

# Qinran Hu

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Born: April 3, 1988 at Zhenjiang, Jiangsu, China  
Nationality: China

## Current position

*Postdoc Fellow*, John A. Paulson School of Engineering and Applied Sciences, Harvard University

## Areas of specialization

Electrical Engineering • Power Systems

## Appointments held

2015 summer Intern at Oak Ridge National Lab, Oak Ridge, TN, USA  
2013 summer Intern at ABB CRC, Raleigh, NC, USA  
2012-13 winter Intern at NARI Technology Development Co., Nanjing, China

## Education

2015 PH.D. in Electrical Engineering, The University of Tennessee Knoxville, United States  
2013 M.S. in Electrical Engineering, The University of Tennessee Knoxville, United States  
2010 B.S. in Electrical Engineering, Chien-Shiung Wu College, Southeast University, China  
2010 B.S. in Electrical Engineering, School of Electrical Engineering, Southeast University, China  
2006 HIGH SCHOOL in Jin Ling, Nanjing, China  
2003 MIDDLE SCHOOL in Jin Ling, Nanjing, China  
2000 PRIMARY SCHOOL in Cheng Xian Jie, Nanjing, China

## Grants, honors & awards (after 2006)

### GRANTS

- 2018 - now Co-PI, usd 112k, The technical pathways toward a reliable carbon-free energy system, funded by Harvard Provost Office
- 2017 - now Major participant, usd 200k, Simulation based integrated energy system planning, collaborative research projects between NARI and Harvard University
- 2016 - now Co-PI, usd 260k, Optimal bidding and assets allocation strategy for generation companies, collaborative research projects between SAC-ABB and Harvard University
- 2016 - now Major participant, The analysis of residential demand response behavior, collaborative research projects among ThinkEco, ComEd, and Harvard University
- 2015 Major participant, Implementation of a wireless sensing system for smart pumping control, funded by Oak Ridge National Laboratory, USA
- 2010 - 2014 Major participant, usd 318k, Ensuring security and reducing price volatility of power systems with extensive controllable load, funded by Department of Energy, USA
- 2010 - 2011 Major participant, Controllable load for smart grid applications, funded by Electric Power Research Institute, USA
- 2007 - 2010 PI, rmb 30k, The design and research of the platform for wheeled educational robot, funded by the Ministry of Education of China

### HONORS

- 2014 Outstanding service for the north american Chinese power professional association
- 2013 Outstanding service for CURENT student leadership council
- 2012 Outstanding service for CURENT student leadership council
- 2010 Outstanding student, Education Dept. of Jiangsu province
- 2010 Scholarship for student abroad, the Ministry of Education of China
- 2009 Chancellor scholarship, Southeast University
- 2007 Outstanding student leader, Southeast University
- 2007 Hua Longxing & Ma Lihua scholarship, Southeast University

### ACADEMIC AWARDS

- 2017 Outstanding Reviewer, Applied Energy
- 2016 Best Reviewer, Journal of Modern Power Systems and Clean Energy
- 2016 Best Reviewer, IEEE Trans. on Smart Grid
- 2016 Best Paper, IEEE Power and Energy Society General Meeting
- 2014 Best Poster, CURENT Center Annual Meeting
- 2009 Second Prize, National Undergraduate Electronic Design Contest
- 2008 First Prize, CPLD Circuit Design Competition of Jiangsu Province
- 2008 Second Prize, National College Student Competition for Mathematical Modeling
- 2008 First Prize, Electric Design Competition, Southeast University
- 2007 Second Prize, Digital System Design Competition, Chien-Shiung Wu College

### OTHER INTERESTING AWARDS

- 2017 Second Place, National "Chunhui" Innovation and Entrepreneurship Competition
- 2017 Finalist as mentor, National Startup Contest for Universities, China
- 2017 7th Place, NECBL Basketball Tournaments - Atlantic North Conference, USA
- 2017 2nd Place in Minesweeper, Harvard CSSA PC game contest, USA
- 2016 6th Place, NECBL Basketball Tournaments - Atlantic North Conference, USA

2015 2nd Place, MIT-Harvard CSSA 3v3 Basketball Match, Boston, MA, USA  
 2015 Top 128 in North America Region, The International 2015, Valve  
 2014 Champion, UTK CSSA 3v3 Basketball Match, Knoxville, TN, USA  
 2013 3rd Place, Photo" Nanjing" in "Chinese Culture in My Eyes" Photo Contest, Knoxville, TN, USA

## Teaching

2017 spring Teaching fellow, course: energy and climate: vision for the future, Harvard University, USA  
 2016 fall Lab assistant, ES 158: PID control of a robot via the feedback from motion capture system, Harvard University, USA  
 2016 summer Guest lecturer, course: power system optimization theory and technology, Southeast University, Nanjing, China  
 2013 - 2014 Mentor, summer REU projects, CURENT Center, USA  
 2012 - 2015 Mentor, senior design projects, The University of Tennessee Knoxville, USA  
 2010 - 2013 Teaching assistant, Courses: power system analysis I & II, power system economics, circuit, The University of Tennessee Knoxville, USA

## Service & activities

### ORGANIZATION

2018 - now Advisor, Silicon Valley China-US Energy Association  
 2018 - now Secretary, working group on low carbon energy system transition and policy, IEEE  
 2015 - now Member, IEEE & IEEE PES  
 2011 - now Member, NACPPA  
 2011 - 15 Student member, IEEE & IEEE PES

### EDITOR & REVIEWER

Editor IEEE PES International Conference on DRPT  
 Committee IET International Conference on RPG  
 J. reviewer IEEE Trans. on Power Systems, IEEE Trans. on Smart Grid, IEEE Trans. on Sustainable Energy, IEEE Trans. on Industrial Informatics, IEEE Trans. on Transportation Electrification, Applied Energy, IET Generation, Transmission & Distribution, Journal of Modern Power System and Clean Energy, Energies, Power systems automation(in Chinese), Energies, Energy Efficiency, Journal of Electrical Engineering Education, International Journal of Electrical Power and Energy Systems  
 C. reviewer IEEE PES General Meeting, IEEE PES T&D, IEEE Conference on Decision and Control (CDC), American Control Conference(ACC), IET International Conference on RPG, Chinese Control Conference(CCC)

### SERVICE

2017 Mentor, applied energy summer camp, Elsevier press  
 2013 - 15 Event coordinator, Confucius institute at the University of Tennessee Knoxville, TN, USA  
 2012 - 15 Mentor & event coordinator on Power Systems, CURENT center, TN, USA  
 2012 - 13 Seminar coordinator, CURENT Center, TN, USA  
 2008 - 09 Vice president, Chien-Shiung Wu college student union, Southeast University, China

### ACTIVITIES

2018

2013 MIT-CHIEF co-founder trip (for Smart RLC), China  
 13th China synergy program for outstanding youth, Chengdu, China  
 2011 Student volunteer, School of engineering, The University of Tennessee Knoxville, USA  
 2009 Young scholar summer camp, Microsoft research asia, Beijing, China  
 2007 9th China synergy program for outstanding youth, Beijing, China

#### OTHER

2017 - now Vice president, Doctorate association, Glasgow, UK  
 2018 Co-founder, Smart RLC, Boston, USA  
 2017 Principle scientist, Singularity Energy (start-up), USA  
 2016 Principle scientist, Cloudergy Co.,China

## Publications & talks

#### BOOK

- [1] F. Li, P. Zhang, S. Adhikari, Y. Wei, and Q. Hu, *18 Vision of Future Control Centers in Smart Grids*. CRC Press, 2014, p. 421.

#### JOURNAL

- [1] X. Dou, P. Xu, Q. Hu, W. Sheng, X. Quan, Z. Wu, and B. Xu, "A distributed voltage control strategy for multi-microgrid active distribution networks considering economy and response speed," *IEEE Access*, vol. 6, pp. 31259–31268, 2018.
- [2] X. Fang, Q. Hu, B.-M. Hodge, and F. Li, "Capacity market model considering flexible resource requirements with renewables," *IEEE Transactions on Sustainable Energy*, under review, 2018.
- [3] Q. Hu, C.-F. Chen, and X. Xu, "Demographic impact of residential demand response," *Applied Energy*, to submit, 2018.
- [4] Q. Hu, X. Chen, L. Bai, F. Li, Q. Wu, and R. Li, "The impact of climatic events on distribution systems with ultra-high penetration of pv," to submit, 2018.
- [5] Q. Hu, F. Li, X. Fang, and L. Bai, "A framework of residential demand aggregation with financial incentives," *IEEE Transactions on Smart Grid*, vol. 9, no. 1, pp. 497–505, 2018.
- [6] Q. Hu and N. Li, "Residential demand response using multi-armed bandit mechanism," *IEEE Transactions on Smart Grid*, to submit, 2018.
- [7] Q. Hu and C.-H. Zhang, "Circadian rhythm detection using modern power grid," to submit, 2018.
- [8] Q. Hu and C. Zhang, "Power systems and health," to submit, 2018.
- [9] R. Li, Q. Hu, and S. Mei, "The pricing mechanism for heating network," *IEEE PES letters*, to submit, 2018.
- [10] R. Li, W. Wei, S. Mei, Q. Hu, and Q. Wu, "Participation of an energy hub in electricity and heat distribution markets: An mpec approach," *IEEE Transactions on Smart Grid*, accepted, 2018.
- [11] X. Zhu, C.-F. Chen, X. Xu, and Q. Hu, "Promoting acceptance of direct load control programs in the united states: Financial incentive versus control option energy," *Energy*, vol. 147, pp. 1278–1287, 2018.
- [12] C. Dong, H. Jia, T. Jiang, L. Bai, Q. Hu, L. Wang, and Y. Jiang, "Effective method to determine time-delay stability margin and its application to power systems," *IET Generation, Transmission & Distribution*, 2017.

- [13] X. Li, F. Li, H. Yuan, H. Cui, and Q. Hu, "Gpu-based fast decoupled power flow with preconditioned iterative solver and inexact newton method," *IEEE Transactions on Power Systems*, vol. 32, no. 4, pp. 2695–2703, 2017.
- [14] J. Xu, W. Zaijun, Y. Xinghuo, and Q. e. a. Hu, "A new method for optimal ftu placement in distribution network under consideration of power service reliability," *SCIENCE CHINA Technological Sciences*, vol. 60, no. 12, pp. 1885–1896, 2017.
- [15] H. Cui, F. Li, Q. Hu, L. Bai, and X. Fang, "Day-ahead coordinated operation of utility-scale electricity and natural gas networks considering demand response based virtual power plants," *Applied Energy*, vol. 176, pp. 183–195, 2016.
- [16] X. Fang, Q. Hu, F. Li, B. Wang, and Y. Li, "Coupon-based demand response considering wind power uncertainty: a strategic bidding model for load serving entities," *IEEE Transactions on Power Systems*, vol. 31, no. 2, pp. 1025–1037, 2016.
- [17] X. Fang, F. Li, Q. Hu, and Y. Wei, "Strategic CBDR bidding considering FTR and wind power," *IET Generation, Transmission & Distribution*, vol. 10, no. 10, pp. 2464–2474, 2016.
- [18] C. Huang, L. Fangxing, Z. Lingwei, X. Yao, H. Qinran, Z. Dao, and L. Yilu, "Data quality issues for synchrophasor applications Part II: problem formulation and potential solutions," *Journal of Modern Power Systems and Clean Energy*, vol. 4, no. 3, pp. 353–361, 2016.
- [19] T. Jiang, L. Bai, F. Li, H. Jia, Q. Hu, and X. Jin, "Synchrophasor measurement-based correlation approach for dominant mode identification in bulk power systems," *IET Generation, Transmission & Distribution*, vol. 10, no. 11, pp. 2710–2719, 2016.
- [20] T. Jiang, L. Bai, G. Li, H. Jia, Q. Hu, and H. Yuan, "Estimating inter-area dominant oscillation mode in bulk power grid using multi-channel continuous wavelet transform," *Journal of Modern Power Systems and Clean Energy*, vol. 4, no. 3, pp. 394–405, 2016.
- [21] X. Kong, L. Bai, Q. Hu, F. Li, and C. Wang, "Day-ahead optimal scheduling method for grid-connected microgrid based on energy storage control strategy," *Journal of Modern Power Systems and Clean Energy*, vol. 4, no. 4, pp. 648–658, 2016.
- [22] J. Mei, Y. Ji, J. Tian, C. Huang, X. Lu, X. Du, Y. Xie, Q. Hu, and T. Ma, "Balancing control schemes for modular multilevel converters using virtual loop mapping with fault tolerance capabilities," *IEEE Transactions on Industrial Electronics*, vol. 63, no. 1, pp. 38–48, 2016.
- [23] X. Dou, K. Yang, X. Quan, Q. Hu, Z. Wu, B. Zhao, P. Li, S. Zhang, and Y. Jiao, "An optimal PR control strategy with load current observer for a three-phase voltage source inverter," *Energies*, vol. 8, no. 8, pp. 7542–7562, 2015.
- [24] Q. Hu, F. Li, and C.-F. Chen, "A smart home test bed for undergraduate education to bridge the curriculum gap from traditional power systems to modernized smart grids," *IEEE Transactions on Education*, vol. 58, no. 1, pp. 32–38, 2015.
- [25] J. Y. Chan and Q. Hu, "Simulation of a smart home energy management system with dynamic price response," *Pursuit-The Journal of Undergraduate Research at the University of Tennessee*, vol. 5, no. 1, p. 6, 2014.
- [26] J. Mei, C. Huang, and Q. Hu, "Quasi-Fixed-Frequency hysteresis current tracking control strategy for modular multilevel converters," *Journal of Power Electronics*, vol. 14, no. 6, pp. 1147–1156, 2014.
- [27] Q. Hu and F. Li, "Hardware design of smart home energy management system with dynamic price response," *IEEE Transactions on Smart Grid*, vol. 4, no. 4, pp. 1878–1887, 2013.
- [28] Y. Xu, Q. Hu, and F. Li, "Probabilistic model of payment cost minimization considering wind power and its uncertainty," *IEEE Transactions on Sustainable Energy*, vol. 4, no. 3, pp. 716–724, 2013.

- [29] Y. Guo, Y. Qian, and Q. Hu, "Gains from zero –story of a freshman who stood onto the platform of international forum," *Physics and Engineering (in Chinese)*, vol. 18, no. 4, 2008.

#### CONFERENCE

- [1] Q. Hu, Y. Li, A. Su, J. Shimada, and N. Li, "Unlocking untapped grid assets by learning techniques: A case study on residential demand response," to submit, 2018.
- [2] S. Yang, Q. Hu, C.-f. Chen, X. Xu, and Z. Wu, "The anomaly detection of a demand response survey adopting local outlier factor," in *The International Conference on Renewable Power Generation (RPG)*, accepted, 2018.
- [3] J. Xu, Z. Wu, Q. Hu, and X. Dou, "An interval arithmetic-based state estimation for unbalanced active distribution networks," in *IEEE PES General Meeting*, Chicago, IL, 2017.
- [4] Y. Xu, C. Huang, F. Li, X. Li, and Q. Hu, "Adaptive gain tuning control strategy for dfig-based wind farms," in *IEEE PES General Meeting*, Chicago, IL, 2017.
- [5] X. Zhang, W. Shi, Q. Hu, B. Yan, A. Malkawi, and N. Li, "Distributed temperature control via geothermal heat pump systems in energy efficient buildings," in *American Control Conference*, Seattle, WA, 2017.
- [6] L. Bai, F. Li, Q. Hu, H. Cui, and X. Fang, "Application of battery-supercapacitor energy storage system for smoothing wind power output: An optimal coordinated control strategy," in *IEEE PES General Meeting*, Denver, CO, 2016.
- [7] X. Fang, F. Li, H. Cui, L. Bai, H. Yuan, Q. Hu, and B. Wang, "Risk constrained scheduling of energy storage for load serving entities considering load and LMP uncertainties," in *IFAC-PapersOnLine*, vol. 49, Elsevier, 2016, pp. 318–323.
- [8] H. Yuan, X. Li, F. Li, X. Fang, H. Cui, and Q. Hu, "Mitigate overestimation of voltage stability margin by coupled single-port circuit models," in *IEEE PES General Meeting*, Denver, CO, 2016.
- [9] L. Bai, Q. Hu, F. Li, T. Ding, and H. Sun, "Robust mean-variance optimization model for grid-connected microgrids," in *IEEE PES General Meeting*, Denver, CO, 2015.
- [10] X. Fang, F. Li, Q. Hu, and N. Gao, "System load margin evaluation using mixed-integer conic optimization," in *North American Power Symposium (NAPS)*, Charlotte, NC, 2015.
- [11] X. Fang, F. Li, Q. Hu, Y. Wei, and N. Gao, "The impact of FTR on LSE's strategic bidding considering coupon based demand response," in *IEEE PES General Meeting*, Denver, CO, 2015.
- [12] Q. Hu, X. Fang, F. Li, X. Xu, C.-F. Chen, and H. Hu, "An approach to assess the responsive residential demand to financial incentives," in *IEEE PES General Meeting*, Denver, CO, 2015.
- [13] Q. Hu, J. Chan, F. Li, and D. Chen, "A comprehensive user interactive simulation tool for smart home application," in *Australasian Universities Power Engineering Conference*, Perth, Australia, 2014.
- [14] S. Adhikari, F. Li, Q. Hu, and Z. Wang, "Heuristic optimal restoration based on constructive algorithms for future smart grids," in *Intelligent System Application to Power Systems (ISAP), International Conference on*, Hersonissos, Greece, 2011.
- [15] L. Liu, Q. Hu, Z. Zhuang, and S. Zhao, "Instant remote transmission," in *The IOSTE Symposium on Science Education for Sustainable Development*, Philippines, 2007.

#### TALKS

- [1] *Unlocking underutilized grid assets by learning techniques: A case study on residential demand response*, 52nd Conference on Information Sciences and Systems at Princeton University, Princeton, NJ, 2018.

- [2] *Optimal bidding strategy for generation companies*, workshop on electricity market and distributed energy resources, Harvard University, 2017.
- [3] *The analysis of users' behavior based on actual demand response data*, seminar, Harvard University, 2017.
- [4] *The distributed energy management for regional energy internet*, invited talk, NARI technology development Co., 2017.
- [5] *The optimal bidding strategy for generation companies*, invited talk, Guodian nanjing automation co., 2017.
- [6] *To support the higher penetration of renewable energies: The modernization of electricity distribution systems*, applied energy summer school, Elsevier Press, 2017.
- [7] *An mechanism for incentive based demand response*, NSF RCN-SEES-SHBE workshop, CURENT center, 2016.
- [8] *Incentive based demand response*, invited talk, Dept. of math, Southeast University, 2016.
- [9] *Incentive based demand response*, invited talk, Guodian Nanjing Automation Co.(SAC), 2016.
- [10] *The impact of residents' behavior on power system operation*, Beiyang forum, Tianjin University, 2016.
- [11] *An approach to assess the responsive residential demand to financial incentives*, IEEE PESGM, Denver, CO, USA, 2015.
- [12] *Residential demand aggregation*, invited talk, Commission of Economic and Information of Jiangsu, 2015.
- [13] *Residential demand aggregation*, invited talk, NARI Technology Development Co., 2015.
- [14] *Residential demand aggregation*, invited talk, Dept. of Electrical Engineering, Southeast University, 2015.
- [15] *Residential demand aggregation*, invited talk, China Electric Power Research Institute, 2015.
- [16] *Residential demand aggregation*, invited talk, Pacific Northwest National Laboratory, 2015.
- [17] *An optimal framework for residential load aggregators*, IEEE PESGM, Washington, DC, USA, 2014.
- [18] *Optimal framework design for residential load aggregators*, IEEE PES T&D, Chicago, IL, USA, 2014.
- [19] *A hardware design of smart home energy management system*, IEEE PESGM, Vancouver, BC, CAN, 2013.
- [20] *Heuristic approach for online distribution system restoration*, IEEE PESGM, Detroit, MI, USA, 2012.
- [21] *Instant remote transmission*, International physics education conference, Manila, Philippines, 2007.

#### PATENT

- [1] Q. Hu, X. Wang, Z. Zhang, R. Hu, and Z. Wu, "Healthy and energy-saving water heater," pat., CN101579192B, 2011.