YU WANG

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EDUCATION

Ph.D. in Mechanical Engineering 2018
University of Illinois at Urbana-Champaign
Dissertation: Statistical verification and differential privacy in cyber-physical systems
Committee: Geir Dullerud (Advisor), Sayan Mitra, Mahesh Viswanathan, Matthew West, and Magnus Egerstedt
Nominated for CSL PhD Thesis Award

M.S. in Statistics 2017
University of Illinois at Urbana-Champaign

M.S. in Mathematics 2016
University of Illinois at Urbana-Champaign

M.S. in Mechanical Engineering 2014
University of Illinois at Urbana-Champaign
Dissertation: Stability of linear autonomous systems under regular switching sequences
Advisor: Geir Dullerud

B.E. in Engineering Mechanics 2012
Tsinghua University
Dissertation: A study of dynamic contact angles of shear-thickening power-law fluids
Advisor: Ke-Qin Zhu

RESEARCH EXPERIENCE

Postdoctoral Associate 2018 - now
Duke University

Graduate Research Assistant 2012 - 2018
University of Illinois at Urbana-Champaign

Undergraduate Research Assistant 2009 - 2012
Tsinghua University

TEACHING AND MENTORING EXPERIENCE

Ph.D. Student Mentor 2018 - now
Mentees: Alper Bozkurt, Mahmoud Elfar, Siddhartha Nalluri, Mojtaba Zarei, Amir Khazraei, and Qitong Gao
Duke University

Teaching Assistant Spring 2018
Convex Methods in Control (ME 561)
University of Illinois at Urbana-Champaign

Teaching Assistant Spring 2017
Estimation and Stochastic Control (ME 598)
University of Illinois at Urbana-Champaign

HONOR AND AWARDS

Best Paper Finalist 2019
ACM SIGBED International Conference on Embedded Software (**EMSOFT**)

CSL PhD Thesis Award Nomination 2018
Coordinated Science Laboratory, University of Illinois at Urbana-Champaign

George B. Grim Fellowship 2012
Department of Mechanical Engineering, University of Illinois at Urbana-Champaign

RESEARCH PROPOSALS

[R1] Collaborative Research: SHF: Medium: Foundations of Formal and Scalable Verification of Hyperproperties in Probabilistic Systems, submitted as **Senior Personnel** (with PI: Borzoo Bonakdarpour, Iowa State University and PI: Miroslav Pajic, Duke University).

PREPRINTS

[P1] **Yu Wang**, Alper Kamil Bozkurt, and Miroslav Pajic, "Attack-Resilient Supervisory Control of Discrete Event Systems", IEEE Transactions on Automatic Control (**TAC**), 2019, **under review**. [arXiv]

[P2] **Yu Wang**, Nima Roohi, Matthew West, Mahesh Viswanathan, and Geir E. Dullerud, "Verifying Stochastic Hybrid Systems with Temporal Logic Specifications via Mori-Zwanzig Model Reduction", IEEE Transactions on Automatic Control (**TAC**), 2019, **under review**.

[P3] **Yu Wang**, Qitong Gao, Borzoo Bonakdarpour, and Miroslav Pajic, "Deep Learning for Stable Monotone Dynamical Systems", Annual Conference on Neural Information Processing Systems (**NeurIPS**), **under review**, 2020. [arXiv]

JOURNAL PUBLICATIONS

[J1] **Yu Wang**, Mojtaba Zarei, Borzoo Bonakdarpour, and Miroslav Pajic, "Statistical Verification of Hyperproperties for Cyber-Physical Systems", ACM Transactions on Embedded Computing Systems (**TECS**), vol. 18, no. 5s, pp. 1-23, 2019. [Presented at EMSOFT '19, Best Paper Finalist]

[J2] **Yu Wang**, Nima Roohi, Matthew West, Mahesh Viswanathan, and Geir E. Dullerud, "Statistical Verification of PCTL Using Antithetic and Stratified Samples", Formal Methods in System Design (**FMSD**), vol. 54, no. 2, pp. 145-163, 2019.

[J3] **Yu Wang**, Xuan Bi, and Annie Qu, "A Logistic Factorization Model for Recommender Systems with Multinomial Responses", Journal of Computational and Graphical Statistics (**JCGS**), pp. 1-9, 2019.

[J4] **Yu Wang**, Nima Roohi, Matthew West, Mahesh Viswanathan, and Geir E. Dullerud, "Stability Analysis of Switched Linear Systems Defined by Regular Languages", IEEE Transactions on Automatic Control (**TAC**), vol. 26, no. 5, pp. 2568-2575, 2017.

[J5] **Yu Wang**, Zhenqi Huang, Sayan Mitra, and Geir E. Dullerud, "Differential Privacy in Linear Distributed Control Systems: Entropy Minimizing Mechanisms and Performance Tradeoffs", IEEE Transactions on Control of Network Systems (**TCNS**), vol. 4, no. 1, pp. 118-130, 2017.

[J6] **Yu Wang** and Ke-Qin Zhu, "A Study of Dynamic Contact Angles of Shear-Thickening Power-Law Fluids", Physics of Fluids (**PoF**), vol. 26, no. 5, p. 052103, 2014.

CONFERENCE PUBLICATIONS

[C1] **Yu Wang**, Siddhartha Nalluri, Borzoo Bonakdarpour, and Miroslav Pajic, "Statistical Model Checking for Hyperproperties", Computer Security Foundations Symposium (**CSF**), **accepted**, Dubrovnik, Croatia, June 2021.

[C2] **Yu Wang**, Nima Roohi, Matthew West, Mahesh Viswanathan, and Geir E. Dullerud, "Verifying PCTL Specifications on Markov Decision Processes via Reinforcement Learning", IEEE Conference on Decision and Control (**CDC**), **accepted**, Jeju Island, Republic of Korea, Dec. 2020.

[C3] Mahmoud Elfar, **Yu Wang** and Miroslav Pajic, "Context-Aware Temporal Logic for Probabilistic Systems", International Symposium on Automated Technology for Verification and Analysis (**ATVA**), **accepted**, Hanoi, Vietnam, Oct. 2020.

[C4] Nima Roohi, **Yu Wang**, Matthew West, Geir E Dullerud, and Mahesh Viswanathan, "STMC: Statistical Model Checker with Stratified and Antithetic Sampling", International Conference on Computer-Aided Verification (**CAV**), **accepted**, Los Angeles, CA, July 2020. [Results Replicated]

[C5] **Yu Wang** and Miroslav Pajic, "Hyperproperties for Robotics: Motion Planning via HyperLTL", IEEE International Conference on Robotics and Automation (**ICRA**), **accepted**, Paris, France, May 2020.

[C6] Alper Kamil Bozkurt, **Yu Wang**, Michael Zavlanos, and Miroslav Pajic, "Control Synthesis from Linear Temporal Logic Specifications Using Model-Free Reinforcement Learning", IEEE International Conference on Robotics and Automation (**ICRA**), **accepted**, Paris, France, May 2020.

[C7] Kyo Kim, Siddhartha Nalluri, Ashish Kashinath, **Yu Wang**, Sibin Mohan, Miroslav Pajic, and Bo Li "Security Analysis Against Spoofing Attacks for Distributed UAVs", Workshop on Decentralized IoT Systems and Security (**DISS**), pp. 1-6, San Diego, CA, Apr. 2020.

[C8] Mojtaba Zarei, **Yu Wang**, and Miroslav Pajic, "Statistical Verification of Learning-Enabled Controlled Systems", ACM International Conference on Hybrid Systems: Computation and Control (**HSCC**), pp. 1-7, Sydney, Australia, Apr. 2020. [Results Replicated]

[C9] **Yu Wang** and Miroslav Pajic, "Attack-Resilient Supervisory Control with Intermittently Secure Communication", IEEE Conference on Decision and Control (**CDC**), pp. 2015-2020, Nice, France, Dec. 2019.

[C10] **Yu Wang** and Miroslav Pajic, "Supervisory Control of Discrete Event Systems in the Presence of Sensor and Actuator Attacks", IEEE Conference on Decision and Control (**CDC**), pp. 5350-5355, Nice, France, Dec. 2019.

[C11] **Yu Wang**, Mojtaba Zarei, Borzoo Bonakdarpour, and Miroslav Pajic, "Statistical Verification of Hyperproperties for Cyber-Physical Systems", ACM SIGBED International Conference on Embedded Software (**EMSOFT**), pp. 1-23, Oct. 2019. [Journal-Track, Best Paper Award Finalist]

[C12] Mahmoud Elfar, **Yu Wang** and Miroslav Pajic, "Security-Aware Synthesis Using Delayed-Action Games", International Conference on Computer-Aided Verification (**CAV**), pp. 180-199, New York, NY, July 2019.

[C13] **Yu Wang**, Nima Roohi, Matthew West, Mahesh Viswanathan, and Geir E. Dullerud, "Statistical Verification of PCTL Using Stratified Samples", IFAC Conference on Analysis and Design of Hybrid Systems (**ADHS**), IFAC-PapersOnLine, vol. 51, no. 1, pp. 85-90, Oxford, UK, July 2018.

[C14] **Yu Wang**, Sayan Mitra, and Geir E. Dullerud, "Differential Privacy and Minimum-Variance Unbiased Estimation in Multi-Agent Control Systems", IFAC World Congress (**WC**), IFAC-PapersOnLine, vol. 50, pp. 9521-9526, Toulouse, France, July 2017.

[C15] Nima Roohi, **Yu Wang**, Matthew West, Geir E. Dullerud, and Mahesh Viswanathan, "Statistical Verification of the Toyota Powertrain Control Verification Benchmark", ACM International Con-

ference on Hybrid Systems: Computation and Control (**HSCC**), pp. 65-70, Pittsburgh, PA, Apr. 2017.

[C16] **Yu Wang**, Nima Roohi, Matthew West, Mahesh Viswanathan, and Geir E. Dullerud, "Verifying Continuous-Time Stochastic Hybrid Systems via Mori-Zwanzig Model Reduction", IEEE Conference on Decision and Control (**CDC**), pp. 3012-3017, Las Vegas, NV, Dec. 2016.

[C17] **Yu Wang**, Hale Hale Matthew, Magnus Egerstedt, and Geir E. Dullerud, "Differentially Private Objective Functions in Distributed Cloud-Based Optimization", IEEE Conference on Decision and Control (**CDC**), pp. 3688-3694, Las Vegas, NV, Dec. 2016.

[C18] Zhenqi Huang, **Yu Wang**, Sayan Mitra, and Geir E. Dullerud, "Controller Synthesis for Linear Dynamical Systems with Adversaries", ACM Symposium and Bootcamp on the Science of Security (**HoTSoS**), pp. 53-62, Pittsburgh, PA, Apr. 2016.

[C19] Zhenqi Huang, **Yu Wang**, Sayan Mitra, Geir E. Dullerud, and Swarat Chaudhuri, "Controller Synthesis with Inductive Proofs for Piecewise Linear Systems: An SMT-Based Algorithm", IEEE Conference on Decision and Control (**CDC**), pp. 7434-7439, Osaka, Japan, Dec. 2015.

[C20] **Yu Wang**, Nima Roohi, Matthew West, Mahesh Viswanathan, and Geir E. Dullerud, "A Mori-Zwanzig and MITL Based Approach to Statistical Verification of Continuous-Time Dynamical Systems", IFAC Conference on Analysis and Design of Hybrid Systems (**ADHS**), IFAC-PapersOnLine, vol. 48, no. 27, pp. 267-273, Atlanta, GA, Oct. 2015.

[C21] **Yu Wang**, Nima Roohi, Matthew West, Mahesh Viswanathan, and Geir E. Dullerud, "Statistical Verification of Dynamical Systems Using Set Oriented Methods", ACM International Conference on Hybrid Systems: Computation and Control (**HSCC**), pp. 169-178, Seattle, WA, Apr. 2015.

[C22] **Yu Wang**, Zhenqi Huang, Sayan Mitra, and Geir E. Dullerud, "Entropy-Minimizing Mechanism for Differential Privacy of Discrete-Time Linear Feedback Systems", IEEE Conference on Decision and Control (**CDC**), pp. 2130-2135, Los Angeles, CA, Dec. 2014.

[C23] **Yu Wang**, Nima Roohi, Geir E. Dullerud, and Mahesh Viswanathan, "Stability of Linear Autonomous Systems under Regular Switching Sequences", IEEE Conference on Decision and Control (**CDC**), pp. 5445-5450, Los Angeles, CA, Dec. 2014.

[C24] Zhenqi Huang, **Yu Wang**, Sayan Mitra, and Geir E. Dullerud, "On the Cost of Differential Privacy in Distributed Control Systems", International Conference on High Confidence Networked Systems (**HiCoNS**), pp. 105-114, Berlin, Germany, Apr. 2014.

SOFTWARE ARTIFACTS

[A1] STMC: Statistical model checker with stratified and antithetic sampling.

[A2] ARSC: Design toolbox for attack-resilient supervisory controllers.

[A3] HyperSMC: Statistical model checker for hyper probabilistic temporal logics.

[A4] MPHyper: Symbolic motion planner for HyperLTL objectives.

[A5] CSRL: Control synthesis for LTL objectives by reinforcement learning.

[A6] SMCLearning: Statistical model checker for deep-neural-network-enabled cyber-physical systems.

INVITED TALKS

[T1] "Verifying the Security of Cyber-Physical Systems", Postdoc Plenary Talk, Southeast Controls Conference, Atlanta, GA, Sept. 2019.

[T2] "Verifying the Security of Cyber-Physical Systems", Department of Computer Science, Iowa State University, Sept. 2019.

[T3] "Security and Privacy in Cyber-Physical Systems", Kevin T. Crofton Department of Aerospace and Ocean Engineering, Virginia Polytechnic Institute and State University, Feb. 2019.

[T4] "Statistical Verification and Differential Privacy in Cyber-Physical Systems", Department of Electrical and Computer Engineering, University of New Mexico, May 2018.

[T5] "Statistical Verification and Differential Privacy in Cyber-Physical Systems", GRASP Lab, Department of Electrical and Systems Engineering, University of Pennsylvania, Nov. 2017.

[T6] "Differential Privacy, Entropy and Security in Distributed Control of Cyber Physical Systems", TSS/SoS Seminar, Information Trust Institute, University of Illinois at Urbana-Champaign, Apr. 2016.

[T7] "A Mori-Zwanzig and MITL Based Approach to Statistical Verification of Continuous-time Dynamical Systems", Midwest Verification Day, Urbana, IL, Oct. 2015.

ACADEMIC SERVICES

Reviewer for American Control Conference (**ACC**) '17-'19, European Control Conference (**ECC**) '16, Conference on Decision and Control (**CDC**) '16-'19, International Conference on Hybrid Systems: Computation and Control (**HSCC**) '17, International Conference on Cyber-Physical Systems (**ICCPS**) '16-'19, International Conference on integrated Formal Methods (**iFM**) '19, Conference on Decision and Game Theory for Security (**GameSec**) '19, IEEE Transactions on Automatic Control (**TAC**), IEEE Transactions on Control of Network Systems (**TCNS**), Control Systems Letters, (**L-CSS**) IEEE Transactions on Signal Processing, (**TSP**) IEEE Transactions on Intelligent Transportation Systems (**TITS**), and **Automatica**.

REFERENCES

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