Debjyoti Chatterjee

Ph.D. candidate, UT Austin

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Education

Ph.D. candidate in Electrical and Computer Engineering **Expected May 2026**
The University of Texas at Austin, TX, GPA: 3.87/4.0
Advisor: Dr. Brian Johnson [funded by US Department of Energy's UNIFI consortium]

M.S. in Electrical and Computer Engineering **Dec 2022**
The University of Texas at Austin, TX, GPA: 3.92/4.0
Thesis: From Grid-following to Grid-forming: Modeling, Control & Applications to Inverter-based Resources

B. Tech. in Electrical and Electronics Engineering **May 2020**
National Institute of Technology, Tiruchirappalli, India, GPA: 9.26/10.0
Thesis: Protection Scheme for Microgrid: Relay Coordination Using Convex Optimization

Areas of Expertise

- Power electronic interfaces for renewable integration
- Fault ride-through of grid-forming (GFM) converters
- Stability and control of low inertia power system
- Device-level and plant-level controller design
- Cascaded multilevel medium-voltage converters
- Interoperability of grid-connected converters

Selected Publications

IEEE PESGM, Is Equal Area Criterion Applicable for Transient Stability Assessment of GFM Inverters? **2025**
IEEE PESGM, Stability Analysis of Multi-inverter Systems with Heterogeneous Grid-Forming Dynamics **2025**
IEEE TPEL, Overcurrent Limiting in Grid-forming Inverters: A Comprehensive Review and Discussion **2024**
IEEE ECCE, Fault Ride-through for Cascaded Inverters using Mixed GFM and GFL Control **2024**
IEEE PESGM, Improved Power Sharing and Loss Mitigation in a Hybrid AC-DC Residential Grid **2024**
IEEE PESGM, Power Flow Control through Bidirectional Converters Under Contingency **2024**
IEEE PESGM, Voltage Balancing of Grid-forming Inverters in Unbalanced, Islanded Microgrids **2023**

Relevant Coursework

Power System Analysis with Renewable Energy Sources, Power System Operation and Control, Fundamentals of Power Electronics, Control of Power Electronics, Energy System Optimization, Power Quality and Harmonics, Introduction to Machine Learning, Data Analytics in Power Systems, Linear Programming, Renewable Energy Technology

Technical Skills

- **Software Platforms**: PSCAD, PSSE, PSLF, MATLAB/Simulink, PLECS, Typhoon HIL, DIgSILENT, EMTP
- **Microcontrollers**: TI C2000 Family (Piccolo and Delfino series)
- **Programming Languages**: Python, C, C++, Embedded C

Professional Engineering Experience

PhD Intern for Grid-Connected Converter Control **May-Aug 2024**
National Renewable Energy Lab (NREL), Golden, Colorado

- Analyzed transient stability of GFM inverters, uncovering critical limitations of classical Equal Area Criterion and Lyapunov transient energy functions in accounting for current limiters and non-conservative forces like damping
- Assessed the impact of non-uniform damping in multi-inverter systems developed in PLECS and Simulink
- Developed transient stability assessment strategy for multi-inverter systems using circuit equivalent energy functions

Technical Power Consulting Intern (Transmission) **May-Aug 2022**
Hitachi Energy, Raleigh, NC

- Conducted generation interconnection studies: power flow, fault study, and contingency analysis using PSS/E
- Synthesized high-resolution (1-second) PV irradiance data to improve microgrid frequency stability study
- Performed a transmission routing study in QGIS and introduced a metric to rank the possible transmission routes

Academic Research Experience

Project 1: Fault Ride-through (FRT) for Series-connected Grid-forming (GFM) Inverters

- Developed novel homogeneous (virtual impedance) and heterogeneous (mixed GFM-GFL) FRT strategies
- Proposed singular-perturbation-based controllers, ensuring small-signal stability and enhanced transient response
- Conducted harware experiments with three 1 kVA/ 90 V series-connected converters to compare current limiting performance, demonstrating superior fault recovery and synchronization with mixed GFM-GFL control

Project 2: Current Limiters (CLs) for GFM Inverters and Their System-level Impacts

- Integrated direct, indirect, and hybrid current limiters into GFM inverters with single- and multi-loop controls
- Investigated the impacts of CLs on transient stability, post-fault recovery, grid synchronization, and protection
- Demonstrated the current-limiting performance of a virtual-impedance-based CL on a 5kW 3-ϕ GFM inverter

Project 3: Interoperability of GFM Inverters with Heterogeneous Primary Controllers

- Built a hardware testbed with three 5 kW, 208 V 3-ϕ GFM inverters in parallel, equipped with droop, dispatchable virtual oscillator (dVOC), and virtual synchronous machine (VSM)-based ac-side power-sharing controllers
- Implemented GFM controllers on TI-C2000 DSP and demonstrated interoperability among parallel GFM converters

Project 4: Voltage Balancing of GFM Inverters in Unbalanced Microgrid

- Estimated required positive, negative, and zero sequence currents to support balanced voltage in unbalanced grid
- Demonstrated that a 3-wire GFM inverter with decoupled positive- and negative-sequence controllers can result in less than 0.05% load voltage imbalance, replicating the voltage balancing capabilities of an ideal voltage source

Research Internship Projects

Visiting Researcher, The University of Waterloo, Canada **May-Aug 2019**

Project: Modeling and Performance Analysis of Synchro-Converter-Based Hybrid AC-DC Microgrid

- Embedded synchronous generator (SG) dynamic equations to GFM controller to emulate SG's dynamic response
- Modeled an advanced interlinking converter to achieve bidirectional power sharing and robust frequency regulation

Summer Research Fellow, Indian Institute of Technology (IIT) Bombay, India **May-Aug 2018**

Project: Modeling and Control of DFIG-based Variable Speed Wind Turbine (WT) Using Vector Control Method

- Developed control strategies for DFIG-based WTs, enabling decoupled active and reactive power control
- Validated a WT model in MATLAB with integrated aerodynamics, mechanical drivetrain, and power electronics

Teaching and Mentoring Experience

Developed comprehensive educational materials for UNIFI consortium on GFM inverters **2024-2025**
Mentored 4 grad students for MS thesis and 5 undergrad students for senior design projects **2022-2024**
Graduate Teaching Assistant for Power Quality and Harmonics, Power System Apparatus and Lab **2021-2023**

Honors and Awards

Best Poster Award, UNIFI Consortium Annual Meeting, Tempe, Arizona **Jan 2025**
George J. Heuer, Jr. Ph.D. Endowed Graduate Fellowship, UT Austin **July 2024**
Professional Development Award, UT Austin **May 2023**
Wilson-Tayabali Family Fellowship and Jordan Baruch Fellowship, UT Austin **Jan 2023**
Charles M. Simmons Endowed Presidential Fellowship in Engineering, UT Austin **Jan 2021**
Institute Day Academic Excellence Award, NIT Tiruchirappalli, India **Feb 2019**
MITACS Globalink Research Fellowship, Govt. of Canada **Jan 2019**
Rambhadran Narayan Alumni Award, NIT Tiruchirappalli, India **May 2018**

Services and Leadership Roles

Working Group Member, UNIFI Specifications for Grid-forming Inverters **2025-2026**
Reviewer, IEEE TPEL, TSG, TEC, PES Letters, TPEL Letters, PESGM, ECCE, Springer JPEL **2023-2025**
OpenMinds 2024 NextGen Energy and Climate Leader, OpenMinds Inc. **2024-2025**
TEX-E Energy Innovation Fellow, Martin Trust Center for MIT Entrepreneurship **2023-2024**
Student Advisory Council, The Kay Bailey Hutchison Energy Center, Austin **2023-2024**
President, Longhorn Energy Club (LEC), UT Austin **2023-2024**