Prajwal Dinesh Bhagwat

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I am an Electrical Engineer, blending comprehensive academic expertise in controls and power systems with hands-on experience in industry. My research is currently centered on pushing the boundaries of grid-forming control for voltage source converters, driving innovation in sustainable energy solutions.

Education

University of Wisconsin-Madison — Madison, WI, USA
PhD candidate in Electrical and Computer Engineering — *Aug 2023 – Aug 2026*
M.S. in Electrical and Computer Engineering — *Aug 2021 – Aug 2023*

- GPA: 3.61/4.00, Specialization: Energy systems
- Research thesis: Three-phase grid-forming droop control for unbalanced systems and fault ride through

PES Institute of Technology — Bengaluru, KA, India
B.E in Electrical and Electronics Engineering — *Aug 2014 – May 2018*

- GPA: 8.44/10.00
- Final project: Adaptive vehicle speed reduction in response to ambient fog density

Work Experience

ECE dept., UW-Madison — Madison
Graduate Research Assistant, Advisor: Dr. Dominic Groß — *Aug 2021 – Present*

- Familiarity with datacenter stochastic modeling with large and small training, and fine-tuning workloads
- Broad research area: Grid-forming (GFM) control for voltage source converters (VSCs) (dc/ac)
- Hardware realization of generalized three-phase GFM control on a wolfspeed inverter board controlled with dSPACE micro-labbox
- Interaction between GFM converters and existing protection schemes:
  - Simulating distance relays and inverse time current relay on transmission and distribution network respectively
  - Applying unbalanced loading and faults to check relay accuracy during current limiting mode of GFM converters
- Generalized GFM droop control for three-wire connection:
  - Controlling VSC connected to a three-wire system with delta-connected output filter capacitors and floating neutral, with a two-phase voltage and frequency control
  - Current limiting methods such as threshold virtual impedance (TVI) and current saturation are used to limit current during unbalanced faults
  - Unbalanced load support is validated through stand-alone operation on Simulink
- Generalized three-phase GFM control for unbalanced operations:
  - Advanced GFM droop controls with maximum degrees of freedom controlling all three-phase voltage and frequency individually with phase balancing feedback
  - Implemented current limiting methods like current saturation and TVI for each phase
  - Conducted steady-state analysis and effect on voltage unbalance factor from the control parameters during unbalanced loading
  - Ran high-fidelity simulations on transmission and distribution systems during unbalanced faults on Simulink
- Presented our work at Unifi general meeting, PESGM, and PSERC IAB meetings
- Reviewer for top journals and conferences such as ECCE, PESGM and IEEE IAS

Electric Power Research Institute (EPRI) — Remote
Intern — *May 2024 – Aug 2024*

- Methods to black-start a micro-grid with multiple GFM VSCs on PSCAD environment:
  - Start up after interconnection and transformer energization
  - Synchronization with sync-check relay
  - Leveraging more than one GFM converter to pickup load

Enphase Energy — Bengaluru
Systems Engineer — *May 2020 – Aug 2021*

- Built lithium ion battery simulator hardware with individual cell simulation controlled with I^2C protocol
- Validation of grid-tied energy management system in *Encharge EMEA*, and scrutinizing energy flow between solar PV, storage, grid and home loads at different tariff rates
- System's design validation for IQ8 PV grid forming inverters and grid synthesising energy storage devices in *Ensemble 2.0* project

- Test plan to validate implementation of IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources (DER)
- Team lead – BMU Test Automation Project: Electronic hardware design of test fixture, embedded coding on Arduino, and software deployment planning
- Energy management solution - *Ensemble 1.0*: Product performance investigation for various grid profiles and micro-grid stability analysis under loaded scenarios and fault ride through

Associate Engineer *Jun 2018 – Apr 2020*

- Firmware and Hardware operation inspection of Battery Management Unit (BMU) associated with *Encharge 3* and *ACB 1.5*
- Development of python scripts for numerous equipment utilized in power handling and measurement
- Collaboration with international teams in China and USA and visited the product development facilities to achieve product centric goals

PES Institute of Technology Bengaluru

Undergrad researcher *Aug 2014 – Aug 2018*

- Implemented maximum power point tracking of a solar panel with the help of Arduino
- Designed and built various prototypes such as inverted pendulum, ball-to-basket shooter, robotic arm and fog detection system for automobiles
- Electrical system incorporation into a tri-cycle as a part of national competition: SAE Effi-cycle 2017

Publications

Published

P. Bhagwat and D. Groß, "Three-phase grid-forming droop control for unbalanced systems and fault ride through," *2023 IEEE Power & Energy Society General Meeting (PESGM), USA,* pp. 1-5

Z Zeng, P Bhagwat, M Saeedifard and D Groß, "Hybrid threshold virtual impedance for fault current limiting in grid-forming converters", *2023 IEEE Energy Conversion Congress and Exposition (ECCE)*

Z. Zeng, P. Bhagwat, M. Saeedifard, and D. Groß, "Black start operation of grid-forming converters based on generalized three-phase droop control under unbalanced conditions", *CIGRE Paris Session, 2024*

P. Bhagwat and D. Groß, "Generalized grid-forming droop control for three-wire connection", *2026 IEEE Power & Energy Society General Meeting (PESGM), USA*

Working paper

P. Bhagwat and D. Groß, "Interaction between GFM converters and existing protection schemes", *IEEE Transactions on Power Delivery*

P. Bhagwat and D. Groß, "Generalized Three-phase Grid-forming Control for Asymmetric Faults and Unbalanced Operation", *IEEE Transactions on Power Delivery*

Patent

D. Groß, and P. Bhagwat "Systems and methods for grid forming control", *US Patent App. 18/181,107*

Technical Skills

Tools: MATLAB, Julia, Simulink, dSPACE Control desk, PSCAD, Python, LTSpice, PLECS, C++

Select Courses: Utility applications of power electronics, Matrix method in machine learning, Nonlinear optimization, Solid state power converters

Awards & Achievements

Best poster award: Unifi General meeting on July-2025, PSERC IAB meeting on May-2022

Co-curricular

Chair, Indian graduate student association, UW-Madison, 2024-2025

Secretary, ECE graduate student association, ECE dept, UW-Madison, 2023-2024

Hobbies

Cycling, snowboarding, scuba diving, hiking and exploring

Languages

English, Kannada and Hindi