

Soham Dutta

GRADUATE RESEARCH ASSISTANT · WPEL, UW SEATTLE, ECE

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Education

University of Washington, Seattle

P.H.D. IN ELECTRICAL ENGINEERING

• Advisor - **Dr. Brian Johnson** GPA - **3.9/4.0**

Seattle, Washington

Sept. 2018 - PRESENT

Indian Institute of Science, Bangalore

MASTER OF ENGINEERING IN ELECTRICAL ENGINEERING (POWER ELECTRONICS)

• Advisor - **Dr. Kaushik Basu** GPA - Course: **6.6/8**, Dissertation Project Grade: **'S' (8/8)**

Bengaluru, India

Aug. 2015 - May. 2017

Jadavpur University

BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING

• GPA - **8.4/10.0**

Kolkata, India

Aug. 2011 - May. 2015

Research Experience

Extreme Fast Charging (XFC) of Electric Vehicles using Medium Voltage grid connected Cascaded AC-DC Converters with Distributed Battery Storage

2021-present

WASHINGTON POWER ELECTRONICS LAB, UNIVERSITY OF WASHINGTON, SEATTLE

- Aim: To develop Cascaded H-Bridge and Dual Active Bridge-based medium voltage grid connected converters for Extreme Fast Charging of Electric Vehicles. The cascaded dc-ac modules are equipped with integrated battery storage and decentralized controllers.
- Development of low voltage scaled-down EV charger hardware prototype.
- Development of decentralized controllers for –
 - Primary and secondary side dc-voltage control of Quad Active Bridge (QAB)-based multiport dc-dc converter.
 - EV charging current control and SOC balancing of storage batteries.
 - Communication-free active and reactive power control of cascaded H-bridge modules,
 - EV charging current ripple minimization by harmonic cancellation via PWM phase shifting.

Modular Wide-Bandgap String Inverters for Low-Cost Medium-Voltage Transformerless PV Systems

2018-2021

WASHINGTON POWER ELECTRONICS LAB, UNIVERSITY OF WASHINGTON, SEATTLE

Publication-1, Publication-2, Publication-3,

Publication-4

- Aim: To develop a line-frequency transformer-less power conversion link between utility scale photovoltaic power plants and the medium voltage electric grid.
- Develop and test grid connected cascaded H-bridge converters with DAB-based dc link.
- Develop decentralized controllers for –
 - Communication-free active and reactive power control of cascaded H-bridge modules,
 - Relaxed filtering via ripple minimization by decentralized PWM interleaving,
 - Dc-link voltage control of Quad Active Bridge (QAB) converter.
- Enhancing the low load power processing efficiency of QAB.

Virtual Oscillator Controller (VOC)-based Parallel Grid-connected Inverters

2019-2020

WASHINGTON POWER ELECTRONICS LAB, UNIVERSITY OF WASHINGTON, SEATTLE

Publication-5, Publication-6

- Aim: To substitute droop control in parallel connected inverters with novel virtual oscillator control which proves to have faster dynamic response and easier implementation.
- Proposed a novel virtual oscillator-based controller (VOC) for parallel connected inverter control and formulated detailed design method for VOC controlled inverters.
- Developed a pre-synchronization strategy for grid-forming VOC inverters and experimentally validated the performance of the VOC.

Development of a Real-time AC Transmission Line Emulator using Power Electronic Converters.

2016-2017

KAUSHIK BASU LAB, INDIAN INSTITUTE OF SCIENCE, BANGALORE

Publication-7, Publication-8,
Master's Thesis

- Aim: To develop a power electronic converter-based hardware platform which emulates a long AC transmission line in real time.
- Developed numerical model of a long AC transmission line and solved the model on a Xilinx Zynq System-on-Chip (SoC)-based control platform in real-time.
- Developed a back-to-back connected 3-phase inverters plus an active front end rectifier based prototype emulator which takes command from the SoC-based controller and emulates a long transmission line in real-time when interfaced to the grid on both sides.

Hardware Design Experience

15-kW, 100 kHz, 3-phase T-type Inverter for Grid Integration of Renewables

2020

WASHINGTON POWER ELECTRONICS LAB, UNIVERSITY OF WASHINGTON, SEATTLE

Hardware Image

- Designed SiC gate driver PCB with isolated driver ISO5852S driving half-bridge SiC MOSFETs and dual-channel driver UCC21530 driving mid-leg SiC MOSFETs. Custom designed +18 V/-5 V gate driver isolated bias supply.
- Designed LCL filter for the 3-level grid tied inverter.

High Frequency Ripple Current & Ripple Voltage Sensor

2020

WASHINGTON POWER ELECTRONICS LAB, UNIVERSITY OF WASHINGTON, SEATTLE

Hardware Image

- Designed an isolated current sensor PCB equipped with ripple separation filter and used for sensing ripple currents of very small amplitude accurately upto 1 MHz.
- Designed a voltage sensor which can exclusively sense output voltage ripple of a converter.

A DSP and FPGA based Integrated Controller Platform for Power Converter Control and Embedded Applications

2018

KAUSHIK BASU LAB, INDIAN INSTITUTE OF SCIENCE, BANGALORE

Hardware Image

- Designed and developed a Microchip DSP (dsPIC33EP256MU814) launch-pad with basic programming, debugging and communication functionalities and also built an interface card around it.
- The interface card hosts a Xilinx Artix-7 FPGA based daughter card (Digilent Cmod A7) and facilitates parallel communication between the DSP and FPGA along with other sensing, PWM, protection features necessary for power electronic hardware control.

10-kW, Si-IGBT based Modular Converters

2016-2017

KAUSHIK BASU LAB, INDIAN INSTITUTE OF SCIENCE, BANGALORE

Design document, Hardware Image

- Took a partial role in the design and development of a Si-IGBT based half-bridge modular converter of 10 KW power rating and 800 V DC input for laboratory research purposes.

Representative Publications

A Practical Digital Implementation of Completely Decentralized Ripple Minimization in Parallel-Connected DC-DC Converters

Journal

SOHAM DUTTA, BRIAN JOHNSON

2022

- IEEE Transactions on Power Electronics

Self-synchronizing Cascaded Inverters with Virtual Oscillator Control

Journal

MINGHUI LU, SOHAM DUTTA, BRIAN JOHNSON

2021

- IEEE Transactions on Power Electronics

Decentralized PWM Interleaving for Ripple Minimization in both Symmetric and Asymmetric Parallel-connected DC-DC Converters

Online (Covid-19)

SOHAM DUTTA, MINGHUI LU, BRIAN JOHNSON

ECCE 2021

- 2021 IEEE Energy Conversion Congress and Exposition (ECCE)

Grid-connected Self-synchronizing Cascaded H-Bridge Inverters with Autonomous Power Sharing

Online (Covid-19)

SOHAM DUTTA, MINGHUI LU, BRANKO MAJUMUNOVIC, RAHUL MALLIK, GAB-SU SEO, DRAGAN MAKSIMOVIC, BRIAN JOHNSON

ECCE 2021

- 2021 IEEE Energy Conversion Congress and Exposition (ECCE)

A Novel Decentralized PWM Interleaving Technique for Ripple Minimization in Series-stacked DC-DC Converters

SOHAM DUTTA, BRANKO MAJUMUNOVIC, SATYAKI MUKHERJEE, RAHUL MALLIK, GAB-SU SEO, DRAGAN MAKSIMOVIC, BRIAN JOHNSON
• 2021 IEEE Applied Power Electronics Conference and Exposition (APEC)

Online (Covid-19)

APEC 2021

Decentralized Control of Cascaded H-Bridge Inverters for Medium-Voltage Grid Integration

SOHAM DUTTA, MINGHUI LU, RAHUL MALLIK, BRANKO MAJUMUNOVIC, SATYAKI MUKHERJEE, GAB-SU SEO, DRAGAN MAKSIMOVIC, BRIAN JOHNSON
• 2020 IEEE 21st Workshop on Control and Modeling for Power Electronics (COMPEL)

Online (Covid-19)

COMPEL 2020

Decentralized Carrier Interleaving in Cascaded Multilevel DC-AC Converters

SOHAM DUTTA, RAHUL MALLIK, BRANKO MAJUMUNOVIC, SATYAKI MUKHERJEE, GAB-SU SEO, DRAGAN MAKSIMOVIC, BRIAN JOHNSON
• 2019 IEEE 20th Workshop on Control and Modeling for Power Electronics (COMPEL)

Toronto, Canada

COMPEL 2019

Soft Switching Over the Entire Line Cycle for a Quadruple Active Bridge DCX in a DC to Three-Phase AC Module

BRANKO MAJUMUNOVIC, SATYAKI MUKHERJEE, RAHUL MALLIK, SOHAM DUTTA, GABSU SEO, BRIAN JOHNSON, DRAGAN MAKSIMOVIC
• 2020 IEEE Applied Power Electronics Conference and Exposition (APEC)

Online (Covid-19)

APEC 2020

A Grid-compatible Virtual Oscillator Controller: Analysis and Design

MINGHUI LU, SOHAM DUTTA, VICTOR PURBA, SAIRAJ DHOPLA, BRIAN JOHNSON
• 2019 IEEE Energy Conversion Congress and Exposition (ECCE)

Baltimore, USA

ECCE 2019

A Pre-synchronization Strategy for Grid-forming Virtual Oscillator Controlled Inverters

MINGHUI LU, SOHAM DUTTA, VICTOR PURBA, SAIRAJ DHOPLA, BRIAN JOHNSON
• 2020 IEEE Energy Conversion Congress and Exposition (ECCE)

Online (Covid-19)

ECCE 2020

Power Electronic Converter Based Flexible Transmission Line Emulation

SOHAM DUTTA, SUSHMIT MAZUMDAR, KAUSHIK BASU
• IEEE Transactions on Industrial Electronics

Journal

2019

Real-time AC transmission line emulation with power electronic converters

SOHAM DUTTA, KAUSHIK BASU
• 2017 National Power Electronics Conference (NPEC)

Pune, India

NPEC 2017

Awards & Achievements

- 2021 **UW ECE Sarala Vadari Award**, In recognition of the quality of research and contributions to the power and energy group at UW Seattle.
- 2015 **All India Rank 57**, In GATE-2015 (Competitive entrance examination for graduate program), out of 1,25,851 applicants in Electrical Engineering.
- 2014 **Finalist**, Autonomous Image Processing robotics competition in Kshitij 2014, the Annual Techno-Management Fest of IIT Kharagpur.
- 2011-13 **Scholarship**, Awarded scholarship under the Scheme of Scholarship for College and University Students reg. of **Govt. of India**, 2011 for the excellent result in Higher Secondary Examination.
- 2011 **All state Rank 386**, In WBEE-2011 (Competitive entrance examination for Undergraduate program) out of around 1,30,000 applicants for Engineering.
- 2011 **All state Rank 4**, Awarded by the Chief Minister for securing a rank of 4 out of 637,808 students in the Higher Secondary Examination of the state of West Bengal, India.

IIT Kharagpur

Seasoned Subjects

Advanced Power Electronics,
Switched Mode Power Conversion,
Analog IC Design, Electronic Systems Packaging,
Digital Controllers for Power Applications, Electric Drives,
Topics in Power Electronics & Distributed Generation,
Digital Control Systems Design,
Mathematical Foundations for Systems Theory,

Programming/Technical Skills

Embedded hardware: TI- C2000 DSPs, Microchip- dsPIC33E, dsPIC30F, Xilinx- Zynq 7010 SoC, Spartan 3AN, PLECS RT Box,
Software platforms: Matlab, Simulink, PLECS, Altium, Cadence Virtuoso, OrCAD, PSCAD, PSIM, Xilinx Vivado, Verilog, VHDL, SolidWorks, LaTeX,

Positions Of Responsibility

2018-21	Reviewer , ECCE, APEC, PEDES, IEEE Transactions on Power Electronics (TPE), IEEE Transactions on Energy Conversion (TEC), IEEE Journal of Emerging and Selected Topics in Power Electronics	
Fall, 2019	Teaching Assistant , EE452: Power Electronics Design	<i>UW Seattle</i>
2017-18	Project Associate , Power Electronics Group, EE Department, IISc Bangalore	<i>IISc Bangalore</i>
Jan-May, 2017	Teaching Assistant , E3 252: Digital Controllers for Power Applications	<i>IISc Bangalore</i>
Aug-Dec, 2016	Lab Assistant , E6 201: Power Electronics	<i>IISc Bangalore</i>
May-Oct, 2014	Student Placement Co-ordinator , Electrical Engineering Department, Jadavpur University	<i>JU, Kolkata</i>
Feb, 2014	Core Committee member , CONVOLUTION 2014 – the first ever Technical Fest of the Electrical Engineering Department of Jadavpur University.	<i>JU, Kolkata</i>