Qiuhua Huang, Ph.D.

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EDUCATION

8/2012 – 5/2016 **PhD**, Electrical Engineering at Arizona State University, Tempe, Arizona, USA

9/2009 – 7/2012 **M.E.,** Electrical Engineering at South China University of Technology

9/2005 – 7/2009 **B.E.**, Electrical Engineering at South China University of Technology

PROFESSIONAL EXPERIENCE

Associate Professor (Tenure-Track), Electrical Engineering, **Colorado School of Mines**

1/2023- Present

- Lead the Power, Intelligence and Computing (PIC) Lab at Mines

4/2022- 12/2022

Principal Power System Engineer, UtiliData, Inc

- Develop edge intelligence solutions for DER and EV integration
- Lead development of internal platform and smart grid chip applications

5/2016 – 4/2022 **Staff Power System Engineer,** Electricity Security Group, **Pacific Northwest National Laboratory (PNNL),** Richland, WA

Senior Power System Engineer (2019-2021), Power System Engineer (2016-2019)

- Lead smart grid R&D projects in (i) machine learning for power system control and renewable integration, (ii) computational methods for power and energy systems modeling and simulation, (iii) power system stability and control, (iv) cyber-physical energy system resilience.
- Project Manager (PM) , Principal Investigator (PI), and Co-PI of 7 power system/smart grid projects over the past 5 years.
- Key developer of T&D co-simulation, RLGC (reinforcement learning for grid control), and TESP (Transactive energy simulation platform) software tools.

PROFESSIONAL SERVICE

Associate Editor, IEEE Transactions on Power Systems, 2022 –

Chair, IEEE PES TF on Interfacing Techniques for Simulation Tools, 2021 –

Vice-chair, PES Working Group on Intelligent Data Mining and Analysis, 2020 –

TCPC member, IEEE ISGT-North America 2022

Associate Editor, IEEE ACCESS, 2019 – Present

Guest Editor, IET Gen., Trans. & Dist. special issue on *Advanced data analytics for power system operation, control, and enhanced situational awareness*, 2019

Guest Editor, IET Smart Grid special issue on *Machine Learning in Power Systems*,

Panel co-chair, IEEE PES GM panel session *Deep Learning and Smart Grid Applications*, Aug. 2018

Proposal reviewer, DOE Office of Electricity, 2018, 2021

PUBLICATIONS

Google profile: https://scholar.google.com/citations?user=7aYmjDYAAAAJ&hl=en&authuser=1

Selected journals

[J1] R. Huang, W. Gao, R. Fan, **Q. Huang**. "Damping inter-area oscillation using reinforcement learning controlled TCSC." IET Gener. Transm. Distrib. 16, 2265–2275 (2022). https://doi.org/10.1049/gtd2.12441

[J2] R. Huang, Y. Chen, T. Yin, **Q. Huang**, J. Tan, W. Yu, X. Li, A. Li, Y. Du, "Learning and Fast Adaptation for Grid Emergency Control via Deep Meta Reinforcement Learning," in IEEE Transactions on Power Systems, 2022, doi: 10.1109/TPWRS.2022.3155117.

[J3] D. Yan, **Q. Huang*,** R. Huang, T. Yin, J. Tan, W. Yu, X. Li. "Physics-informed Evolutionary Strategy based Control for Mitigating Delayed Voltage Recovery", *IEEE Trans. on Power Systems*, early access. doi:10.1109/TPWRS.2021.3132328

[J4] R. Huang, Y. Chen, T. Yin, X. Li, A. Li, J. Tan, W. Yu, Y. Liu, **Q. Huang*** "Accelerated Derivative-free Deep Reinforcement Learning Based Load Shedding for Emergency Voltage Control," *IEEE Trans. on Power Systems*, early access, 2021, DOI: 10.1109/TPWRS.2021.3095179

[J5] L. Fan, C. Zhao*, G. Zhang, **Q. Huang**. "Flexibility Management in Economic Dispatch with Dynamic Automatic Generation Control", *IEEE Trans. on Power Systems*, early access, 2021, DOI: 10.1109/TPWRS.2021.3103128

[J6] X. Sun, X. Li, S. Datta, X. Ke, **Q. Huang**, R. Huang, Z. Jason Hou*, "Smart Sampling for Reduced and Representative Power System Scenario Selection," *IEEE Open Access Journal of Power and Energy*, vol. 8, pp. 293-302, 2021, doi: 10.1109/OAJPE.2021.3093278.

[J7] Wang S., L. Du, X. Fan, and **Q. Huang**. "Deep Reinforcement Scheduling of Energy Storage Systems for Real-time Voltage Regulation in Unbalanced LV Networks with High PV Penetration." *IEEE Transactions on Sustainable Energy,2021*. doi:10.1109/TSTE.2021.3092961

[J8] R. Hossain, **Q. Huang***, R. Huang, "Graph Convolutional Network-Based Topology Embedded Deep Reinforcement Learning for Voltage Stability Control", *in IEEE Transactions on Power Systems, doi: 10.1109/TPWRS.2021.3084469.*

[J9] F. Tao, D. Wang, X. Fan, **Q. Huang***, "Component Importance and Interdependence Analysis for Transmission, Distribution and Communication Systems", *CSEE Journal of Power and Energy System*, 2021

[J10] **Q. Huang**, D. Ramasubramanian*, V. Vittal, B. Keel, J. Silva. "Effect of Accurate Modeling of Converter Interfaced Generation (CIG) on a Practical Bulk Power System," *IET Generation, Transmission & Distribution*, vol. 14, no. 15, pp. 3108-3116, 2020

[J11] N. Mohan, A. L. Figueroa-Acevedo, M. Elizondo, W. Hess, J. Obrien, **Q. Huang**, J. Bakke; B. Heath; J. Okullo; C. Tsai; Y. V. Makarov, D. Osborn, A. Prabhakar, "Synchronized Phasor Measurement Unit-based Central Controller for Normal and Contingent Operation of a High-Capacity HVDC Macrogrid for the Continental US," *IEEE Transactions on Power Systems*. vol. 36, no. 1, pp. 680-688, Jan. 2021.

[J12] **Q. Huang**, R. Huang*, W. Hao, J. Tan, R. Fan, Z. Huang. "Adaptive Power System Emergency Control Using Deep Reinforcement Learning," *IEEE Transactions on Smart Grid,* vol. 11, no. 2, pp. 1171-1182, March 2020

[J13] Q. Zhang, K. Dehghanpour, Z. Wang* and **Q. Huang**, "A Learning-based Power Management Method for Networked Microgrids Under Incomplete Information," *IEEE Transactions on Smart Grid*. vol. 11, no. 2, pp. 1193-1204, March 2020

[J14] **Q. Huang**, R. Huang, B. J. Palmer, Y. Liu, S. Jin, R. Diao, Y. Chen, Y. Zhang. "A Generic Modeling and Development Approach for WECC Composite Load Model," *Electric Power Systems Research,* vol. 172, pp. 1-10, 2019

[J15] X. Li, X. Fan, H. Ren, Z. Hou, **Q. Huang,** S. Wang, O. Ciniglio, "Data-driven Feature Analysis in Control Design for Series-Compensated Transmission Systems," *IEEE Trans. on Power Systems.* vol. 34, no. 4, pp. 3297-3299, July 2019

[J16] **Q. Huang**, T. McDermott, Y. Tang, A. Makhmalbaf, D. Hammerstrom, A. Fisher, L. Marinovici, T. Hardy "Simulation-Based Valuation of Transactive Energy Systems," *IEEE Trans. on Power Systems*, vol. 34, no.5, pp. 4138-4147, 2019

[J17] **Q. Huang**, V. Vittal. "Advanced EMT and phasor domain hybrid simulation with comprehensive modeling and simulation mode switching capabilities," *IEEE Trans. on Power Systems*, vol. 33, no. 6, pp. 6298-6308, Nov. 2018.

[J18] M. A. Elizondo, N. Mohan, J. O'Brien, **Q. Huang**, D. Orser, W. Hess, W. Zhu, D. Chandrashekhara, Y.V. Makarov, D. Osborn, J. Feltes, H. Kirkham, D. D. Duebner, Z. Huang, "HVDC Macrogrid Modeling for Power-flow and Transient Stability Studies in North American Continental-Level Interconnections," *CSEE Journal of Power and Energy System*, vol.3, no.4, pp. 390-398, 2018

[J19] D. Shu, X. Xie*, Q. Jiang, **Q. Huang**, C. Zhang, "A novel interfacing technique for distributed hybrid simulations combining EMT and transient stability models," *IEEE Trans. on Power Delivery*, vol. 33, no.1, pp.130-140. Feb. 2018

[J20] **Q. Huang**, V. Vittal*. "Integrated transmission and distribution system power flow and dynamic simulation using mixed three-sequence/ three-phase modeling," *IEEE Trans. on Power Systems*, vol. 32, no. 5, pp. 3704-3714, Sept. 2017. **(2019 IEEE PES Prize Paper Award and Technical Committee Prize Paper Award)**

[J21] **Q. Huang**, V. Vittal*. "Application of Electromagnetic Transient-Transient Stability Hybrid Simulation to FIDVR Study." *IEEE Trans. on Power Systems*, vol.31, no.4, pp. 2634-2646, 2016

Book Chapters

[B1] **Q. Huang**, L. D. Marinovici, J. Hansen, J. Lian, D. J. Hammerstrom, T. Hardy, T. E. McDermott, S. E. Widergren. "Transactive Energy Systems for Future Power Grid: Theory, Simulation and Valuation." *Intelligent Power Grid of Tomorrow: Modeling, Planning, Control, and Operation*. Springer Publishing. In press

Selected Conference Papers

[C1] M. Penne, W. Qiao, L. Qu, L. Qu, R. Huang and **Q. Huang**, "Active Disturbance Rejection Control of Doubly-Fed Induction Generators Driven by Wind Turbines," 2021 IEEE Energy Conversion Congress and Exposition (ECCE), 2021, pp. 965-972, doi: 10.1109/ECCE47101.2021.9595083.

[C2] Vu T., T. Yin, S. Mukherjee, R. Huang, and **Q. Huang**. "Safe Reinforcement Learning for Emergency Load Shedding of Power Systems." *In Proc of IEEE PES General Meeting 2021*

[C3] K. Mahapatra, X. Fan, X. Li, Y. Huang, and **Q. Huang.** "Physics Informed Reinforcement Learning for Power Grid Control using Augmented

Random Search." *In Proc of* 2022 Hawaii International Conference on System Sciences (HICSS).

[C4] Y. Liu, Z. Chu, P. Etingov, Y. Zhang, Y. Tang, **Q. Huang**, S. Kundu, D. James, D.P. Chassin. "Detailed Modeling of Residential End-Use Motor Load and Protection for Distribution System Transient Study." *In Proc of IEEE ISGT-NA 2019*

[C5] **Q. Huang**, V. Vittal. "OpenHybridSim: an open source tool for EMT and phasor domain hybrid simulation." *In Proc of IEEE PES GM*, Boston, MA, 2016

[C6] **Q. Huang**, M. Zhou, Y. Zhang, et al. "Exploiting cloud computing for power system analysis," *In Proc of POWERCON* 2010, vol.1, no.6, pp. 24-28 Oct. 2010

AWARDS AND HONORS

- IEEE PES General Meeting Best Conference Paper 2020
- **IEEE PES Prize Paper Award (link)** 2019
- IEEE PES Technical Committee Prize Paper Award 2019
- Publication Of-The-Year Award, PNNL EED 2019
- R&D 100 Finalist 2019
- **R&D 100 Award (link)** 2018
- IEEE PES General Meeting Best Conference Paper 2018
- Outstanding Performance Award, PNNL EED 2016
- Best Poster Award at PSERC IAB Winter meeting 2015
- Best Poster Award at PSERC IAB Winter meeting 2014
- Graduate Student First Class Scholarship 2009

PATENTS

X. Fan, X. Li, E.L. Barrett, **Q. Huang**, J.G. O'brien, R. Huang, Z. Hou, R. Diao. "Transformative Remedial Action Scheme Tool (TRAST)", US Patent 11,042,132

INVITED TALKS

1. "Reduced-Order DER Dynamic Models from Machine Learning." at IEEE PES GM 2021, Panel Session "Dynamic Modeling in Distribution", July 26, 2021
2. "Transmission and Distribution Dynamic Co-Simulation: Interfacing Techniques and Test Cases" at IEEE PES GM 2021, July 26, 2021
3. "Accelerated deep reinforcement learning for grid emergency control" at IEEE ISGT NA 2021, Panel session "Artificial Intelligence/Machine Learning (AI/ML) for Power System Resilience" Feb. 16, 2021
4. "Novel Machine Learning for Grid Operation and Control" at EPRI Advisory Board Meeting, September 16th, 2020
5. "Open Source Platform and Data Sets for Developing and Benchmarking Reinforcement Learning Algorithms for Grid Control" at 2020 IEEE PES GM Panel Session "Machine Learning for Power System Planning and Operation," August 5, 2020
6. "Power System Control and Decision-making Via Deep Reinforcement Learning" at 2019 INFORMS Annual Meeting Session WD85 "Machine Learning for Energy System Operations", October 23, 2019, Seattle, WA
7. "Stochastic Planning and Operations: Bridging the Gaps Between Research and Industry Application" at 2019 IEEE PES General Meeting **Super Session** on "Risk-Based System Planning and Operation," Atlanta, GA, USA, August 8, 2019
8. "Coordination of Transmission, Distribution and Communication Systems for Prompt Power System Recovery after Disasters" at 2019 IEEE PES General

Meeting Panel Session “Enhancing Cyber-Physical Resilience of Smart Grid: Design, Operation, and Control”, Atlanta, GA, USA, August 7, 2019

9. “Application of Machine Learning in Power Systems” at IEEE Smart Grid webinar, November 1, 2018 (Link: Part 1, Part 2)
10. “Integrated Transmission and Distribution System Power Flow and Dynamic Simulation Using Mixed Three-Sequence/ Three-Phase Modeling”, at IEEE PES GM 2018, Portland, OR, USA, August 7, 2018
11. “InterPSS—A New Generation, Open Power System Simulation Engine” at PNNL EI group brownbag, Richland, WA, USA, August 11, 2017
12. “Co-simulation techniques for power systems: experiences and outlook” at Power and Energy Webinar Series of NACPPA, May 28, 2016
13. “Electromagnetic transient and phasor domain hybrid simulation and its application to detailed FIDVR studies” at PSERC IAB Winter meeting, College Station, TX, USA, Dec 3, 2015