Dr. T. S. Bheemraj

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Research Interests

- Broadly interested in the domain of Power Electronics.
- Current research interests include High Voltage High Frequency Power Electronics, Pulsed Power Applications, Dual Active Bridge Converter, Resonant Converter, Planar Magnetics

Teaching Experience

December 2024 – till date
- **Assistant Professor at Maulana Azad National Institute of Technology Bhopal (MANIT Bhopal)**

Industry Experience

March 2023 – November 2024
- **Project Engineer at Centre for Development of Advanced Computing (C-DAC) Trivandrum**
  Responsibilities: Research and development in the area of power electronics focused on High voltage High frequency power conversion.

Academic Background

2018 – 2023
- **Ph.D. in Electrical Engineering**
  National Institute of Technology (NIT), Calicut, India
  Research area: *Power Electronics*
  Thesis title: *Performance Improvement of DC-DC Converter Configurations and their Control Strategies*

2015 – 2017
- **M.Tech. in Electrical Engineering**
  National Institute of Technology (NIT), Rourkela, India
  Specialization: *Industrial Electronics*
  Thesis title: *Prediction and Prevention of Load Encroachment for Reliable Operation of Distance Relay*

2011 – 2015
- **B.Tech. in Electrical and Electronics Engineering**
  National Institute of Technology (NIT), Calicut, India

Publication Details

Journal Articles

1. Bheemraj, T. S., Anil Kumar, Y., Karthikeyan, V., & Pragaspathy, S. (2023). A hybrid structured high step-up dc–dc converter for integration of energy storage systems in military applications. *IEEE Transactions on Circuits and Systems II: Express Briefs*, *70*(4), 1545–1549. https://doi.org/10.1109/TCSII.2022.3225900

2. Bheemraj, T. S., Karthikeyan, V., & Kumaravel, S. (2023). A quintuple phase shift modulation scheme in multilevel dual active bridge converter for battery energy storage system. *International Journal of Circuit Theory and Applications*, *51*(4), 1665–1684. https://doi.org/https://doi.org/10.1002/cta.3508

3. Bheemraj, T. S., Karthikeyan, V., & S., K. (2023). Pso based universal phase shift modulation scheme for dab converter to eliminate backflow power in energy storage applications. *International Journal of Circuit Theory and Applications*, *51*(8), 3792–3805. https://doi.org/https://doi.org/10.1002/cta.3615

4. Bheemraj, T. S., Prajapathi, D., Karthikeyan, V., & Kumaravel, S. (2023). A novel high gain non-isolated three-port dc–dc converter for dc microgrid applications. *Journal of Circuits, Systems and Computers*, *32*(13), 2350226. https://doi.org/10.1142/S0218126623502262

5. Krishna, B., Bheemraj, T. S., & Karthikeyan, V. (2021). Optimized active power management in solar pv-fed transformerless grid-connected system for rural electrified microgrid. *Journal of Circuits, Systems and Computers*, *30*(03), 2150039. https://doi.org/10.1142/S0218126621500390

Conference Proceedings

1. Bheemraj, T. S., Babu, K., Rafi, M., K G, A., & T G, S. J. (2023). *Influence of magnetizing inductance and dead time in the performance of half-bridge llc resonant converter.* https://doi.org/10.1109/PESGRE58662.2023.10404569

2. Rafi, M., Subhash Joshi, T. G., Babu, K., & Bheemraj, T. (2023). *Efficient core utilization methods in planar magnetic components.* https://doi.org/10.1109/NPEC57805.2023.10384927

3. Bheemraj, T. S., Krishna, B., Karthikeyan, V., & Kumaravel, S. (2019). *High accurate dual loop controller for power regulation in dab dc-dc converter for solar pv applications.*

Patents Applied

1. *"20kV High Voltage High Frrequency Planar Magnetic Component"*. (2024). Indian Patent: 202441058044 dated 31/07/2024.

2. *"Dual-Fed Flux-Coupled Converter with Natural Redundancy for X-Ray Generator"*. (2024). Indian Patent: 202441060870 dated 12/08/2024.

3. *"Stretching and staggering PCB windings for efficient core area utilization"*. (2023). Indian Patent: 202341085225 dated 13/12/2023.

Sponsored Projects

- **"Development of Power Supply for X-ray Generation". (2021-24). Sponsored by MeitY, Joint proposal with Indian Institute of Science (IISc), Bangalore, and Allengers Medical Systems Pvt. Ltd., Chandigarh, under the prinicipal investigation of Dr. Subhash Joshi T.G., Scientist F, C-DAC Trivandrum, Budget Rs. 554.17Lakhs.**
  Role: Project Engineer

  Contributions:

  1. Design of gate driver, heatsink, DC link capacitor and soft switching capacitor
  2. Loss analysis of LCC converter in PSIM simulation platform
  3. Estimation of voltage and current stress of LCC converter and voltage multiplier in PSIM simulation platform over entire operating load range
  4. Selection, purchase and characterization of component used in the unit
  5. Controller Design for LCC converter
  6. Experimental analysis of 150kV high voltage tank

- **"Development of High Voltage High Frequency Planar Magnetic Components". (2019-23). Sponsored by MeitY, Joint proposal with Indian Institute of Science (IISc), Bangalore, under the prinicipal investigation of Dr. Subhash Joshi T.G., Scientist F, C-DAC, Trivandrum, Budget Rs. 151.43Lakhs**
  Role: Project Engineer

  Contributions:

  1. Experimental analysis for comparison study of Half Bridge LLC resonant converter with planar magnetics and conventional magnetics
  2. Magnetic analysis in JMAG
  3. Experimental determination of interwinding and intrawinding capacitance of planar transformer

Consultancy Projects

- **"Development of 2.5MWp System for Generation of 3.5kA Peak Overdamped Current for Measuring Inductance at 3.5kA",Industry: Noratel India Power Components Pvt. Ltd. (2023-25). Prinicpal consultant- Dr. Subhash Joshi T.G., Scientist F, C-DAC, Trivandrum, Budget Rs. 10Lakhs**
  Role: Project Engineer

  Contributions:

  1. Analytical design and simulation of the system in PSIM platform
  2. Selection of components
  3. Experimental validation of the system
  4. Documentation of the design and results

Academic Projects

Ph.D. **Performance Improvement of DC-DC Converter Configurations and their Control Strategies**
In this project, design, development and analysis was carried out in Dual Active Bridge Converter, Dual Input Single Output High Gain DC-DC Converter, Switched Capacitor based Multilevel Inverter and High Gain DC-DC Converter.
Skills acquired:

1. Solid knowledge of Power Electronics Fundamentals, Power Switching Devices (MOSFET/ IGBT), Switched mode power supplies, Magnetics & Gate Driver Design.
2. Hands on experience in Intel and Xilinx based FPGA Boards
3. Proficiency in circuit analysis, circuit simulation using MATLAB/LTspice/PSIM/PSCAD/Proteus.
4. Ability to perform independent test & measurement activities using oscilloscope, power supply, multimeter, and digital electronic load.
5. Familiarity with Analog / Digital controllers, ADC, DAC, signal conditioning circuits, voltage and current sensors, OPAL-RT, and dSPACE
6. Experience in particle swarm optimization (PSO) technique

M.Tech. **Prediction and Prevention of Load Encroachment for Reliable Operation of Distance Relay.**
A prediction and prevention system of load encroachment in transmission line was designed and implemented. Due to overloading in transmission line, tripping occurs in distance relays, hence all loads are affected disturbing the functioning of the entire grid. The developed system was used to detect and prevent the load encroachment based on sensitivity factors.
Skills acquired: MATLAB Programming

B.Tech. **Grid Tied Solar Power**
The project work involved the design of a boost DC-DC converter and seven level inverter for grid tied solar power application
Skills acquired: Simulink, MATLAB, PCB design in Proteus, Arduino Mega 2560

Awards/Achievements

2023 **DG Award for Core Research**, for the Development of High Voltage High-Frequency Planar Magnetic Components.

2021 - 2022 **Chair**- IEEE Power & Energy Society Student Branch Chapter NIT Calicut

2019 - till date Reviewer in various IEEE journals and IEEE conferences

Courses & Workshops Conducted

- TEQIP III sponsored Online Faculty Development Programme on "Electric Vehicle & Renewable Powered Charging Station (EVRC-2019) held during December 15th – 21st, 2019 organized by the Department of Electrical Engineering, National Institute of Technology Calicut.
Role: Student Co-ordinator

Courses & Workshops Conducted (continued)

- Five-day short-term course on “Renewable Powered EV charging station- Challenges in converter design and storage (RPECS-2020)” held during march 10th-14th 2020 organized by the Department of Electrical Engineering, National Institute of Technology Calicut.
  Role: Student Co-ordinator
- Online Faculty Development Programme on “Practical Challenges in the Design and Development of Electric Vehicles - 2020 (PCEV-2020)” held during August 24th - 28th, 2020 organized by the Department of Electrical Engineering, National Institute of Technology Calicut.
  Role: Student Co-ordinator

Trainings, Short Term courses & Workshops Attended

- AICTE Training And Learning Academy Online FDP on "Electric Vehicles" from 2021-1-25 to 2021-1-29 at National Institute of Technology Calicut
- One Week Workshop on “FPGA Controllers for Electrical Power Applications” sponsored by SCLA Grant IEEE Industrial Electronics Society at VNIT Nagpur, during 15-19 March 2021.
- “Model predictive control in power electronics: a critical review and recent industrial products" by Dr. Tobias Geyer, Professor, Stellenbosch University, South Africa, organised by IEEE IA/IE/PELS Jt. Ch.Kerala on 20th June 2020.
- “Shaping Future Energy with Microgrids" by SUHAS S, Global Product Manager MGS100, FIMER India, organised by IEEE IA/IE/PELS Jt. Chapter Kerala on 30th June2020.
- National Workshop on “Delve into the future of Electric Vehicle” organized by industrial power group of the department of electrical engineering, NIT Calicut on 15th & 16th March 2019 in association with Robert Bosch & Mathworks.
- One week training at Southern Railways Electrical Loco Shed, Erode, Tamil Nadu from 14/06/2013 - 19/06/2013.
- Two weeks training at Lower Periyar Power Station (KSEB) Karimanal, Kerala from 16/07/2014 - 25/07/2014.
- One week training at Kerala Electrical Allied Engineering Company Limited (KEL) Ernakulam, Kerala from 06/06/2013 to 11/06/2013.
- One month training The Fertilizers and Chemicals Travancore Limited (FACT) Eloor, Kerala from 31/05/2012 - 30/06/2012.