Yifan Zhou

Contact Information

Department of Electrical and Computer Engineering
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Research Interests

Microgrid and Networked Microgrids, Quantum Information Sciences, Quantum Grid, Formal Verification, Artificial Intelligence Driven Smart Grid.

Appointments

Department of Electrical and Computer Engineering, Stony Brook University, New York, U.S.

Postdoc, Electrical Engineering, From: February 2020

- Supervisor: Peng Zhang, Associate Professor.

Eversource Energy Center, University of Connecticut, Connecticut, U.S.

Postdoc, Electrical Engineering, August 2019 - February 2020

- Supervisor: Peng Zhang, Associate Professor.

Professional Preparation

Tsinghua University, Beijing, China

Ph.D., Electrical Engineering, September 2014-July 2019

- Supervisor: Yong Min, Professor.
- GPA: 92.0/100, Rank: **5/58**

B.S., Electrical Engeering, September 2010-July 2014

- GPA: 93.1/100, Rank: **1/132**

Refereed Journal Publications

1. **Yifan Zhou**, Peng Zhang, "Noise-resilient quantum machine learning for power system stability assessment", IEEE Transactions on Power Systems, May. 2021. (under review)
2. Fei Feng, **Yifan Zhou**,Peng Zhang, "Quantum Power Flow", IEEE Transactions on Power Systems, accepted, 2021.
3. **Yifan Zhou**, Peng Zhang, "Neuro-reachability of networked microgrids", IEEE Transactions on Power Systems, 2020. (under second round review)
4. **Yifan Zhou**, Fei Feng, Peng Zhang, "Quantum Electromagnetic Transient Program", IEEE Transactions on Power Systems, accepted, 2021.
5. **Yifan Zhou**, Peng Zhang, "Reachable dynamics of networked microgrids with large disturbances", IEEE Transactions on Power Systems, vol. 36, no. 3, pp. 2416-2427, May 2021.
6. **Yifan Zhou**, Peng Zhang, "Reachable Power Flow: Theory to Practice", IEEE Transactions on Power Systems, vol. 36, no. 3, pp. 2532-2541, May 2021.
7. **Yifan Zhou**, Peng Zhang, "Reachable eigenanalysis", IEEE Transactions on Power Systems, vol. 35, no. 6, pp. 4936-4939, Nov. 2020.
8. **Yifan Zhou**, Peng Zhang, "Reachable Power Flow", IEEE Transactions on Power Systems, vol. 35, no. 4, pp. 3290-3293, Jul. 2020.

9. **Yifan Zhou**, Wei Hu, Yong Min, *et al*, "Power and Energy Flexibility of District Heating System and Its Application in Integrated Power and Heat Dispatch", Energy, vol. 190, January 2020.
10. **Yifan Zhou**, Wei Hu, Yong Min, *et al*, "Integrated Power and Heat Dispatch Considering Available Reserve of Combined Heat and Power Units", IEEE Transactions on Sustainable Energy, vol. 10, no. 3, pp. 1300-1310, July 2019.
11. **Yifan Zhou**, Wei Hu, Yong Min, *et al*, "Active Splitting Strategy Searching Approach Based on MISOCP with Consideration of Island Stability", Journal of Modern Power Systems and Clean Energy, vol. 7, no. 3, pp. 475-490, 2019.
12. **Yifan Zhou**, Wei Hu, Yong Min, *et al*, "Modeling and Optimization of Multitype Power Sources Stochastic Unit Commitment Using Interval Number Programming", Journal of Energy Engineering, vol. 143, no. 5, 2017.
13. Wei Hu, Yong Min, **Yifan Zhou**, *et al* "Wind power forecasting errors modelling approach considering temporal and spatial dependence", Journal of Modern Power Systems and Clean Energy, vol. 5, no. 3, 2017.
14. **Yifan Zhou**, Wei Hu, Yong Min, *et al*, "Peak Regulation Compensation Price Decision for Combined Heat and Power Unit and Profit Allocation Method", Proceedings of the Chinese Society for Electrical Engineering, vol.39, no.18, pp. 5325-5335+5579, 2019.
15. **Yifan Zhou**, Wei Hu, Yong Min, *et al*, "Coordinated Power and Heat Dispatch Considering Peak Regulation Initiative of Combined Heat and Power Unit", Automation of Electric Power Systems, vol.43, no.19, pp. 42-51, 2019.
16. **Yifan Zhou**, Wei Hu, Yong Min, *et al*, "Dynamic Comprehensive Evaluation of Chines Power System Development Level Based on Provincial Data", Automation of Electric Power Systems, vol.40, no.18, pp. 76-83, 2016.

Refereed Conference Publications

1. **Yifan Zhou**, Peng Zhang, Yue Meng "An ODE-Enabled Distributed Transient Stability Analysis for Networked Microgrids", IEEE Power and Energy Society General Meeting, 2020.
2. **Yifan Zhou**, Wei Hu, Yong Min, *et al*, "A semi-supervised anomaly detection method for wind farm power data preprocessing", IEEE Power and Energy Society General Meeting, 2017.
3. **Yifan Zhou**, Wei Hu, Yong Min, *et al*, "MILP-based Splitting Strategy Searching Considering Island Connectivity and Voltage Stability Margin", IEEE Power and Energy Society General Meeting, 2016.
4. **Yifan Zhou**, Wei Hu, Yong Min, *et al*, "A novel active splitting strategy search method with modularity-based network partition", IEEE Innovative Smart Grid Technologies - Asia (ISGT ASIA), 2015.
5. **Yifan Zhou**, Wei Hu, Yong Min, *et al*, "Coherency feature extraction based on DFT-based continuous wavelet transform", IEEE PES Asia-Pacific Power and Energy Engineering Conference (APPEEC), 2015.
6. **Yifan Zhou**, Wei Hu, Yong Min, *et al*, "Modelization and optimization of multi-type power generators joint scheduling based on improved PSO", IEEE PES Asia-Pacific Power and Energy Engineering Conference (APPEEC), 2014.

Projects

Quantum Grid, NSF, $ 0.5 M

Senior Personnel, September 2021 – September 2024

- This project aims to develop a new area of Quantum Grid, the world' s first quantum-engineered power infrastructure that integrates quantum computing, quantum artificial intelligence (AI), quantum networking and quantum security to enable a scalable, self-protecting, autonomic and ultra-resilient power grid capable of coordinating ultra-scale renewable energy systems and securing America' s communities and cities.

Practical Quantum Analytics for Ultra-Efficient and Resilient Bulk Power Systems Operations, DOE Office of Electricity, $ 1.2 M

October 2020 – September 2023

- This project aims to develop practical and scalable quantum analytics for power systems to enable resilient bulk power system operations. The main tasks will be to develop fundamental and efficient quantum computing algorithms for power flow, eigenvalue analysis and distributed control by using today' s noisy-intermediate-scale quantum computers. An open-source QGrid Analytics Toolbox will be developed, which consists of efficient linear and non-linear quantum solvers and quantum consensus-based distributed algorithms for power flow, stability, and transient analysis which will support future computing needs for fast and resilient bulk power grid operations.

AI-Enabled, Provably Resilient Networked Microgrids, NSF, $ 1 M

Senior Personnel, August 2020 – May 2021

- This project aims to develop and demonstrate AI-enabled, provably resilient networked microgrids (AI-Grid). The key innovation is a programmable platform that integrates continuous-depth deep neural networks, reachability analysis, formal control, and cybersecurity technologies to enable scalable, self-protecting, autonomic and ultra-resilient microgrids and NMs.
- My work includes: (1) establish an AI-enabled on-line dynamic model discovery method of dynamic NM models; (2) devise AI-enabled formal methods for the on-line dynamic verification and resilient control of NMs under various uncertainties and unidentified subsystems.

Formal Analysis for Dynamic Stability Assessment of Large Interconnected Grids under Uncertainties, DOE Office of Electricity, $ 1.05 M

August 2019 – Present

- This project investigates the formal verification of microgrid, including steady state performance, small-signal stability and transient stability with advanced microgrid control.
- My work includes: (1) devise the reachability methods for power flow, eigenvalue and dynamic analysis of networked microgrids to enable steady-state, small-signal stability and large-signal stability verification under various uncertainties; (2) devise data-driven formal verification methods for networked microgrid by deep learning algorithms.

Integrated Heat and Power Operation Utilizing Flexibility from District Heating System

January 2017 – July 2019

- This project investigates the operational flexibility of the combined heat and power (CHP) units, and utilize this flexibility for integrated heat and power optimal dispatch.
- My contribution is devising a polytope projection-based method to quantify the operational flexibility of the CHP units in different time scale, which can well reflect the heating-dependency, temporal-coupling and component coupling features of the CHP unit's flexibility.

Data-driven Renewable Energy Uncertainty Formulation Jan. 2016 – Dec. 2016

- My contribution is: (1) devising a semi-supervised anomaly detection method for raw data preprocess of renewable energies, which can achieve a good balance between the detection performance and required labels; (2) establishing a wind power uncertainty modelling method by pair-copula theory considering the temporal and spatial dependence.

Control Strategy Decision for Power System Active Splitting June 2015 – May 2017

- This project aims to investigate the splitting strategy decision method for power system real-time control .
- My contribution is formulating the mathematical model for splitting strategy searching considering island operation requirements in the steady state and during the transient process, and investigating the specific splitting strategies for Hubei provincial power system by numerical simulation.

Research Experience

Visiting Graduate May 2018 – October 2018
School of Engineering and Applied Sciences, Harvard University
Supervisor: Na Li, Gordon McKay Professor.

Teaching Experience

Instructor (Graduate Course) Spring 2021
ESE586 - Microgrids
Department of Electrical and Computer Engineering, Stony Brook University

Teaching Assistant (Graduate Course) Spring 2017
70220172 - Power System Theory and Analysis
Department of Electrical Engineering, Tsinghua University

Teaching Assistant (Undergraduate Course) Fall 2015, 2016, 2017
30220343 - Automatic Control Theory
Department of Electrical Engineering, Tsinghua University

Teaching Assistant (Undergraduate Course) Spring 2014
20220443 - Electric and Electronic Technique (2)
Department of Electrical Engineering, Tsinghua University

Awards

Reviewer Awards

- Outstanding Reviewer for IEEE Transactions on Power Systems 2020

Student Awards — Tsinghua University

- Summa Cum Laude, Tsinghua University (1.5%) 2014
- Tsinghua Second-Class Scholarship for Integrated Excellence 2018
- Tsinghua First-Class Scholarship for Integrated Excellence 2015,2013,2012
- Outstanding Graduate of Beijing 2014
- Outstanding Thesis Award, Tsinghua University 2014