

Hongxun Hui

Ph.D. Candidate
Smart Grid Operation and Optimization Laboratory
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Education

Zhejiang University

Ph.D., College of Electrical Engineering.

Hangzhou, China

09/2015 – 06/2020

- Academic adviser: Prof. **Yonghua Song** (*Fellow of the Royal Academy of Engineering, Member of Academia Europaea, Rector of the University of Macau*) & Prof. **Yi Ding** (*National Thousand Young Talents Program*)
- Expertise: Control Theory, Operation and Optimization of Power System, Demand Response, HVACs, Market.
- Award: The First Batch of the Academic Rising Star Program in Zhejiang University, Tang Lixin Scholarship

Zhejiang University

B.S., College of Electrical Engineering. Overall GPA: 3.88/4.0 (top 3%)

Hangzhou, China

09/2011 – 06/2015

- Expertise: Advanced Mathematics, Probability Theory, Control Theory, Electrical Machinery, Programming in C.
- Award: Outstanding Graduates of Zhejiang University, Meritorious Winner in ICM

Professional Experience

Virginia Tech

Visiting Scholar, Advanced Research Institute.

Arlington, USA

10/2018 – 10/2019

- Academic adviser: Prof. **Saifur Rahman** (Joseph R. Loring Professor of Electrical and Computer Engineering, and Director of Advanced Research Institute, National Capital Region)
- Expertise: Control and dynamic performance analysis of the power system with the control loop of HVACs; Coupon-based demand response for consumers facing the flat-rate retail pricing electricity market.

The University of Tennessee

Short-term Exchange, CURENT Engineering Research Center

Knoxville, USA

06/2019 – 07/2019

- Academic adviser: Prof. **Fangxing (Fran) Li** (James W. McConnell Professor in the Department of Electrical Engineering and Computer Science)
- Expertise: Inertia support of virtual synchronous generator by air conditioning systems, 5G network-based internet of things for demand response in smart grid.

Duke Kunshan University

Academic Program

Kunshan, China

08/2014 – 12/2014

- Courses in English by Professors from Duke University, including the core course on Academic Writing.

Research Interests

- **Demand response:** modeling and control of flexible loads (especially HVACs), capacity evaluation, operating reserve, frequency regulation, peak-shaving services, access abilities of renewable energies.
- **Electricity market:** business model and market framework of demand response, electricity price policy, incentive mechanism, transaction method, settlement method, economy evaluation.
- **Uncertainty analysis:** reliability model and multiple uncertainties of flexible loads, reliability evaluation method, multi-time scale dispatch model of wind power and flexible resources.

Publications

Books

1. Yi Ding (advisor), Yonghua Song (advisor), **Hongxun Hui** and Changzheng Shao. Integration of Air Conditioning and Heating into Modern Power Systems. Springer; 2019. (**All eight chapters**)

Journal Publications

1. **Hongxun Hui**, Yi Ding, Zhenzhi Lin, Pierluigi Siano and Yonghua Song, "Capacity Allocation and Optimal Control of Inverter Air Conditioners Considering Area Control Error in Multi-area Power Systems," *IEEE Transactions on Power Systems*, Early Access, Jun. 2019.
2. **Hongxun Hui**, Yi Ding, Yonghua Song and Saifur Rahman, "Modeling and Control of Flexible Loads for Frequency Regulation Services Considering Compensation of Communication Latency and Detection Error," *Applied Energy*, vol. 250, pp. 161-74, Sep. 2019.

3. **Hongxun Hui**, Yi Ding and Menglian Zheng, "Equivalent Modeling of Inverter Air Conditioners for Providing Frequency Regulation Service", *IEEE Transactions on Industrial Electronics*, vol. 66, no. 2, pp. 1413-23, Feb. 2019.
4. **Hongxun Hui**, Yi Ding, Weidong Liu, You Lin and Yonghua Song, "Operating Reserve Evaluation of Aggregated Air Conditioners", *Applied Energy*, vol. 196, pp. 218-228, Jun. 2017.
5. Yi Ding, **Hongxun Hui** (Corresponding Author), Zhenzhi Lin, Menglian Zheng, Xinyao Qu and Wenqi Cui, "Design of Business Model and Market Framework Oriented to Active Demand Response of Power Demand Side," *Automation of Electric Power Systems*, vol. 41, no. 14, Jul. 2017. (in Chinese)
6. Dunjian Xie, **Hongxun Hui**, Yi Ding and Zhenzhi Lin, "Operating Reserve Capacity Evaluation of Aggregated Heterogeneous TCLs with Price Signals," *Applied Energy*, vol. 216, pp. 338-47, Apr. 2018.
7. Wenqi Cui, Yi Ding, **Hongxun Hui**, Zhenzhi Lin, Pengwei Du, Yonghua Song and Changzheng Shao, "Evaluation and Sequential Dispatch of Operating Reserve Provided by Air Conditioners Considering Lead-Lag Rebound Effect," *IEEE Transactions on Power Systems*, vol. 33, no. 6, pp. 6935-50, Nov. 2018.
8. Yi Ding, Wenqi Cui, Shujun Zhang, **Hongxun Hui**, Yiwei Qiu and Yonghua Song, "Multi-state Operating Reserve Model of Aggregate Thermostatically-Controlled-Loads for Power System Short-term Reliability Evaluation," *Applied Energy*, vol. 241, pp. 46-58, May 2019.
9. Yi Ding, Kaining Luan and **Hongxun Hui** (Corresponding Author), "Energy Saving and Emission Reduction From the Glowworm Project—Coupon-based Demand Response Demonstration in Flat Rate Market," *IEEE Spectrum*, vol. 78, pp. 76-78, Jan. 2019. (in Chinese)
10. Xinran Zhuang, Chengjin Ye, Yi Ding and **Hongxun Hui**, "Data-driven Reserve Allocation with Frequency Security Constraint Considering Inverter Air Conditioners," *IEEE Access*, Aug. 2019.
11. Weidong Liu, **Hongxun Hui** (Corresponding Author), Lijun Zhang, Chenbo Xu, Yikai Sun, Yi Ding, "Analysis on Peak Load Regulation Potential and Evaluation Model of Residential Loads," *Southern Power System Technology*, vol. 10, suppl. 1, pp. 256-263, Dec. 2016. (in Chinese)
12. Yi Ding, Huahua Wu, **Hongxun Hui** (Corresponding Author), and Jun Zhang, "Analysis and Related Suggestions on Power Market Mechanism of Demand Side Response in China," *Southern Power System Technology*, vol. 10, no. 3, pp. 24-31, Mar. 2016. (in Chinese)
13. Kang Xie, Kaijie Zhang, Kaining Luan, **Hongxun Hui**, Yishuang Hu and Yi Ding, "Exploration of Demand Response Score Scheme Under the Background of Electric Power System Reform," *Power Demand Side Management*, vol. 21, no. 3, May 2019. (in Chinese)
14. Zuofeng Li, Wenqi Cui, Zhenyu Chen, **Hongxun Hui**, Kaining Luan, Bin Yang and Yi Ding, "Research and Practice of Interruptible Load in the Market Environment (I)," *Power Demand Side Management*, vol. 18, no. 6, Nov. 2016. (in Chinese)
15. Zhenyu Chen, Wenqi Cui, **Hongxun Hui**, Bin Yang, Kaining Luan and Yi Ding, "Research and Practice of Interruptible Load in the Market Environment (II)," *Power Demand Side Management*, vol. 19, no. 1, Jan. 2017. (in Chinese)

Submitted Journal Publications

1. **Hongxun Hui**, Yi Ding, Kaining Luan, Tao Chen, Saifur Rahman and Yonghua Song, "Coupon-Based Demand Response for Consumers Facing the Flat-Rate Retail Pricing," *IEEE Transactions on Smart Grid*.
2. **Hongxun Hui**, Yi Ding, Tao Chen, Saifur Rahman and Yonghua Song, "Dynamic and Stability Analysis of the Power System With the Control Loop of Inverter Air Conditioners," *IEEE Transactions on Power Systems*.
3. **Hongxun Hui**, Qingxin Shi, Yi Ding, Saifur Rahman, Fangxing Li and Yonghua Song, "Inertia Support and Frequency Regulation of Virtual Synchronous Generator by IACs," *IEEE Transactions on Power Systems*.
4. **Hongxun Hui**, Yi Ding, Qingxin Shi, Fangxing Li, Yonghua Song and Jinyue Yan, "5G Network-based Internet of Things for Demand Response in Smart Grid: A Survey on Application Potential," *Applied Energy*.
5. Qiangqiang Xie, **Hongxun Hui**, Yi Ding, Chengjin Ye, Zhenzhi Lin, Jiadong Cui and Peng Wang, "Utilization of Flexible Residential Loads for Voltage Control and Demand Response," *IEEE Transactions on Sustainable Energy*.
6. Kang Xie, **Hongxun Hui**, Yi Ding, "Review of Modeling and Control Strategy of Thermostatically Controlled Loads for Virtual Energy Storage System," *Protection and Control of Modern Power Systems*.
7. Yi Ding, Dunjian Xie, **Hongxun Hui** and Yan Xu, "Game-Theoretic-Based Demand Side Management of Thermostatically Controlled Loads for Smoothing the Tie-line Power of Microgrid," *IEEE Transactions on Industrial Electronics*.
8. Xinran Zhuang, Yi Ding, Changzheng Shao and **Hongxun Hui**, "Reliability Evaluation of Interconnected Power Systems with VSC-HVDC Links Considering the Frequency Dynamics," *IET Generation, Transmission &*

9. Xingying Chen, Shuyang Xu, Jun Xie, Saifur Rahman, Jixiang Wang, **Hongxun Hui** and Tao Chen, “Agent-based Modelling and Simulation of Electricity Market with Residential Demand Response,” *IET Generation, Transmission & Distribution*.

Peer Reviewed Conference Publications

1. **Hongxun Hui**, Yi Ding, Yonghua Song and Saifur Rahman, “Modelling and Dynamic Performance Analysis of the Power System Under Unit Contingency Shutdown Accidents Considering Demand Response,” *International Conference on Applied Energy*, Sweden, Aug. 2019.
2. **Hongxun Hui**, Yi Ding, Shihai Yang, “Modeling and Analysis of Inverter Air Conditioners for Primary Frequency Control Considering Signal Delays and Detection Errors,” *Energy Procedia*, vol. 158, pp. 4003-10, Hong Kong, China, 2019.
3. **Hongxun Hui**, Yi Ding, Kaining Luan and Daoqiang Xu, “Analysis of 815 Blackout in Taiwan and the Improvement Method of Contingency Reserve Capacity Through Direct Load Control”, *IEEE PES General Meeting*, Portland, U.S.A., 2018.
4. **Hongxun Hui**, Xing Jiang, Yi Ding, Yonghua Song and Li Guo, “Demonstration of Friendly Interactive Grid Under the Background of Electricity Market Reform in China”, *In Environment and Electrical Engineering and 2017 IEEE Industrial and Commercial Power Systems Europe (EEEIC/I&CPS Europe)*, pp. 1-5. IEEE, Milan, Italy, 2017.
5. **Hongxun Hui**, Weidong Liu and Yi Ding, “Quantitative Analysis of Air Conditioner Aggregation for Providing Operating Reserve”, *Energy Procedia*, vol. 104, pp. 50-55, Jinan, China, 2016.
6. Sheng Wang, **Hongxun Hui**, Yi Ding and Chengzhi Zhu, “Cooperation of Demand Response and Traditional Power Generations for Providing Spinning Reserve”, *Energy Procedia*, vol. 421, pp. 2035-41, Cardiff, UK, 2017.
7. Xinyao Qu, **Hongxun Hui**, Shengchun Yang, Yaping Li and Yi Ding, “Price Elasticity Matrix of Demand in Power System Considering Demand Response Programs”, *International Conference on Energy Engineering and Environmental Protection*, Sanya, China, 2017.
8. Xinyao Qu, **Hongxun Hui**, Yi Ding and Kaining Luan, “Optimal Control of Intelligent Electricity Consumption for Residential Customers Considering Demand Response”, *Applied Energy Symposium and Forum*, Tianjin, China, 2017.
9. Wenqi Cui, Yi Ding, **Hongxun Hui**, Maozhen Li, “Two-stage Payback Model for the Assessment of Curtailment Services Provided by Air Conditioners,” *Energy Procedia*, vol. 142, pp. 2050-6, Cardiff, UK, 2017.
10. Kaijie Zhang, Yi Ding, **Hongxun Hui**, Xiaolun Fang and Kang Xie, “Dispatching Potential Evaluation of Thermostatically Controlled Loads Based on Realistic Customer Electricity Data in China,” *IEEE Conference on Energy Internet and Energy System Integration*, Changsha, China, 2019.

SELECTED PATENTS

1. Yonghua Song, **Hongxun Hui**, Yi Ding, et al. “A Calculation Method of Aggregated Air Conditioners for Providing Regulation Services for Power Systems,” No. CN201610821647.X, Dec. 2018. (Issued Patent)
2. Yi Ding, **Hongxun Hui**, Yonghua Song, “An Intelligent Meter with Multi-time Scale Electricity Prices,” No. CN201610543375.1, Oct. 2016. (Issued Patent)
3. Yonghua Song, **Hongxun Hui**, Yi Ding, “A Smart Home System Based on the Real-time Electricity Prices,” No. CN201610540869.4, Oct. 2016. (Substantive Examination)
4. **Hongxun Hui**, Yibai Lu, Lequan Yu, Litong Lv, Hui Sun, “An Electrocardiogram Detection Device Based on Bluetooth Communication,” No. CN201410094326.5, Mar. 2016. (Issued Patent)
5. **Hongxun Hui**, Yi Ding, Yonghua Song, et al. “A Power Consumption Estimation Method Considering the Uncertainty of Electricity Prices,” No. CN201710501055.4, Oct. 2017. (Substantive Examination)
6. Yi Ding, **Hongxun Hui**, Zhenyu Chen, Yonghua Song, et al. “A Power Consumption Estimation Method Considering the Incentive Mechanism,” No. CN201710502069.8, Nov. 2017. (Substantive Examination)

RESEARCH EXPERIENCES

Modeling and Potential Analysis of Flexible Loads

Nanjing, China

Supported by China Electric Power Research Institute (No. DZ71-15-004)

09/2015 – 06/2016

Position: Project director. Supervisor: Prof. Yi Ding

- Mathematical and physical model of typical flexible loads, such as air conditionings, EVs and batteries, are developed by MATLAB.
- The response characteristics, potential and uncertainty with real-time electricity prices are simulated.

- The proposed models and methods have been implemented in Jiangsu Province.

Research and Application of Demand Response

Supported by State Grid Jiangsu Electric Power Co., Ltd (No. KH20161699)

Nanjing, China
03/2016 – 11/2016

Position: Project director. Supervisor: Prof. Yi Ding

- The market mechanism and implementation plan of demand response projects are established for the existing electricity organization structure in China.
- The new spike price policy is implemented. According to the energy efficiency evaluation report in Jiangsu Province, the investments in power plants and transmission lines are postponed around 16.78 billion RMB.

Research on Peak-shaving Capacities and Operation Mechanisms of Flexible Loads

Supported by State Grid Zhejiang Electric Power Co., Ltd (No. 5211JY15001S)

Hangzhou, China
01/2016 – 12/2017

Position: Project director. Supervisor: Prof. Yi Ding

- Peak-shaving capacities of flexible loads are evaluated quantitatively, considering multiple uncertainties.
- The accessible abilities of renewable energies are evaluated considering loads participating in peak-shaving.
- The reliability and economy of the system before and after integrating demand response are evaluated.

Market Mechanism Design for Demand Response

Supported by Ministry of Science and Technology of China (No. 2016YFB0901103)

Nanjing, China
07/2016 – 06/2020

Position: Project director. Supervisor: Prof. Yi Ding

- A business model and a market framework are designed for loads participating in demand response project, including the determination of electricity prices, the transaction method, and the settlement method.
- Around 110,000 customers will be equipped with smart devices and participate in the project, which will be the largest demand response project in China.

Reliability Analysis and Optimization of Smart Grid Considering the Coordinated Operation of Flexible Resources and Wind Power

Supported by National Natural Science Foundation of China (No. 51577167)

Hangzhou, China
01/2016 – 12/2019

Position: Project participant. Supervisor: Prof. Yi Ding

- The basic mechanism causing multiple uncertainties of different types of flexible resources is analyzed.
- The reliability models and evaluation methods for power systems is proposed considering the coupling effects between wind power and flexible resources.

ADDITIONAL INFORMATION

Professional Services

- **Vice President**, IEEE Industry Applications Society Student Branch Chapter in Zhejiang University
- **Journal Reviewer** of *IEEE Transactions on Sustainable Energy* (Since 2019), *Applied Energy* (Since 2018), *Journal of Modern Power Systems and Clean Energy* (Since 2018), *International Journal of Electrical Power & Energy Systems* (Since 2017), *IEEE Transactions on Industrial Electronics* (Since 2017)
- **Conference Reviewer** of *IEEE PES General Meeting*, *International Conference on Applied Energy*, *IEEE Sustainable Power & Energy Conference*, *International Conference on Smart Energy Systems and Technologies*, *IEEE International Conference on Environment and Electrical Engineering* and *IEEE Industrial and Commercial Power Systems Europe*.

Teaching

- Teaching Fellow, *Power System Operation and Control* (Instructor: Prof. Yi Ding and Prof. Pierluigi Siano), College of Electrical Engineering, Zhejiang University, 2016.

Community Contribution

- A Volunteer in Affiliated Hospital of Zhejiang University School of Medicine
- A Lifetime Member in Future Entrepreneur Club, Zhejiang University