TONG HUANG

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RESEARCH INTERESTS

My research interests lie in the following intertwined areas: **data analytics**, **cyber security**, and the **modeling and control** of power grids with deep renewables and energy storage.

HIGHLIGHTS

- Won the **Best Paper Award** (*top* 0.76% of 1448 papers submitted) as the first author in the 54-th Hawaii International Conference on System Sciences
- Won the **Best Paper Award** (*top* 5% of around 1600 papers submitted) as the first author in the IEEE Power & Energy Society General Meeting, 2020
- **Delivered all lectures** of an undergraduate/graduate course as a Graduate Teaching Fellow at Texas A&M University (Application of Data Science in Modern Power Systems)
- Actively participated in the writing of a proposal that won a **$4.4M** grant from the Department of Energy; the technical side of the proposal was built on my research on grid cybersecurity
- Published 5 journal and magazine articles, 9 conference papers and 1 patent

ACADEMIC APPOINTMENTS

Massachusetts Institute of Technology, Cambridge, MA *Jan. 2022 - now*
Postdoctoral Associate at MIT Laboratory of Information & Decision Systems
Mentor: Marija Ilic (NAE member)

Texas A&M University, College Station, TX *Sep. - Dec. 2021*
Postdoctoral Researcher (Mentor: Le Xie, Fellow of IEEE)

EDUCATION

Texas A&M University, College Station, Texas *Aug. 2017 - Aug. 2021*
Doctor of Philosophy in Electrical Engineering
Thesis: Physical and Cyber Anomaly Management in Massively Digitized Power Systems

Massachusetts Institute of Technology, Cambridge, Massachusetts *Sep. - Dec. 2018*
Visiting Ph.D. student at Laboratory of Information & Decision Systems

Texas A&M University, College Station, Texas *Aug. 2014 - May. 2017*
Master of Science in Electrical Engineering

North China Electric Power University, Baoding, China *Sep. 2009 - Jul. 2013*
Bachelor of Engineering in Electric Power Engineering and its Automation

INDUSTRY EXPERIENCE

Mitsubishi Electric Research Laboratories, Cambridge, Massachusetts *May - Aug. 2019*
Intern Researcher at Data Analytics group

- Developed a framework for parameter coordination of networked microgrids against disasters
- Drafted a conference paper (won the **Best Paper Award**) and a patent published

ISO New England, Holyoke, Massachusetts *Jan. - May 2018*
Intern Researcher at the Department of Business Architecture Technology

- Developed PCM-TSAT adaptor for studying cascading failure from a transient viewpoint
- Developed Sensitivity Analysis Tool for Vermont model improvement

TEACHING EXPERIENCE

Undergraduate/graduate course: Application of Data Science in Modern Power Systems
Instructor *Jan. - May 2020*

- Provided lectures; developed course materials; mentored students; and supervised TA

Teaching Assistant *Sep. - Dec 2017*

- Designed homework/quiz/exam; provided tutorials; graded homework/quiz/exam

PROPOSAL EXPERIENCE

Proposal Title: Secure Monitoring and Control of Solar Power Distribution System Through Dynamic Watermarking *May - Nov. 2019*

- Drafted part of concept paper and part of technical volume
- Drafted a response letter and slides for a pre-selection clarification interview
- Result: **$4.4 million** grant from the Department of Energy

HONORS AND AWARDS

- **Best Paper Award**, 54-th Hawaii International Conference on System Sciences, 2021
- **Best Paper Award**, IEEE Power & Energy Society General Meeting, 2020
- Graduate Teaching Fellowship, Texas A&M University, 2020
- Thomas Powell'62 and Powell Industries Inc. Fellowship, 2020
- Third Place Poster Award, IEEE Texas Power and Energy Conference, 2021

PUBLICATIONS

Journal Papers:

[1] **T. Huang**, S. Gao, and L. Xie,"A Neural Lyapunov Approach to Transient Stability Assessment of Power Electronics-interfaced Networked Microgrids," in *IEEE Transactions on Smart Grid* (accepted, to appear).

[2] **T. Huang**, J. Ramos-Ruiz, W. Ko, J. Kim, P. Enjeti, P. Kumar, and L. Xie,"Enabling Secure Peer-to-peer Energy Transaction through Dynamic Watermarking in Future Distribution Grids," in *IEEE Electrification Magazine*, vol. 9, no. 3, pp. 55-64, Sept. 2021.

[3] **T. Huang**, N. M. Freris, P. R. Kumar and L. Xie, "A Synchrophasor Data-Driven Method for Forced Oscillation Localization Under Resonance Conditions," in *IEEE Transactions on Power Systems*, vol. 35, no. 5, pp. 3927-3939, Sept. 2020

[4] **T. Huang**, B. Satchidanandan, P. R. Kumar and L. Xie, "An Online Detection Framework for Cyber Attacks on Automatic Generation Control," in *IEEE Transactions on Power Systems*, vol. 33, no. 6, pp. 6816-6827, Nov. 2018.

[5] **T. Huang**, M. Wu and L. Xie, "Prioritization of PMU Location and Signal Selection for Monitoring Critical Power System Oscillations," in *IEEE Transactions on Power Systems*, vol. 33, no. 4, pp. 3919-3929, July 2018.

Conference Papers:

[6] A. Jena, **T. Huang**, S. Sivaranjani, D. Kalathil, and L. Xie, "Distributed Learning-based Stability Assessment for Large Scale Networks of Dissipative Systems," *2021 60th Conference on Decision and Control*.

[7] J. Ramos-Ruiz, H. Ibrahim, J. Kim, **T. Huang**, P. Enjeti, L. Xie, and, P. Kumar, "Validation of a Robust Cyber Shield for a Grid Connected PV Inverter System via Digital Watermarking Principle," *2021 IEEE 12th International Symposium on Power Electronics for Distributed Generation Systems* (PEDG).

[8] **T. Huang**, S. Gao, X. Long, and L. Xie, "A Neural Lyapunov Approach to Transient Stability Assessment in Interconnected Microgrids," in *54-th Hawaii International Conference on System Sciences* (HICSS 54), 2021. (**Best Paper Award**, *top* 0.76% of 1448 papers submitted)

[9] **T. Huang**, H. Sun, K. Kim, D. Nikovski, and L. Xie, "A holistic framework for parameter coordination of interconnected microgrids against disasters," *IEEE Power and Energy Society General Meeting 2020*. (**Best Paper Award**, *top* 5% of around 1600 papers submitted)

[10] J. Ramos-Ruiz, J. Kim, W. Ko, **T. Huang**, P. Enjeti, P. Kumar, and L. Xie, "An Active Detection Scheme for Cyber Attacks on Grid-tied PV Systems," in *IEEE CyberPELS*, Miami, FL, USA, 2020, pp. 1-6

[11] **T. Huang**, B. Wang, J. Ramos-Ruiz, P. Enjeti, P. R. Kumar, and L. Xie, "Detection of Cyber Attacks in Renewable-rich Microgrids Using Dynamic Watermarking," *IEEE PES General Meeting* 2020.

[12] W. Li, **T. Huang**, N. Freris, P. Kumar, and L. Xie "Data-driven Localization of Forced Oscillations in Power Systems," in *IEEE PES Innovative Smart Grid Technologies Asia* (ISGT Asia), 2019.

[13] **T. Huang**, N. M. Freris, P. R. Kumar, and L. Xie, "Localization of forced oscillations in the power grid under resonance conditions," *52nd Annual Conference on Information Sciences and Systems* (CISS), Princeton, NJ, 2018, pp. 1-5.

[14] M. S. Modarresi, **T. Huang**, H. Ming, and L. Xie, "Robust Phase Detection in Distribution Systems," *2017 IEEE Texas Power and Energy Conference* (TPEC), College Station, TX, 2017, pp. 1-5.

Papers in Preparation/under Review:

[15] X. Zheng, N. Xu, L. Trinh, D. Wu, **T. Huang**, S. Sivaranjani, Y. Liu, and L. Xie, "PSML: A Multi-scale Time-series Dataset for Machine Learning in Decarbonized Energy Grids," *arXiv preprint* arXiv:2110.06324 (2021).

[16] L. Xie, **T. Huang**, Y. Liu, M. Wang, V. Vittal, P. Kumar, S. Shakkottai, E. Xing, and Y. Cui, "Accelerating the Electric Grid Carbon Neutral Transition through Domain-tailored Artificial

Intelligence," *Joule* (submitted).

[17] L. Xie, **T. Huang**, P. Kumar, A. Thatte, and S. Mitter, "On a Control Architecture for Future Electric Energy Systems," *Proceedings of the IEEE* (submitted).

[18] L. Xie, Y. Sun, X. Zheng, **T. Huang**, and T. Bruton, "Massively Digitized Power Grid: Opportunities andChallenges from Use-inspired AI," *Proceedings of the IEEE* (submitted).

[19] W. Ko, J. Ramos-Ruiz, **T. Huang**, J. Kim, P. Enjeti, P. Kumar, and L. Xie, "Robust Dynamic Watermarking for Cyber-physical Security of Inverter-Based Resources in Distribution Systems," *IEEE Transactions on Smart Grid* (submitted).

PATENT DISCLOSURE

H. Sun, **T. Huang**, and K. Kim, "Methods and Systems for A Holistic Framework for Parameter Coordination of Interconnected Microgrid Systems against Disasters," *U.S. Patent No. 11,196,256*, Dec. 7, 2021.

PRESENTATIONS & INVITED TALKS

[P1] "Physical Anomaly Management in Massively Digitized Power Systems"
Laboratory of Information & Decision Systems EESG Seminar Series
Massachusetts Institute of Technology (MIT), Oct. 20, 2022

[P2] "A Neural Lyapunov Approach to Transient Stability Assessment in Interconnected Microgrid"
54-th Hawaii International Conference on System Sciences (HICSS 54), 2021, paper presentation
HICSS-54 Energy Systems Track Virtual Session, poster presentation

[P3] "Forced Oscillation Localization in ERCOT System through Synchrophasors"
The North American Synchrophasor Initiative (NASPI) Work Group Meeting, Nov. 3, 2020

[P4] "Tutorial of Forced Oscillation Localization Tool"
Electric Reliability Council of Texas (ERCOT), Aug. 12, 2020

[P5] "Detection of Cyber Attacks in Renewable-rich Microgrids Using Dynamic Watermarking"
IEEE Power & Energy Society (PES) General Meeting, Aug. 5, 2020

[P6] "A Holistic Framework for Parameter Coordination of Interconnected Microgrids against Disasters" *IEEE Power & Energy Society (PES) General Meeting*, Aug. 3, 2020

[P7] "Robust PCA over Dynamic Systems: A Case of Forced Oscillation Localization"
LIDS & Stats Tea Talk, Laboratory of Information & Decision Systems
Massachusetts Institute of Technology (MIT), Nov. 7, 2018

[P8] "PMU Prioritization and Forced Oscillation Localization in Power Systems"
ISO New England, Sep. 13, 2018

[P9] "An Online Defense Framework against Cyber Attacks on Automatic Generation Control"
ISO New England, Feb. 2018

[P10] "Prioritization of PMU Location and Signal Selection for Monitoring Critical Oscillations"
IEEE Power & Energy Society (PES) General Meeting, Aug. 4, 2020
Electric Reliability Council of Texas (ERCOT), Nov. 17, 2017
Shenzhen Research Institute of Big Data, The Chinese University of Hong Kong (Shenzhen), Aug. 17, 2017

RESEARCH PROJECT

DOE: Secure Monitoring and Control of Solar Power Distribution System Through Dynamic Watermarking *Jul. 2020 - now*

- Led development of cyber attack detector for microgrids based on the dynamic watermarking
- Developing corrective control for cyber attacks in microgrids
- Wrote quarterly reports and made slides for quarterly review

Synchrophasor Analytics for ERCOT *Jun. 2019 - Jun. 2020*

- Led development of a machine learning-based tool of forced oscillation localization
- Delivered tutorial sessions of the tool developed to ERCOT engineers

PROFESSIONAL ACTIVITIES

- *Session Chair*, The 53rd North American Power Symposium (NAPS) 2021
- *Session Chair*, IEEE Power & Energy Society (PES) General Meeting 2020
- *Committee Member*, IEEE Texas Power and Energy Conference (TPEC) 2019
- *Webinar Coordinator*, MIT A+B 2020
- *Virtual Meeting Coordinator*, IEEE Power & Energy Society Women in Power (2020 - now)
- *Journal Reviewer*: IEEE Transactions on Power Systems, IEEE Transactions on Smart Grids, IEEE Transactions on Industry Applications, IEEE Internet of Things Journal, IEEE Industry Applications Magazine, IEEE Power Engineering Letters, International Journal of Electrical Power & Energy Systems, Energy Systems, IEEE Open Access Journal of Power and Energy, IEEE Power and Energy Technology Systems Journal
- *Conference Reviewer*: IEEE PES General Meeting 2018-2021, Power System Computation Conference (PSCC 2018), Texas Power and Energy Conference (TPEC 2018), Annual Conference of the IEEE Industrial Electronics Society (IECON 2020)

PRESS COVERAGE

"HICSS-54 Best Paper Award Tong et al., 2021"
Texas A&M Engineering Experiment Station Smart Grid Center News, Jan. 2021
"Research team receives best paper award at flagship IEEE conference"
Texas A&M University Engineering News, Sept. 2020
"2020 IEEE PES Best Paper Award"
Texas A&M Engineering Experiment Station Smart Grid Center News, Aug. 2020
"Best conference paper of IEEE PES-GM 2020"
Mitsubishi Electric Research Laboratories (MERL) News & Event, Jun. 2020
"Cybersecurity and solar energy: How are they related?"
Texas A&M University Engineering News, Jan. 2020
"Researchers receive $4.4M Department of Energy grant to enhance solar technology"
Texas A&M Engineering Experiment Station News, Sep. 2019