

RAHUL MALLIK

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SUMMARY

Fifth-year Ph.D. student pursuing a career in power electronics with focus on converter modeling, design, optimization, control, and testing. Expertise in grid-forming inverters, high-frequency isolated medium-voltage converters for PV and wind systems, and electric drives.

TECHNICAL STRENGTHS

Tools	MATLAB, PSCAD, ALTIUM, PLECS, Real Time Simulator, SPICE
Languages	Python, C, VERILOG, Embedded C, FORTRAN, Assembly Language
Microcontrollers	TI C2000 Family (Piccolo and Delfino series)

EDUCATION

Ph.D. in Electrical Engineering University of Texas, Austin, TX, USA.	Sept 2018- May 2023
University of Washington, Seattle, WA, USA. GPA: 3.87/4	
ME in Electrical Engineering Indian Institute of Science, Bangalore, India. GPA: 6.9/8; Rank: 2/16	July 2015 - June 2017
BE in Electrical Engineering Jadavpur University, Kolkata, India. GPA: 9.16/10; Rank: 5/118; JBNTS Scholar	August 2011 - June 2015

RESEARCH EXPERIENCE

Graduate Research Assistant, University of Washington, Seattle <i>Advisor : Dr. Brian Johnson</i>	Sept 2018- Present Seattle, WA, USA
<ul style="list-style-type: none">· Successfully implemented series connection of a novel isolated dc-dc topology - the quadruple active bridge (QAB) converter to support a medium voltage grid from PV. Each module achieved a 97.5% efficiency for rated conditions of 250 V dc-input and 2kWpk PV-power. Developed a hierarchy of fully functional MPPT, dc-link, interleaving, and grid-forming ac-side controls. Leveraging modularity and bidirectional power transfer capability of the QAB, multiple units were connected in series-input series-output to experimentally demonstrate wind energy harvesting.· Developed nonlinear limit cycle based droop to achieve decentralized power sharing between series and parallel connected converters. Experimentally verified a system with mixture of Grid-forming and Grid-following inverters to show the universality of proposed control structure.· Successfully completed prototyping a fully functional 250 W electric bike motor drive module. Designed and validated an optimal field-oriented control for a <i> jerk-free </i> ride by manipulating error and control effort through an H_∞-based norm minimization.	

Graduate Research Assistant, Indian Institute of Science <i>Advisor : Dr. Vinod John</i>	July 2015 - June 2017 Bangalore, India
Developed a fault ride-through scheme for grid-forming solar micro-inverters that can sustain short-circuit faults and recover without any human intervention. Conventional inner current-outer voltage loop control was modified to include current limiting algorithms and state-machine based impedance emulation to ride through <i>almost</i> dead-short faults on the ac side. Proposed controllers were verified on a back-to-back 1 kVA set-up. [Thesis]	

PROFESSIONAL EXPERIENCE

Electrical Engineering Intern, Enphase Energy, Austin <i>Manager : Dr. Fernando Rodriguez</i>	Mar 2021- June 2021 Austin, TX, USA
For a solar water pump project, I contributed to designing and validating a variable frequency control drive with six commercial Enphase-IQ8D inverters to drive a three-phase 5-hp induction motor. The main challenges addressed were phase splaying for driving a three-phase motor from decentralized single-phase modules sharing no communication. The control code was written in a python-encapsulated-C based firmware and a final demonstration showed a minimum 55% water-to-wire efficiency.	

Designed an extensive simulation to study the impact of introducing IGBT-based modular multilevel converters to expand an existing thyristor-based point-to-point substation into a four-terminal microgrid in China. A switched-level simulation in PSCAD/EMTDC for the 500 kV/1 GW system was implemented for fault study and stability analysis.

SELECTED PUBLICATIONS

- R. Mallik, B Majmunovic, S Dutta, GS Seo, D Maksimovic, B Johnson, "Control Design of Series-connected PV-powered Grid-forming Converters via Singular Perturbation" accepted in IEEE Transactions on Power Electronics, 2022.
- R. Mallik, B Majmunovic, S Dutta, GS Seo, D Maksimovic, B Johnson, "A Lyapunov-based Generalized Dc-Side Controller Design for PV-Connected Systems" in Proc. Energy Conversion Congress and Exposition (ECCE), 2022.
- M. Lu, R. Mallik, S. Dhople and B. Johnson, "Dispatchable Virtual-oscillator-controlled Inverters with Current-limiting and MPPT Capabilities" in Proc. Energy Conversion Congress and Exposition (ECCE), 2021.
- R. Mallik, A. Pace, S. Burden and B. Johnson, "Accurate Small-Signal Discrete-Time Model of Dual Active Bridge using Saltation Matrices" in Proc. Energy Conversion Congress and Exposition (ECCE), 2020.
- Other publications[Google Scholar]

OTHER EXPERIENCE

- Course instructor for Power Electronics Control at UW-Seattle (EE 458/533 - Winter 22)
- Teaching Assistant to multiple power electronics courses focused on switched mode power conversion, and power electronics control.
- Reviewed several journal and conference papers in related areas of Power Electronics and Power Systems. Received the star reviewer award for IEEE Transactions on Energy Conversion for 2020.
- As an officer of the Graduate Student Association of UW-ECE (Fall 2019- Fall 2021), organized social events and technical forums targeted toward fellow graduate students.

SELECTED GRADUATE LEVEL COURSES

- Power Electronics: Switched Mode Power Conversion, Electric Drives, Electronic System Packaging, Topics in Power Electronics, Economics and Distributed Generation.
- Control: Convex optimization, Robust Control, Non-Linear Control
- Power System: Advanced Computer Aided Power System Analysis, Power Systems Dynamics and Control
- Analog Electronics: Linear Integrated Circuits.

ACADEMIC ACHIEVEMENTS

- Recipient of the Sarala Vadri Award (2021) for quality of research and contribution to the life of the power and energy group at University of Washington Electrical and Computer Engineering. Engineering.
- Second prize in Electric Energy Student Poster Competition organized by UW-Seattle (2019).
- Recipient of the Ministry of Human Resources Development, Govt. of India scholarship (2015-2017).
- Recipient of prestigious Jagadis Bose National Science Talent Search Scholarship (<https://www.jbnsts.org/>) for four years of Bachelors study (2011-2015).
- Secured joint 2nd place in Masters and 5th place with First Class Honours in Bachelor of Engineering in Electrical Engineering.

REFERENCES

- Dr. Brian B. Johnson (website) brianbj@uw.edu
University of Washington, Seattle, US.
- Dr. Vinod John (website) vjohn@ee.iisc.ernet.in
Indian Institute of Science, Bangalore, India.