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University of Michigan-Shanghai Jiao Tong University Joint Institute
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Research Interests:

Game theory, multi-agent modeling, applications in decentralized modeling and control of networked energy systems such as hybrid energy systems, wireless power transfer systems, microgrids, and smartgrids.

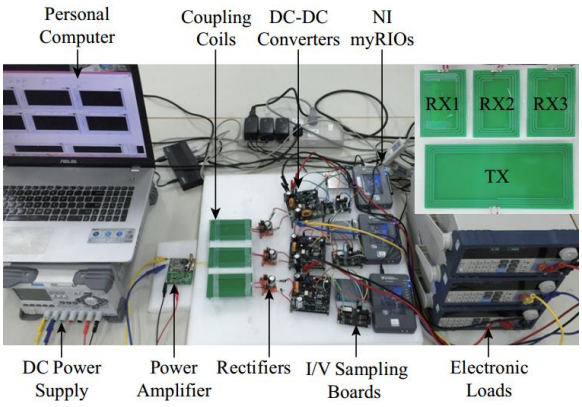
Education:

University of Michigan-Shanghai Jiao Tong University Joint Institute, Shanghai, P.R. China

- Ph.D. candidate, Electrical and Computer Engineering, September 2012 - Present.
- B.S., Electrical and Computer Engineering, August 2012.

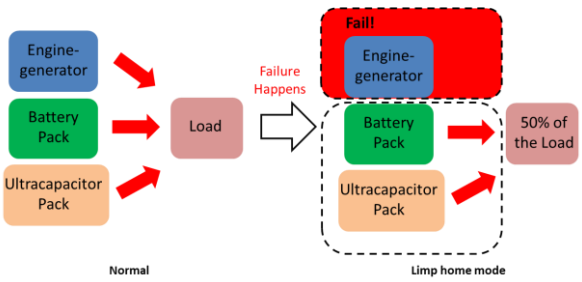
Research Experiences:

1. **Decentralized Charging Control of A Wireless Networked Energy System: A Game Theoretic Approach (December 2014 - present)**



A decentralized charging control of a wireless networked energy system, namely a multiple-receiver wireless power transfer system is discussed and analyzed. This charging control problem is challenging due to the decentralized nature of the system and possible changing numbers and types of the energy storage devices as loads of the receivers. The charging control problem is formulated as a generalized Stackelberg game. At each control instant, the generalized Nash equilibrium is reached by searching the Lagrange multiplier that determines the charging power of each receiver, while the total charging power is updated in a step-by-step manner. All the theoretical results are validated through both simulation and experiments with different energy storage devices quit and join the wireless charging.

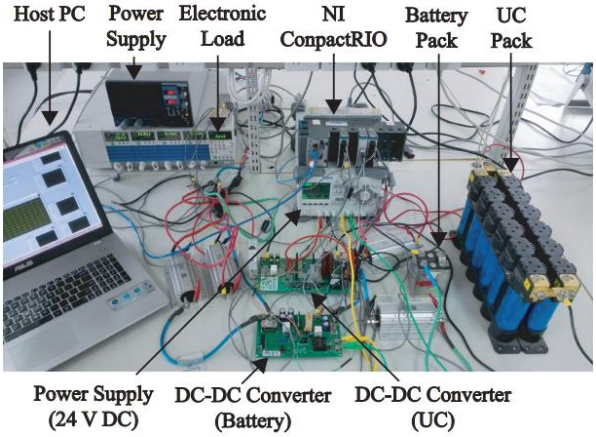
2. **Game Theory-based Fault Tolerance Control for Multi-Source Energy Systems (December 2015 - present)**



Fault tolerance control is discussed through a decentralized game theoretic approach, in which a three-source (engine-generator, battery and ultracapacitor packs) hybrid energy system is used as an example. The energy management problem among the energy sources and the load is formed into a non-cooperative power distribution game, where the engine-generator, the battery pack, the UC pack, and the load are modeled as independent players. Each player has its own objective, i.e., reducing fuel consumption, prolonging battery cycle life, maintaining UC

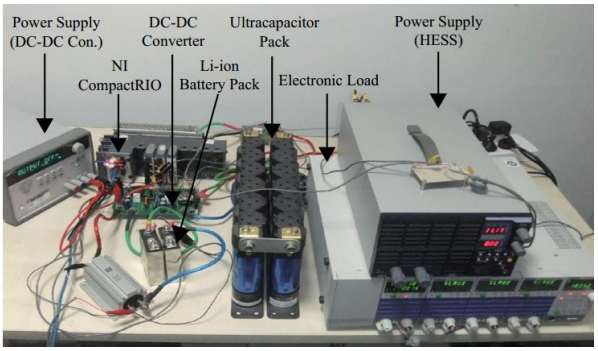
charge/discharge capability, and meeting the load requirement, represented by different utility functions. In this game, a new Nash equilibrium is reached when some of the sources fail. The weight coefficients in the utility functions are updated through a genetic algorithm. This decentralized approach makes the energy management reconfigurable and flexible when fault happens [Under Investigation].

3. A Game Theory Approach to Energy Management of An Engine-generator/Battery/Ultracapacitor Hybrid Energy System (March 2014 - January 2016)



The complex configuration and behavior of multisource hybrid energy systems (HESs) present challenges to their energy management. For a balanced solution, it is especially important to represent and take advantage of the characteristics of each device, and the interactive relationship among them. Therefore, multi-agent modeling and a game theory-based control strategy are proposed and combined for the energy management of an example engine-generator/battery/ultracapacitor HES. The energy management problem is then formulated as a non-cooperative current control game. The Nash equilibrium is analytically derived as a balanced solution that compromises the different preferences of the independent devices. All the theoretical results are validated through both simulation and experiments. [Publication]

4. Utility Function-Based Real-Time Control of A Battery-Ultracapacitor Hybrid Energy System (September 2012 - January 2014)



A cooperative game theory-based energy management of a battery-ultracapacitor hybrid energy system is discussed and analyzed. The example system employs the battery semi-active topology. In order to represent different performance and requirements of the battery and ultracapacitor packs, the two packs are modeled as two independent but related agents using the NetLogo environment. Then the energy management problem is converted to a multi-objective optimization problem solved by using the Karush-Kuhn-Tucker conditions. The weights in the objective functions are chosen based on the location of the knee point in the Pareto set. All the theoretical results are validated through both simulation and experiments [Publication].

Project Experiences:

2015.11～present: Beijing Jiao Tong University, China Team Leader

Develop a complete battery management system including sensing circuits, SOC and SOH estimation, and active balancing circuit.

2014.03～2015.11: ChangAn Automotive, China Team Leader

Develop and implement an energy management strategy for a series hybrid electrical vehicle powered by engine-generator, battery and ultracapacitor packs.

2013.04～2015.04: Nippon Chemi-Con, Japan Team Member

Test and analyze the lithium-ion battery cycle life improvement through using ultracapacitors.

2012.09～2013.09: Nippon Chemi-Con, Japan Team Member
Design and test a battery-ultracapacitor hybrid energy storage system including design and fabricate of bidirectional/unidirectional DC/DC converters, programming and integration.

Extracurricular Experiences：

2015.09～2015.12:	UM-SJTU JI Capstone Design	Teaching Assistant
2015.03～2015.05:	Ve216-Signals and Systems	Teaching Assistant
2014.05～2014.08:	Ve216-Signals and Systems	Teaching Assistant
2014.03～2014.05:	Ve216-Signals and Systems	Teaching Assistant
2013.03～2013.05:	Ve216-Signals and Systems	Teaching Assistant
2012.05～2012.08:	UM-SJTU JI Capstone Design	Teaching Assistant
2010.10～2010.11:	2010 EXPO Shanghai	Volunteer

Scholarships & Awards：

- Best Presentation Recognition in IEEE Industrial Electronics Society Annual Conference, 2014 and 2015
- "Utility Function-Based Real-Time Control of A Battery–Ultracapacitor Hybrid Energy System" published in IEEE Trans. on Industrial Informatics, appeared in IEEE Industrial Electronics Technical News (ITeN), 2015
- UM-SJTU Joint Institute Dean's List (six times, GPA > 3.5)

Certificates & Skills：

- English: Fluent in speaking and writing (note: working language in UM-SJTU Joint Institute)
- Professional software skill: Labview, CCS, Matlab, C++, Netlogo, PSIM, AVL Cruise
- Professional micro controller design experience: NI myRIO, NI CompactRIO, DSP 28335, Micro Chip PIC 32

Journal Papers：

1. **H. Yin**, C. Zhao, M. Li, C. Ma: "Utility Function-Based Real-Time Control of A Battery-Ultracapacitor Hybrid Energy System", *IEEE Transactions on Industrial Informatics*, Vol. 11. No. 1, pp. 220-231, February 2015. [PDF]
2. **H. Yin**, C. Zhao, M. Li, C. Ma, M. Chow: "A Game Theory Approach to Energy Management of An Engine-generator/Battery/Ultracapacitor Hybrid Energy System", *IEEE Transactions on Industrial Electronics, accepted on Jan*. 26th, 2016. [PDF]
3. **H. Yin**, W. Zhou, M. Li, C. Ma, "An Adaptive Fuzzy Logic Based Energy Management Strategy on Battery/Ultracapacitor Hybrid Electric Vehicles", *IEEE Transactions on Transportation Electrification*, accepted on Mar. 27th, 2016. [PDF]
4. **H. Yin**, M. Fu, C. Ma, "Decentralized Charging Control of A Wireless Networked Energy Storage System: A Game Theoretic Approach", *IEEE Transactions on Industrial Informatics*, (Under 1st review)
5. M. Fu, **H. Yin**, X. Zhu, C. Ma: "Analysis and Tracking of Optimal Load in Wireless Power Transfer Systems", *IEEE Transactions on Power Electronics*, Vol. 30, No. 7, pp. 3952-3963, July 2015. [PDF]
6. C. Zhao, **H. Yin**, Z. Yang, and C. Ma, "Equivalent series resistance based energy loss analysis of a battery semi-active hybrid energy storage system," *IEEE Transactions on Energy Conversion*, Vol. 30, No. 3, pp. 1081-1091, September 2015. [PDF]
7. C. Zhao, **H. Yin**, and C. Ma, "Quantitative evaluation of LiFePO4 battery cycle life improvement using ultracapacitors," *IEEE Transactions on Power Electronics*, Vol. 31, No. 6, pp. 3989-3993, June 2016. [PDF]

Conference Papers：

1. **H. Yin**, M. Fu, C. Zhao, and C. Ma, “Power distribution of a multiple-receiver wireless power transfer system: A game theoretic approach” in 2015 IEEE 41th Annual Conference, Yokohama, Japan, 2015: 001776-001781. [PDF]
2. **H. Yin**, C. Zhao, Z. Yang, and C. Ma, “Control of a generator-battery-ultracapacitor hybrid energy system using game theory” , in 2014 IEEE 40th Annual Conference, Dallas, USA, 2014: 3115-3121 [PDF]
3. **H. Yin**, C. Zhao, M. Li, and C. Ma, “Optimization based energy control for battery/super-capacitor hybrid energy storage systems”, in 2013 IEEE 39th Annual Conference, Vienna, Austria, 2013: 6764-6769 .[PDF]
4. W. Zhou, M. Li, **H. Yin**, and C. Ma, “An adaptive fuzzy logic based energy management strategy for electric vehicles,” in 2014 IEEE 23rd International Symposium on Industrial Electronics (ISIE), Istanbul, Turkey, June 1-4, 2014, pp. 1778–1783.
5. C. Zhao, **H. Yin**, Z. Yang, C. Ma: “A Quantitative Comparative Study of Efficiency for Battery-Ultracapacitor Hybrid Systems”, the 40th Annual Conference of the IEEE Industrial Electronics Society, Dallas, USA, Nov. 30-Dec. 1, 2014. [PDF]
6. C. Zhao, **H. Yin**, M. Fu, C. Ma, “Analysis, control, and wireless charging of energy systems using ultracapacitors”, 2014 IEEE International Electric Vehicle Conference, Dec. 17-19, 2014, Florence, Italy. [PDF]
7. C. Zhao, **H. Yin**, Z. Yang, C. Ma, "Equivalent Series Resistance-based Real-time Control for a Battery-Ultracapacitor Hybrid System", the 41st Annual Conference of the IEEE Industrial Electronics Society, Yokohama, Japan, Nov. 9-12, 2015. [PDF]