mir**
[saleemmir\[at\]ee.iitr.ac.in](mailto:saleemmir[at]ee.iitr.ac.in)
Department of Electrical Engineering
Indian Institute of Technology Roorkee