

Minghui Lu, Ph.D.

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Expertise

Power Electronics, Electric Power Systems, Renewable Energy Systems, Control Theory, Decentralized Control, Electrical Machines

Appointments

¹ May. 2018–Present **University of Washington Seattle, WA 98195**

Postdoctoral Researcher – Leading and working on projects from department of energy (DOE) (Collaborating with Prof. Brian Johnson)

Fall 2022–Present **University of Texas at Austin, TX 78712**

Research Associate – Leading and working on projects from department of energy (DOE)

Education

² Nov. 2014–Aug. 2017 **Aalborg University, Denmark**

Ph.D. in Power Electronics Engineering, Department of Energy Technology

Supervisor: Prof. Frede Blaabjerg (IEEE Fellow)

Aug. 2011–Jun. 2014 **Huazhong University of Science and Technology (HUST), China**

Master in Electrical Engineering, School of Electrical and Electronic Engineering

Aug. 2007–Jun. 2011 **Harbin Institute of Technology (HIT), China**

Bachelor in Electrical Engineering, School of Electrical and Electronic Engineering

Publications

Conferences: 23; Journals: 13; Sum of the times cited: 769; H-index: 13

□ Journal Papers:

- [1] **M. Lu**, X. Wang, P.C. Loh, F. Blaabjerg, “Resonance Interaction of Multi-Parallel Grid-Connected Inverters with LCL-Filter,” **IEEE Transactions on Power Electronics**, vol. 32, no. 2, pp. 894-899, Feb. 2017. (Google Citation: [141](#))
- [2] **M. Lu**, X. Wang, P.C. Loh, F. Blaabjerg, “Graphical Evaluation of Time-Delay Compensation Techniques for Digitally-Controlled Converters,” **IEEE Transactions on Power Electronics**, vol. 33, no. 03, pp. 2601-2614, Mar. 2018. (Google Citation: [60](#))
- [3] **M. Lu**, F. Blaabjerg, et al, “Benchmarking Stability and Robustness against Grid Impedance Variation for LCL-Filtered Grid-Interfacing Inverters,” **IEEE Transactions on Power Electronics**, vol. 33, no. 10, pp. 9033-9046, Oct. 2018. (Google Citation: [78](#))
- [4] **M. Lu**, Y. Yang, B. Johnson, F. Blaabjerg, “An Interaction-Admittance Model for Multi-Inverter Grid-Connected Systems,” **IEEE Transactions on Power Electronics**, vol. 34, no. 08, pp. 7542-7557, Nov. 2018. (Google Citation: [32](#))
- [5] Z. Xin, X. Wang, Z. Qin, **M. Lu**, et al, “An Improved Second-Order Generalized Integrator Based Quadrature Signal Generator,” **IEEE Transactions on Power Electronics**, vol. 32, no. 2, pp. 894-899, Feb. 2017. (Google Citation: [176](#))

¹University of Washington: Rank No. 7 Best Global University, US News Ranking 2022.

²Aalborg University: No. 1 in Engineering among European Universities.

- [6] **M. Lu**, S. Duan, et al, “Research on Parallel Operation of Power Storage System Based on Standalone PV System,” *Power Electronics*, vol. 03, pp. 105-111, Mar. 2013.
- [7] **M. Lu**, S. Dhople, B. Johnson, “Benchmarking Nonlinear Oscillators for Grid-forming Inverter Control,” *IEEE Transactions on Power Electronics*, 2022, doi: 10.1109/TPEL.2022.3162530.
- [8] **M. Lu**, S. Dutta, B. Johnson, “Self-synchronizing Cascaded Inverters with Virtual Oscillator Control,” *IEEE Transactions on Power Electronics*, Oct. 2021, doi: 10.1109/TPEL.2021.3134662.
- [9] **M. Lu**, “Virtual Oscillator Grid-forming Inverters: State of the Art, Modeling, and Stability,” *IEEE Transactions on Power Electronics*, Mar. 2022, doi: 10.1109/TPEL.2022.3163377.
- [10] **M. Lu**, “An Inrush Current Limiting Strategy for Virtual-oscillator-controlled Grid-forming Inverters”, *IEEE Transactions on Energy Conversion*, 2022.
- [11] **M. Lu**, S. Dhople, D. Zimmanck, B. Johnson, “Spontaneous Phase Balancing in Delta-connected Single-phase Grid-forming Inverters”, *IEEE Transactions on Power Electronics*, 2022.
- [12] **M. Lu**, S. Dhople, B. Johnson, “Simultaneous Phase Balancing and Synchronization in Single-phase Grid-forming Inverters”, *IEEE Transactions on Power Electronics*, 2022. (Submitted)
- [13] **M. Lu**, W. Cai, S. Dhople, B. Johnson, “Phase Balancing and Large-signal Stability in Single-phase GFM Inverters with Transformer”, *IEEE Transactions on Power Electronics*, 2022. (Submitted)
- [14] O. Ajala, **M. Lu**, S. Dhople, B. Johnson, “Model Reduction for Inverters with Current Limiting and Dispatchable Virtual Oscillator Control,” *IEEE Transactions on Energy Conversion*, 2021, doi: 10.1109/TEC.2021.3083488.

■ Conference Papers:

- [1] **M. Lu**, V. Purba, S. Dhople, B. Johnson, “Comparison of Droop Control and Virtual Oscillator Control Realized by Andronov-Hopf Dynamics,” in the proceeding of the 46th Annual Conference of the IEEE Industrial Electronics Society (IECON 2020), Singapore.
- [2] **M. Lu**, B. Johnson, “A Pre-synchronization Strategy for Grid-compatible Virtual Oscillator Controlled Inverters,” in the IEEE ECCE 2020, Detroit, MI, US.
- [3] **M. Lu**, B. Johnson, “A Grid-compatible Virtual Oscillator Controller,” in the IEEE ECCE 2019, Baltimore, MD, US. (Google Citation: [57](#))
- [4] **M. Lu**, B. Johnson, “Adaptation of Commercial Current-controlled Inverters for Operation with Virtual Oscillator Control,” in the IEEE APEC 2019, Anaheim, CA, US.
- [5] **M. Lu**, X. Wang, F. Blaabjerg, et al, “Grid-voltage-feedforward active damping for grid-connected inverter with LCL filter,” in the IEEE APEC 2016, Long Beach, CA, US, Mar. 2016, pp.1941-1946.
- [6] **M. Lu**, X. Wang, P.C. Loh, F. Blaabjerg, “Interaction and Aggregated Modeling of Multiple Paralleled Inverters with LCL Filter,” in the IEEE ECCE 2015, Montreal, CA, Sep. 2015, pp. 1-7. (Google Citation: [31](#))
- [7] **M. Lu**, X. Wang, P.C. Loh, F. Blaabjerg, “An analysis method for harmonic resonance and stability of multi-paralleled LCL-filtered inverters,” in the IEEE PEDG 2015, Jun. 2015, pp 1-7. (Google Citation: [30](#))
- [8] **M. Lu**, S. Duan, et al. “Coordinate Control of Parallel Connected Power Conditioning System for Battery Energy Storage System in Microgrid,” In the IEEE APEC 2014, Fort Worth, Texas, US, Mar. 2014, pp. 704-711.
- [9] **M. Lu**, S. Duan, et al. “Research on Control Strategy of Paralleled Power Conditioning System with Energy Storage Capability,” in Proc. of 7th Symposium on Power Electronics and Electrical Drives (SPEED 2013), Apr. 2013, Shanghai Jiaotong University, Shanghai, China. (Award for Excellent Paper)
- [10] **M. Lu**, S. Duan, et al. “Current Sharing Control Strategy of Modular Large Capacity Energy Storage Converter,” in Proc. of the 8th Wuhan Power Supply Society Conference 2012 (WPSSC 2012), Dec. 2012, Huazhong University of Science and Technology, Wuhan, China. (Best Paper Award)
- [11] T. Dragicevic, M. Alhasheem, **M. Lu**, and F. Blaabjerg, “Improved model predictive control for high voltage quality in ups applications,” in the IEEE ECCE 2017, Cincinnati, OH, US.

- [12] H. Wang, H. Wang, **M. Lu**, “Impedance characteristics modelling of a two-terminal active capacitor,” in the IEEE COMPEL 2017, Stanford University, Stanford, CA, US.
- [13] **M. Lu**, F. Blaabjerg, “Stability Identification and Robust Design of LCL Filters for Grid-Connected Inverters Considering Grid-Voltage Feedforward Regulator,” in the IEEE COMPEL 2017, Stanford University, Stanford, CA, USA. (Award: 10 papers out of 142)
- [14] **M. Lu**, X. Wang, P.C. Loh, F. Blaabjerg, “Graphical Evaluation of Time-Delay Compensation Techniques for Digitally-Controlled Converters,” in the IEEE ECCE 2017, Cincinnati, OH.
- [15] B. Johnson, **M. Lu**, “A Circuit-equivalent Model for Current-controlled Grid-tied Inverters,” in the IEEE COMPEL 2019, Toronto, Canada.
- [16] **M. Lu**, F. Blaabjerg, X. Wang, “Interaction admittance-based modeling of multi-paralleled grid-connected inverter with LCL-filter,” in the IEEE SPEC 2016, Auckland, NZ, Dec. 2016, pp. 1-7.
- [17] **M. Lu**, Z. Xin, X. Wang, R. Beres, F. Blaabjerg, “Extended stable boundary of LCL-filtered grid-connected inverter based on an improved grid-voltage feedforward control,” in the IEEE ECCE 2016, Milwaukee, US, Sep. 2016, pp. 1-7.
- [18] S. Dutta, **M. Lu**, “Decentralized Control of Cascaded H-bridge Inverters for Medium-Voltage Grid Integration,” in the IEEE COMPEL 2020, Aalborg, Denmark.
- [19] **M. Lu**, V. Purba, S. Dhople, B. Johnson, “Unified Equivalent-circuit Models for Voltage-source Inverters that Capture Averaged Dynamics and Power-flow Solutions in Distribution Networks,” in the HICCS 2021, Hawaii, US.
- [20] R. Billmeyer, **M. Lu**, S. Dhople, B. Johnson, “Modeling and Simulation of Power-electronic Inverters in Analog Electronic Circuit Simulators,” in the 2021 IEEE International Symposium on Circuits and Systems, South Korea.
- [21] **M. Lu**, R. Mallik, S. Dhople, B. Johnson, “Dispatchable Virtual Oscillator Controlled Inverters with Current-limiting and MPPT Capabilities,” in the 2021 IEEE Energy Conversion Congress and Exposition, Vancouver, CA.
- [22] S. Dutta, **M. Lu**, B. Johnson, “A Novel Decentralized PWM Interleaving Technique for Ripple Minimization in Parallel-connected DC-DC Converters,” in the 2021 IEEE Energy Conversion Congress and Exposition, Vancouver, CA.
- [23] S. Dutta, **M. Lu**, B. Johnson, “Grid-connected Self-synchronizing Cascaded Inverters with Autonomous Power Sharing,” in the 2021 IEEE Energy Conversion Congress and Exposition, Vancouver, CA.

--- Projects

- From 2021 **Universal Interoperability for Grid-Forming Inverters (UNIFI) Consortium:** UNIFI project focuses on integrating grid-forming inverters into electric grids at any scale, to enable high penetration of inverter-based resources, like solar and wind.
Funding source: Department of Energy (DOE), \$25 millions USD.
Role: Modeling and Control of Grid-forming inverters.
- From 2021 **A Unified Multiphysics Approach for Modeling, Control, and Optimization of Wave Energy Converters:** Unified circuit equivalence combining the power electronics system and wave energy generation dynamics.
Funding source: Department of Energy (DOE), \$2 millions USD.
- From 2020 **A Scalable Control Architecture for 100% PV Penetration with Grid Forming Inverters:** Next-generation 100% renewables-based electric power grid.
Funding source: Department of Energy (DOE), \$5 millions USD.
Role: Lead of Inverter-based Power System Modeling and Control.
- From 2018 **Modular Wide-Bandgap String Inverters for Low-Cost Medium-Voltage Transformerless PV Systems.**

Funding source: Department of Energy (DOE), \$2 millions USD.

Role: Modeling of Cascaded Medium Voltage System.

2014–2017 **HARMONY-Harmonic Identification, Mitigation and Control in Power Electronics Based Power Systems:** Grid-following inverters and Power electronics based power system.

Funding source: European Commission, \$20 millions DKK.

Role: Inverters Resonance and Interactions.

2012–2014 **Control Technologies for Power Conditioning System in Charge-Discharge-Storage Power Station.**

Invited Talks

- Oct. 2019 **ShanDong University, Qilu Forum:** Nonlinear Decentralized Control Techniques of Power Electronics Systems
- Jan. 2019 **University of Washington-Applied Physics Laboratory:** Power Electronics in Wave Energy Application
- Aug. 2017 **Aalborg University:** Stability Analysis and Performance Optimization for the Multi-Parallel Grid Inverters System
- Jul. 2017 **Kansas University:** Stability Analysis and Performance Optimization for the Multi-Parallel Grid Inverters System
- Jul. 2017 **Stanford University:** Stability identification for grid-connected inverters with LCL filters

Teaching

EE 458: Power Electronics Controls - University of Washington, Seattle campus, 2022

Skills

- Programming: Proficiency in Matlab/C/C++. Qualified TI DSP algorithm programming skills
- Communication: Latest Texas Controlcard EtherCAT, CAN
- Simulation: Extensive experience in Matlab/Simulink and PLECS simulation environment
- Experiments: Extensive experience in rapid control prototyping using dSPACE real time target and hardware experiments (power electronics, grid-interfacing inverter)
- Mathematics: Linear algebra, Calculus, Numerical Algorithms, Matrix Theory

Honors & Achievements

- 2019 **Star Reviewer Award** of IEEE Transactions on Energy Conversions
- 2017 IEEE Conference Award: COMPEL 2017, Stanford University (10 out of 196)
- 2014 National Graduate Scholarship Program
- 2013 Hopewind Scholarship for Excellent Students
- 2013 Paper Award on the 7th Symposium on Power Electronics & Electrical Drives
- 2013 Paper Award for Excellent Paper on the 8th Wuhan Power Supply Society Conference
- 2012 First Prize for student, East Electrical Scholarship for Outstanding Students
- 2010 Siemens A&D Scholarship for Excellent Students
- 2010 Undergraduate Electronic Design Contest, Second Prize
- 2009 National Undergraduate Electronic Design Contest, Second Prize

Service

- May 2021 **Special Session Organizer:** IEEE ECCE Asia 2021, Singapore. Session: Modeling and Control Challenges for Grid-forming Inverters and Low-inertia Power Systems
- Jul. 2020 **Session Chair:** 2020 IEEE KPEC, Manhattan, KS, 2020. Session: Electrical Device Modeling/Analysis
- Jun. 2019 **Session Chair:** 46th IEEE Photovoltaic Specialists Conference (PVSC) Chicago, 2019. Session: Power Electronics and Microgrid for PV
- 2014–Present Reviewer for journals and conferences:
- IEEE Transactions on Power Electronics (TPEL)
 - IEEE Transactions on Energy Conversion (TEC)
 - IEEE Transactions on Power Systems (TPWRS)
 - IEEE Transactions on Industrial Electronics (TIE)
 - IEEE Transactions on Industrial Informatics (TII)
 - IEEE Journal of Emerging and Selected Topics in Power Electronics (JESTPE)
 - IEEE Access and Electronics Letters
 - IEEE Power Engineering Letters
 - Conference: IEEE ECCE 2016, 2017, 2018, 2019, 2020, 2021
 - Conference: IEEE APEC 2016, 2017, 2018, 2019, 2020, 2021

Referees

1. **Frede Blaabjerg**, Ph. D., Professor, IEEE Fellow
Department of Energy Technology, Aalborg University
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2. **Brian B. Johnson**, Ph. D., Assistant Professor
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3. **Sairaj Dhople**, Ph. D., Professor
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