

JUNJIAN QI**Assistant Professor**

Department of Electrical and Computer Engineering
 Renewable Energy Systems Faculty Cluster
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Work Experience

Assistant Professor University of Central Florida	Orlando FL Aug. 2017–present
Joint Appointed Argonne Staff University of Chicago	Chicago IL Dec. 2016–Jul. 2017
Postdoctoral Appointee Argonne National Laboratory Advisor: Dr. Jianhui Wang	Lemont IL Jan. 2015–Jul. 2017
Research Associate University of Tennessee, Knoxville Advisor: Prof. Kai Sun	Knoxville TN Sept. 2013–Jan. 2015

Education

Tsinghua University Ph.D. Electrical Engineering Dissertation Title: “Power Grid Cascading Failure Models and Mechanisms” Advisor: Prof. Shengwei Mei Cumulative GPA: 3.93/4.0	Beijing China Jul. 2013
Shandong University B.E. Electrical Engineering Advisor: Prof. Yutian Liu Cumulative GPA: 3.86/4.0 (top 3/224)	Jinan China Jun. 2008

Recent Long-Term Activity

Complex Systems Summer School Santa Fe Institute Duties: Attended 160 hours of an intensive series of graduate-level lectures, laboratory sessions, and discussion sessions focusing on foundational ideas, tools, and current topics in complex systems re-	Santa Fe NM Jun. 8–Jul. 4, 2014
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search. Led an interdisciplinary project “Controlling the Self-organizing Dynamics in Sandpile Models by Failure Tolerance and Applications to Economic and Ecological Systems”.

Visiting Scholar

Iowa State University

Advisor: Prof. Ian Dobson

Duties: Worked on applying branching processes to cascading blackout analysis.

Ames IA

Feb.–Aug. 2012

Professional Affiliations & Services

- Member, AAAS 2017–present
- Member, IEEE 2012–present
- Member, IEEE Power and Energy Society 2014–present
- Member, SIAM 2014–present
- Secretary, IEEE Task Force “Voltage Control for Smart Grids” 2016–present
- Technical program committee member, 2017 IEEE International Conference on Smart Grid Communications (SmartGridComm) 2017
- Technical program committee member, Fifth International Symposium on Control, Automation, Industrial Informatics and Smart Grid (ICAIS’17) 2017
- Member, IEEE Cascading Failure Working Group 2014–present
- Attendee and speaker, NASPI Work Group Meeting 2014–2016
- Attendee, National Workshop on Resilience Research Oct. 22–23, 2015
- Attendee, Workshop on “Security & Resilience of Grid Integration With Distributed Energy Resources : Lessons Learned & Future Outlook” Jul. 13–14, 2016
- Reviewer, Quadrennial Technology Review 2015 of U.S. Department of Energy 2015
- Reviewer, Université Libre de Bruxelles (ULB)’s 2016–2021 research call 2016
- Active reviewer for top journals and conferences in power systems, control, and physics: Proc. IEEE, IEEE Trans. Power Systems, IEEE Trans. Smart Grid, IEEE Trans. Automatic Control, IEEE Trans. Control System Technology, IEEE Trans. Sustainable Energy, IEEE Transactions on Industrial Informatics, IEEE Trans. Control of Network Systems, IEEE Power Engineering Letters, IEEE Systems Journal, IEEE Journal on Emerging and Selected Topics in Circuits and Systems, IET Generation, Transmission & Distribution, International Journal of Electrical Power and Energy Systems, European Transactions on Electrical Power, Journal of Renewable and Sustainable Energy, Electric Power Component and Systems, Journal of Modern Power Systems and Clean Energy, Physica A, Engineering Optimization, Communications in Nonlinear Science and Numerical Simulation, Recent Patent on Engineering, PLoS ONE, 2015 54th IEEE Conference on Decision and Control, 2016 American Control Conference, 2016 IEEE Electrical Power and Energy Conference (EPEC), and 2017 IEEE Power and Energy Society General Meeting.

Funding

Argonne National Laboratory

Jan. 2015–Jul. 2017

- PI: “Cybersecurity for Renewables, Distributed Energy Resources and Smart Inverters,” *DOE OE CEDS Award GM0100*, 2016. (\$1.8 million, 2016–2019)
- coPI: “Extreme Event Modeling,” *DOE OE Award GMLC 1.4.17*, 2016. (\$3 million, 2016–2019)
- coPI: “A Novel Hierarchical Frequency-Based Load Control Architecture,” *DOE ARPA-E NODES Award DE-AR0000702*, 2016. (\$2,692,016, 2016–2019)
- coPI: “Protection and Dynamic Modeling, Simulation, and Analysis of Cascading Failures,” *DOE OE Award GM0111*, 2016. (\$300K, 2016–2017)

Honors & Awards

- Argonne Outstanding Postdoctoral Performance Award (4 out of 315) 2016
- Best Conference Paper in IEEE PES General Meeting 2014
- Tsinghua Scholarship for Overseas Graduate Studies 2012
- First-class Tsinghua-New Fortune Scholarship 2011, 2012
- Tsinghua-China Aerospace Science and Technology Scholarship 2009
- Excellent Graduation Thesis Author of Shandong University 2008
- First-class Shandong University Comprehensive Scholarship 2006, 2007

Teaching Experience

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| University of Tennessee, Knoxville | Knoxville TN |
| • Taught a lecture on <i>Cascading Failure</i> in ECE522 “ <i>Power Systems Analysis II</i> ” | Apr. 15, 2014 |
| • Taught a lecture on <i>Optimal Power Flow</i> in ECE521 “ <i>Power Systems Analysis I</i> ” | Nov. 25, 2013 |

Publications

Books

[B1] K. Sun, Y. Hou, W. Sun, and J. Qi, *Power System Control under Cascading Failures: Understanding, Mitigation, and Restoration*, to be published by Wiley in 2017.

The book is estimated to consist of approximately 225,000 words and 500 pages. This book covers three major topics related to prevention of cascading power outages in a power transmission grid: modeling and analysis of cascading failures for reliable and efficient simulation and better understanding of important mechanisms, root causes and propagation patterns of failures and power outages; controlled system separation to mitigate of cascading failures addressing key questions such as where, when, and how to separate; optimal system restoration from cascading power outages and blackouts by well-designed milestones, optimized procedures, and emerging techniques.

Peer-Reviewed Journal Papers

[J25] Y. Li, B. Feng, G. Li, J. Qi, D. Zhao, and Y. Mu, “Optimal distributed generation planning in active distribution networks considering integration of energy storage,” *Applied Energy*, accepted.

[J24] W. Huang, K. Sun, J. Qi, and J. Ning, “Optimization of dynamic reactive power sources using

mesh adaptive direct search," *IET Generation, Transmission & Distribution*, accepted.

[J23] W. Ju, K. Sun, and J. Qi, "Multi-layer interaction graph for analysis and mitigation of cascading outages," *IEEE Journal on Emerging and Selected Topics in Circuits and Systems*, vol. 7, no. 2, pp. 239–249, Jun. 2017.

[J22] G. Huang, J. Wang, C. Chen, J. Qi, and C. Guo, "Integration of preventive and emergency responses for power grid resilience enhancement," *IEEE Trans. Power Systems*, in press.
doi:10.1109/TPWRS.2017.2685640

[J21] W. Huang, K. Sun, J. Qi, and J. Ning, "Optimal allocation of dynamic var sources using the Voronoi diagram method integrating linear programming," *IEEE Trans. Power Systems*, in press.
doi:10.1109/TPWRS.2017.2681459

[J20] H. Liu, J. Qi, J. Wang, P. Li, C. Li, and H. Wei, "EV dispatch control for supplementary frequency regulation considering the expectation of EV owners," *IEEE Trans. Smart Grid*, in press.
doi:10.1109/TSG.2016.2641481

[J19] J. Qi, A. Hahn, X. Lu, J. Wang, and C. C. Liu, "Cybersecurity for distributed energy resources and smart inverters," *IET Cyber-Physical Systems: Theory & Applications*, vol. 1, no. 1, pp. 28–39, Dec. 2016.

[J18] J. Qi, Y. Kim, C. Chen, X. Lu, and J. Wang, "Demand response and smart buildings: A survey of control, communication, and cyber-physical security," *ACM Trans. Cyber-Physical Systems*, in press.

[J17] H. Liu, Y. Yang, J. Qi, J. Li, H. Wei, and P. Li, "Frequency droop control with scheduled charging of electric vehicles," *IET Generation, Transmission, & Distribution*, vol. 11, no. 3, pp. 649–656, Feb. 2017.

[J16] M. Yang, J. Wang, H. Diao, J. Qi, and X. Han, "Interval estimation for conditional failure rates of transmission lines with limited samples," *IEEE Trans. Smart Grid*, in press.
doi:10.1109/TSG.2016.2618623

[J15] P. Li, J. Qi, J. Wang, H. Wei, X. Bai, and F. Qiu, "An SQP method combined with gradient sampling for small-signal stability constrained OPF," *IEEE Trans. Power Systems*, vol. 32, no. 3, pp. 2372–2381, May 2017.

[J14] H. Lin, C. Chen, J. Wang, J. Qi, D. Jin, Z. Kalbarczyk, and R. K. Iyer, "Self-healing attack-resilient PMU network for power system operation," *IEEE Trans. Smart Grid*, in press.
doi:10.1109/TSG.2016.2593021

[J13] J. Qi, W. Ju, and K. Sun, "Estimating the propagation of interdependent cascading outages with multi-type branching processes," *IEEE Trans. Power Systems*, vol. 32, no. 2, pp. 1212–1223, Mar. 2017.

[J12] J. Qi, K. Sun, J. Wang, and H. Liu, "Dynamic state estimation for multi-machine power system by unscented Kalman filter with enhanced numerical stability," *IEEE Trans. Smart Grid*, in press.
doi:10.1109/TSG.2016.2580584

[J11] A. F. Taha, J. Qi, J. Wang, and J. H. Panchal, "Risk mitigation for dynamic state estimation against cyber attacks and unknown inputs," *IEEE Trans. Smart Grid*, in press.
doi:10.1109/TSG.2016.2570546

[J10] J. Qi, J. Wang, H. Liu, and A. D. Dimitrovski, "Nonlinear model reduction in power systems by balancing of empirical controllability and observability covariances," *IEEE Trans. Power Systems*, vol. 32, no. 1, pp. 114–126, Jan. 2017.

[J9] J. Qi, W. Huang, K. Sun, and W. Kang, "Optimal placement of dynamic var sources by using

empirical controllability covariance," *IEEE Trans. Power Systems*, vol. 32, no. 1, pp. 240–249, Jan. 2017.

[J8] K. Sun, J. Qi, and W. Kang, "Power system observability and dynamic state estimation for stability monitoring using synchrophasor measurements," *Control Engineering Practice*, vol. 53, pp. 160–172, Aug. 2016.

[J7] J. Qi and S. Pfenninger, "Controlling the self-organizing dynamics in a sandpile model on complex networks by failure tolerance," *EPL (Europhysics Letters)*, vol. 111, no. 3, 38006, Aug. 2015.

[J6] J. Qi, K. Sun, and W. Kang, "Optimal PMU placement for power system dynamic state estimation by using empirical observability gramian," *IEEE Trans. Power Systems*, vol. 30, no. 4, pp. 2041–2054, Jul. 2015.

[J5] J. Qi, K. Sun, and S. Mei, "An interaction model for simulation and mitigation of cascading failures," *IEEE Trans. Power Systems*, vol. 30, no. 2, pp. 804–819, Mar. 2015.

[J4] J. Qi, I. Dobson, and S. Mei, "Towards estimating the statistics of simulated cascades of outages with branching processes," *IEEE Trans. Power Systems*, vol. 28, no. 3, pp. 3274–3282, Aug. 2013.

[J3] J. Qi, S. Mei, and F. Liu, "Blackout model considering slow process," *IEEE Trans. Power Systems*, vol. 28, no. 3, pp. 3410–3419, Aug. 2013.

[J2] G. He, S. Dong, J. Qi, and Y. Wang, "Robust state estimator based on maximum normal measurement rate," *IEEE Trans. Power Systems*, vol. 26, no. 4, pp. 2058–2065, Nov. 2011.

[J1] J. Qi, G. He, S. Mei, and Z. Gu, "A review of power system robust state estimation," *Advanced Technology of Electrical Engineering and Energy*, vol. 3, pp. 59–64, Jul. 2011.

Peer-Reviewed Conference Papers

[C7] N. Duan, A. Dimitrovski, S. Simunovic, K. Sun, J. Qi, and J. Wang, "Embedding spatial decomposition in Parareal in Time power system simulation," *IEEE PES ISGT Europe*, 2017.

[C6] J. Qi, K. Sun, and W. Kang, "Adaptive optimal PMU placement based on empirical observability gramian," *10th IFAC Symposium on Nonlinear Control Systems (NOLCOS 2016)*, Monterey, CA USA, vol. 49, no. 18, pp. 482–487, Aug. 2016. (**Invited Paper**)

[C5] W. Ju, J. Qi, and K. Sun, "Simulation and analysis of cascading failures on an NPCC power system test bed," *IEEE Power and Energy Society General Meeting*, Denver CO, pp. 1–5, Jul. 2015.

[C4] W. Huang, K. Sun, J. Qi, and Y. Xu, "Voronoi diagram based optimization of dynamic reactive power sources," *IEEE Power and Energy Society General Meeting*, Denver CO, pp. 1–5, Jul. 2015.

[C3] W. Huang, K. Sun, J. Qi, and Y. Xu, "A new approach to optimization of dynamic reactive power sources addressing FIDVR issues," *IEEE Power and Energy Society General Meeting*, National Harbor MD, pp. 1–5, Jul. 2014. (**Best Paper**)

[C2] J. Qi and S. Mei, "Blackout model considering slow process and SOC analysis," *IEEE Power and Energy Society General Meeting*, San Diego CA, pp. 1–6, Jul. 2012.

[C1] J. Qi, G. He, S. Mei, and F. Liu, "Power system set membership state estimation," *IEEE Power and Energy Society General Meeting*, San Diego CA, pp. 1–7, Jul. 2012.

Talk

- [T18] "Cybersecurity for renewables, distributed energy resources, and smart inverters," Poster Presentation, *U.S. DOE Grid Modernization Initiative Peer Review*, Arlington VA, Apr. 18, 2017.
- [T17] "Recent progress: resilience, security, and demand response," *CEEESA Seminar*, Bldg 362, Argonne National Laboratory, Lemont IL, Jan. 27, 2017.
- [T16] Contributed Argonne National Laboratory's presentation in the *DOE OE CEDS Peer Review Meeting*, Arlington VA, Dec. 7, 2016.
- [T15] "DER cybersecurity framework," *DER Cybersecurity Project Industry Advisory Board Review Meeting*, Argonne National Laboratory, Lemont IL, Oct. 5, 2016.
- [T14] "Enhancing power grid cybersecurity to improve critical electric infrastructure resilience," *Brown Bag Talks*, Bldg 203, Argonne National Laboratory, Lemont IL, Sept. 13, 2016.
- [T13] "Cybersecurity for renewables, distributed energy resources, and smart inverters," *DOE OE CEDS Annual Review Meeting*, Aug. 24, 2016.
- [T12] "Enhancing power grid cybersecurity to improve critical electric infrastructure resilience," *Resilience Week 2016*, Chicago IL, Aug. 18, 2016.
- [T11] "DOE CEDS Project—Cybersecurity for renewables, distributed energy resources, and smart inverters," *DER Cybersecurity Project Industry Advisory Board Kickoff Meeting*, Argonne National Laboratory, Lemont IL, Aug. 10, 2016.
- [T10] "Cascading failure simulation, analysis, and mitigation," *Talk Given to Visitors from Guangxi University*, Argonne National Laboratory, Lemont IL, Aug. 16, 2016.
- [T9] Contributed a two-hour industry technical webinar "Grid modernization laboratory consortium: Extreme event modeling," Jun. 16, 2016.
- [T8] "Secure dynamic state estimation using PMU data under model uncertainty and cyber attacks," *NASPI Work Group Meeting*, Atlanta GA, Mar. 24, 2016.
- [T7] "Optimal PMU placement for power system dynamic state estimation by using empirical observability gramian," Transactions Session T18, *IEEE Power and Energy Society General Meeting*, Denver CO, Jul. 29, 2015.
- [T6] "An interaction model for simulation and mitigation of cascading failures," Transactions Session T6, *IEEE Power and Energy Society General Meeting*, Denver CO, Jul. 28, 2015.
- [T5] "Power system dynamics: simulation, estimation, and cybersecurity," *CEEESA Seminar*, Bldg 202, Argonne National Laboratory, Lemont IL, Jul. 10, 2015.
- [T4] "Monitoring and control of bulk power systems: cascading failure, state estimation, sensor placement problems and beyond," *Advance Grid Modeling Section Seminar*, Bldg 202, Argonne National Laboratory, Lemont IL, Oct. 31, 2014.
- [T3] "Modeling of cascading failures in power systems," *Student Leadership Seminar*, University of Tennessee, Knoxville TN, Jan. 17, 2014.
- [T2] "Blackout model considering slow process and SOC analysis," *IEEE Power and Energy Society General Meeting*, San Diego CA, Jul. 2012.
- [T1] "Power system set membership state estimation," Poster Presentation, *IEEE Power and Energy Society General Meeting*, San Diego CA, Jul. 2012.