XIN CHEN

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Research Interests

- Sustainable power and energy system, human-cyber-physical system (smart grid and smart city)
- Data-driven decision-making, distributed control and optimization, reinforcement learning
- Carbon emissions flow, decarbonization decision-making

Professional Experiences

07/2022 –	**Massachusetts Institute of Technology**, Energy Initiative & Operation Research Postdoctoral Associate (Advisor: Prof. Andy Sun) Topic: *Adaptive optimization and learning for clean power systems*
02/2022 –	**Singularity Energy**, Inc., MA, US Research Scientist *Lead the development of carbon flow analysis and decarbonization products*
02/2022 – 06/2022	**Harvard University**, School of Engineering and Applied Sciences Postdoctoral Fellow (Advisor: Prof. Na Li) Topic: *Data-driven optimization and control of cyber-physical systems*
05/2021 – 08/2021	**Siemens Technology**, Autonomous System and Control Group, NJ, US Intern Researcher Project: *Dynamic power system model calibration using PMU data*

Education

09/2017 – 01/2022	**Harvard University**, School of Engineering and Applied Sciences Ph.D. in Electrical Engineering (Advisor: Prof. Na Li) Thesis: *Distributed and data-driven decision-making for sustainable power systems*
09/2018 – 07/2019	**Harvard University Center for the Environment** Harvard Graduate Consortium Program on Energy and Environment
09/2015 – 07/2017	**Tsinghua University**, Department of Electrical Engineering Master of Science in Electrical Engineering
09/2011 – 07/2015	**Tsinghua University** Bachelor of Science in Engineering Physics, Energy Experimental Class Bachelor of Science in Economics, School of Economics and Management

Selected Awards

2021	**Outstanding Student Paper Award** (one of three), in IEEE 60th Conference on Decision and Control (CDC)
2019	Award of Distinction in Teaching, Harvard University
2018	**Best Student Paper Award Finalist** (one of two), in 2018 IEEE Conference on Control Technology and Applications (CCTA)
2017	**Excellent Master Graduate**, Tsinghua University, Beijing, China
2017	Outstanding Master Thesis Award, Tsinghua University, Beijing, China

2016 **Best Conference Paper Award**, in 2016 IEEE PES General Meeting

2010 1st Prize, National Chemistry Olympiad Competition, Jiangxi Province, China

Teaching Experiences

2019 Fall Teaching Fellow, ES 155: Systems and Control, Harvard University. (Student Rating: 5.0/5.0)

2018 Fall Teaching Fellow, ES 155: Systems and Control, Harvard University.
(**Harvard Award of Distinction in Teaching**)

Student Advising

- Darell Hwang and Victor Qin, undergraduates, Harvard University (co-advised with Prof. Na Li)
  Topic: *Online trajectory tracking with predictions and practical implementation on two-wheel robots*.
- Yutong Nie, undergraduate, Zhejiang University (co-advised with Prof. Na Li)
  Topic: *User learning and selection via contextual multi-armed bandits for residential demand response*.
- Vera Zhou, undergraduate, Harvard University
  Independent Study Project: *Utility maximization and dynamic pricing for optimal demand response*.

Publications

- **Preprints**

[P2] **Xin Chen**, Jorge I. Poveda, Le Xie, and Na Li, "Distributed Model-Free Feedback Control for Real-Time Optimal Power Flow", Working Paper.

[P1] **Xin Chen**, Jorge I. Poveda, and Na Li, "Model-Free Feedback Constrained Optimization via Projected Zeroth-Order Dynamics", arXiv:2206.11123, 2022.

- **Journal Articles**

[J10] **Xin Chen**, Guannan Qu, Yujie Tang, Steven Low, and Na Li "Reinforcement Learning for Selective Key Applications in Power Systems: Recent Advances and Future Challenges," IEEE Transactions on Smart Grid, vol. 13, no. 4, pp. 2935-2958, July 2022.

[J9] **Xin Chen**, Yingying Li, Jun Shimada, and Na Li, "Online Learning and Distributed Control for Residential Demand Response," IEEE Transactions on Smart Grid, vol. 12, no. 6, pp. 4843-4853, Nov. 2021.

[J8] **Xin Chen**, and Na Li, "Leveraging Two-Stage Adaptive Robust Optimization for Power Flexibility Aggregation," IEEE Transactions on Smart Grid, vol. 12, no. 5, pp. 3954-3965, Sept. 2021.

[J7] **Xin Chen**, Yutong Nie, and Na Li, "Online Residential Demand Response via Contextual Multi-Armed Bandits," IEEE Control Systems Letters, vol. 5, no. 2, pp. 433-438, Apr. 2021.

[J6] **Xin Chen**, Changhong Zhao, and Na Li, "Distributed Automatic Load Frequency Control with Optimality in Power Systems," IEEE Transactions on Control of Network Systems, vol. 8, no. 1, pp. 307-318, Mar. 2021.

[J5] **Xin Chen**, Emiliano Dall'Anese, Changhong Zhao, and Na Li, "Aggregate Power Flexibility in Unbalanced Distribution Systems," IEEE Transactions on Smart Grid, vol. 11, no. 1, pp. 258-269, Jan. 2020.

[J4] **Xin Chen**, Wenchuan Wu, and Boming Zhang, "Robust Capacity Assessment of Distributed Generation in Unbalanced Distribution Networks Incorporating ANM Techniques," IEEE Transactions on Sustainable Energy, vol. 9, no. 2, pp. 651-663, Apr. 2018.

[J3] Chenhui Lin, Wenchuan Wu, **Xin Chen**, and Weiye Zheng, "Decentralized Dynamic Economic Dispatch for Integrated Transmission and Active Distribution Networks Using Multi-parametric Programming," IEEE Transactions on Smart Grid, vol. 9, no. 5, pp. 4983-4993, Sept. 2018.

[J2] **Xin Chen**, Wenchuan Wu, Boming Zhang, and Chenhui Lin, "Data-driven DG Capacity Assessment Method for Active Distribution Networks," IEEE Transactions on Power Systems, vol. 32, no. 5, pp. 3946-3957, Sept. 2017.

[J1] **Xin Chen**, Wenchuan Wu, and Boming Zhang, "Robust Restoration Method for Active Distribution Networks," IEEE Transactions on Power Systems, vol. 31, no. 5, pp. 4005-4015, Sept. 2016.

- **Machine Learning Conference Papers**

[C7] **Xin Chen**, Yujie Tang, Na Li, "Improve Single-Point Zeroth-Order Optimization Using High-Pass and Low-Pass Filters", 39th International Conference on Machine Learning (ICML), Baltimore, MD, USA, 2022.

[C6] Yingying Li, **Xin Chen**, and Na Li, "Online Optimal Control with Linear Dynamics and Predictions: Algorithms and Regret Analysis", 33rd Conference on Neural Information Processing Systems (NeurIPS), Vancouver, Canada, 2019.

- **Power & Control Conference Papers**

[C5] **Xin Chen**, Jorge I. Poveda, and Na Li, "Safe Model-Free Optimal Voltage Control via Continuous-Time Zeroth-Order Methods," 60th IEEE Conference on Decision and Control (CDC), Austin, Texas, USA, 2021. (**Outstanding Student Paper Award**)

[C4] **Xin Chen**, Yutong Nie, and Na Li, "Online Residential Demand Response via Contextual Multi-Armed Bandits," 59th IEEE Conference on Decision and Control (CDC), Jeju Island, Korea, 2020.

[C3] **Xin Chen**, and Na Li, "Exponential Stability of Primal-Dual Gradient Dynamics with Non-Strong Convexity," 2020 American Control Conference (ACC), Denver, USA, pp. 1612-1618, 2020.

[C2] **Xin Chen**, Changhong Zhao, and Na Li, "Distributed Automatic Load-Frequency Control with Optimality in Power Systems," 2018 IEEE Conference on Control Technology and Applications (CCTA), Copenhagen, Denmark, pp. 24-31, 2018. (**Best Student Paper Award Finalist**)

[C1] **Xin Chen**, Wenchuan Wu, and Boming Zhang, "A Robust Approach for Active Distribution Network Restoration Based on Scenario Techniques Considering Load and DG Uncertainties," IEEE Power and Energy Society General Meeting (PESGM), Boston, MA, USA, 2016. (**Best Conference Paper Award**)

Chapter in Book

[1] **Xin Chen** and Wenchuan Wu, "Network Reconfiguration and Restoration Control for Active Distribution Networks," Chapter in *Active Distribution Network Analysis, Operation and Control* (in Chinese), Science Press, China, Sept. 2016.

Patents

- US Provisional Patent: 63/368663. Grid carbon flow and decarbonization decision-making. **Xin Chen** and Wenbo Shi. 2022.
- US Provisional Patent. Methane emissions intensity and tracing in gas networks. **Xin Chen** and Wenbo Shi.
- US Patent US2017/0070044A1. Robust restoration method for active distribution network. Wenchuan Wu, …, **Xin Chen**, et al. Publication date: Mar/9/2017.
- Chinese Patent CN106169750B. A method for calculating total supply capability of active distribution network based on second-order cone relaxation. Wenchuan Wu, …, **Xin Chen**, et al. Oct/19/2018.

- Chinese Patent CN106099984B. A data-driven method for evaluating the capacity of distributed generation in active distribution network. Wenchuan Wu, …, **Xin Chen**, et al. Granted date: Oct/19/2018.
- Chinese Patent CN105140917B. Robust restoration method for active distribution network under uncertainty. Wenchuan Wu, …, **Xin Chen**, et al. Granted date: May/10/2017.

Professional Services

- **Conference Committee and Organizer**:

2023	Technical program committee for 14th ACM International Conference on Future Energy Systems (ACM e-Energy 2023).
2022	Chair for the session "Stochastic derivative-free optimization" in 2022 International Conference on Continuous Optimization (ICCOPT).
2021	Chair for the session "Data-driven optimization and control for power systems" in 2021 INFORMS Annual Meeting.
2021	Assistant for the session "Adversarial Learning" in 3rd Learning for Dynamics & Control (L4DC).

- **Reviewer for Journals**: IEEE Transactions on Smart Grid, IEEE Transactions on Power Systems, Automatica, IEEE Transactions on Automatic Control, IEEE Transactions on Sustainable Energy, IET Generation, Transmission & Distribution, IET Renewable Power Generation, Systems & Control Letters, IEEE Control Systems Letters, International Journal of Electrical Power & Energy Systems, etc.
- **Reviewer for Conferences**: IEEE Conference on Decision and Control, American Control Conference, IEEE PES General Meeting, IEEE Conference on Control Technology and Applications, IEEE International Conference on SmartGridComm, Learning for Dynamics and Control (L4DC) Conference, European Control Conference, International Symposium on Mathematical Theory of Networks and Systems, etc.

Invited Talks

10/2022	2022 INFORMS Annual Meeting, Indianapolis, IN, US *Reinforcement learning for decision-making and control in power systems*
07/2022	International Conference on Continuous Optimization (ICCOPT) 2022, Bethlehem, PA, US *Leverage high-pass and low-pass filters to improve single-point zeroth-order optimization*
07/2022	39th International Conference on Machine Learning (ICML), Baltimore, MD, USA *Improve single-point zeroth-order optimization using high-pass and low- pass filters*
07/2022	2022 IEEE PES General Meeting, Denver, CO, US Tutorial: *Distributed model-free optimal voltage control*
03/2022	Center for Intelligent and Networked Systems, Tsinghua University, China *Model-free control and optimization using zeroth-order methods*
03/2022	SEAS Research Showcase - Lightning Talks, Harvard University, MA, US *The future of smart power and energy system*
12/2021	60th Conference on Decision and Control (CDC), Austin, Texas, US *Safe model-free optimal voltage control via continuous-time zeroth-order methods*
10/2021	2021 INFORMS Annual Meeting, Anaheim, California, US *Model-free optimal voltage control in distribution systems*
06/2021	Siemens Technology, Autonomous System and Control Research Group, NJ, US *Real-time feedback optimal voltage control*
12/2020	59th Conference on Decision and Control (CDC), Jeju Island, Korea

Online residential demand response via contextual multi-armed bandit

07/2020 2020 American Control Conference (ACC), Denver, CO, US
Exponential stability of primal-dual gradient dynamics with non-strong convexity

08/2018 2nd IEEE Conference on Control Technology and Applications, Copenhagen, Denmark
Distributed automatic load-frequency control with optimality in power systems

07/2016 2016 IEEE PES General Meeting, Boston, MA, US
Robust restoration approach for active distribution network based on scenario techniques