YU YANG

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POSITION

Associate professor *Oct. 2021 - present*
School of Automation Science and Engineering
Xi'an Jiaotong University, Shaanxi, China

Postdoctoral Scholar *Aug. 2018 - Aug. 2021*
Berkeley Education Alliance for Research in Singapore (BEARS)
University of California, Berkeley
Supervisor: Prof. Costas J. Spanos (UC Berkeley)
Co-supervisor: Prof. Guoqiang Hu (NTU)

EDUCATION

PhD., Department of Automation *Sept. 2013 - Jul. 2018*
Tsinghua University
Supervisor: Prof. Xiaohong Guan
Co-supervisor: Prof. (Samuel) Qing-Shan Jia

Visiting scholar, Department of Electrical Engineering *Mar. 2016 - Mar. 2016*
University of Leuven, Belgium
Visiting supervisor: Prof. Geert Deconinck

B.S., Department of Control Science and Engineering *Sept. 2009 - Jul. 2013*
Huazhong University of Science and Technology

RESEARCH INTERESTS

My research interest lies in the optimization, decision-making and mechanism design for cyber-physical systems (CPS), including smart grids, smart buildings, energy communities among many others. I have been continuously devoting to overcoming the modeling and computational challenges faced by the emerging large-scale complex dynamic systems under uncertainties. To achieve the target, my research deeply depends on interdisciplinary theories including but not limited to

- **Learning: Markov decision process (MDP), reinforcement learning (RL), multi-agent reinforcement learning, etc.**
- **Distributed convex or nonconvex optimization: alternating direction method of multipliers (ADMM), etc.**
- **Games: Collation game and Stackelberg game, etc.**

I have particular interest in exploring the deep integration of interdisciplinary theories such as distributed optimization and reinforcement learning to advance intelligent systems.

PROJECTS OUTLINE

1. Optimal integration of distributed energy resources (DERs) at consumer side via market mechanism design (SinBerBEST project, National Research Foundation of Singapore), *2018 - 2021*.

- **Proposed a stable energy storage (ES) sharing mechanism across multiple households for energy community based on coalition game which provides high ES utilization and fair cost allocation across the participants.**
- **Proposed a novel peer-to-peer (P2P) energy trading mechanism based on Stackelberg game which enables the prosumers with DERs to trade energy for maximal economic benefits considering both the energy transmission loss and physical electric network transmission capacity constraints.**
- **Proved the existence of the Stackelberg equilibrium for the P2P energy trading mechanism, which implies the balance of economic benefits among competing stakeholders.**

2. Adaptive and intelligent control of heating, ventilation, and air-conditioning (HVAC) systems for energy-efficient buildings (SinBerBEST project, National Research Foundation of Singapore), *2018 - 2021*.

- **Proposed a comprehensive model for HVAC system operation cost optimization considering human comfort model (i.e., thermal comfort and IAQ).**
- **Proposed novel distributed algorithms for commercial HVAC systems to coordinate the heating/cooling control of multiple zones for providing human comfort, which can overcome the computation challenges with the large-scale non-linear and non-convex complex optimization problems.**
- **Established the convergence of the distributed method for general nonconvex optimization.**

3. Temporal and spatial coordination of electric vehicle (EV) charging demand with onsite renewable generation in sustainable cities (National Natural Science Foundation of China), *2015 - 2018*.

- **Established a Markov decision process (MDP) model for the temporal and spatial scheduling of EV charging demand at multiple renewable-powered charging stations, which is able to fully capture the temporal and spatial dynamics of EV charging demand related to human driving behaviors.**
- **Proposed a distributed reinforcement learning (DRL) algorithm to empower the vehicles to learn their charging polices for minimal charging cost through the interactions with the charging stations The DRL algorithm is novel in overcoming the computation intensity of centralized learning framework and protecting privacy.**
- **Established the convergence of the distributed method for general nonconvex optimization.**
- **Proved the convergence of the DRL.**

4. Data-driven prediction of energy consumption of occupants in buildings (National Natural Science Foundation of China), *2014 - 2015*.

- **Build a platform by using non-intrusive sensors (i.e., weather stations, power meters, GPS location devices, illuminance sensors) to monitor the energy consumption behaviors of graduates at appliance level in correlated buildings (i.e., laboratory, dormitory).**

. Proposed a data-driven Markov chain model for predicting the energy consumption of occupants by using multi-dimensional information (i.e., time, occupant location, weather, etc.) with improved prediction accuracy.

PUBLICATIONS

Journal Papers

. Y. Yang, Q. -S. Jia, Z. Xu, X. Guan, and C. J. Spanos, "Proximal ADMM for Nonconvex and Nonsmooth Optimization," vol. 146, 110551, *Automatica*, 2022.

. Y. Yang, Y. Chen, G. Hu and C. J. Spanos, "Optimal Network Charge for Peer-to-Peer Energy Trading: A Grid Perspective," *IEEE Transactions on Power Systems*, vol. 38, no. 3, pp. 4185-4194, 2022.

. Y. Yang, G. Hu, and C. J. Spanos, "Optimal Sharing and Fair Cost Allocation of Community Energy Storage," *IEEE Transactions on Smart Grid*, vol. 12, no. 5, pp. 4185-4194, 2021.

. Y. Yang, S. Srinivasan, G. Hu, and C. J. Spanos, "Distributed Control of Multi-zone HVAC Systems Considering Indoor Air Quality," *IEEE Transactions on Control Systems Technology*, vol. 29, no. 6, pp. 2586-2597, 2021.

. Y. Yang, G. Hu, and C. J. Spanos, "Stochastic Optimal Control of HVAC system for Energy-efficient Buildings," *IEEE Transactions on Control Systems Technology*, vol. 30, no. 1, pp. 376-383, 2021.

. Y. Yang, G. Hu, and C. J. Spanos, "HVAC Energy Cost Optimization for a Multi-zone Building via A Decentralized Approach," *IEEE Transactions on Automation Science and Engineering*, vol. 17, no. 4, pp. 1950-1960, 2020.

. Y. Yang, Q. -S. Jia, X. Guan, X. Zhang, Z. Qiu, and G. Deconinck, "Decentralized EV-based Charging Optimization With Building Integrated Wind Energy," *IEEE Transactions on Automation Science and Engineering*, vol. 16, no. 3, pp. 1002-1017, 2018.

. Y. Yang, Q. -S. Jia, G. Deconinck, X. Guan, Z. Qiu, and Z. Hu, "Distributed Coordination of EV Charging with Renewable Energy in a Microgrid of Buildings," *IEEE Transactions on Smart Grid*, vol. 9, no. 6, pp. 6253-6264, 2017.

. Y. Chen, Y. Yang, and X. Xu, "Towards transactive energy: An analysis of information-related practical issues," Energy Conversion and Economics, vol. 3, no. 3, pp. 112-121, 2022.

. T. Long, Q. -S. Jia, G. Wang, Y. Yang, "Efficient Real-Time EV Charging Scheduling via Ordinal Optimization," *IEEE Transactions on Smart Grid*, vol. 12, no. 5, pp. 4029-4038, 2021.

. Q.-S. Jia, Y. Yang, L. Xia, and X. Guan, "A Tutorial on Event-Based Optimization With Application in Energy Internet," *Control Theory & Applications*, vol. 35, no. 1, pp. 32-40, 2018.

Conference Papers

. Y. Yang, Q. -S. Jia, and X. Guan, "Stochastic Coordination of Aggregated Electric Vehicle Charging With On-site Wind Power at Multiple Buildings," *56th IEEE Conference on Decision and Control*, pp. 4434-4439, Melbourne, Australia, Dec. 12-15, 2017.

. **Y. Yang, Q. -S. Jia, and X. Guan, "The joint scheduling of EV charging load with building mounted wind power using simulation-based policy improvement," *IEEE International Symposium on Flexible Automation*, pp. 165-170, Cleveland, Ohio, USA, Aug. 1-3, 2016.**

. **Y. Yang, Q.-S. Jia, and X. Guan, "Improving the Prediction Accuracy of Building Energy Consumption using Location of Occupant-A Case Study," *IEEE International Conference on Industrial Technology*, pp.1550-1555, Taipei, China, Mar. 14-17, 2016.**

PRESENTATIONS(2021-)

. ***Distributed Optimization and Its Applications in Cyber-Physical Energy Systems*, invited talk, Shanghai Jiaotong University, Mar. 26, 2023.**

. ***Using Decentralized Optimization to Advance Cyber-Physical Energy System*, invited talk, Tsinghua University, Mar. 14, 2022.**

. ***Selling Renewable Utilization Service to Consumers via Cloud Energy Storage*, seminar talk, Berkeley Education Alliance for Research in Singapore, Singapore, oct. 29, 2021.**

ACADEMIC SERVICE

. **Associate Editor *Results in Control and Optimization*, 2021-present.**

. **Accociate Editor of the16th *IEEE International Conference on Control and Automation*, 2020.**

. **Reviewer of international journals: *IEEE Transactions on Automatic Control, Automatica, IEEE Control Systems Letters (L-CSS)*, *IEEE Transactions on Control Systems Technology*, *IEEE Transactions on Smart Grid*, *IEEE Transactions on Automation Science and Engineering*, *SCIENCE CHINA Information Sciences*.**