Danielle C. Tarraf

Department of Electrical & Computer Engineering
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EDUCATION

2006 **Massachusetts Institute of Technology**, Ph.D., Mechanical Engineering
Major: Control and Dynamical Systems
Thesis: A finite state machine framework for robust analysis and control of hybrid systems

1998 **Massachusetts Institute of Technology**, S.M., Mechanical Engineering
Thesis: Design of an unloader for rotary compressors

1996 **American University of Beirut**, B.E., Mechanical Engineering

EXPERIENCE

7/2008-present **The Johns Hopkins University**
Assistant Professor, Department of Electrical & Computer Engineering
◇ Broad themes of my research: Control and systems theory, particularly as it interfaces with computer science, data and computation, with motivating applications in autonomy, critical infrastructure networks and financial markets.
◇ Research projects include: Model complexity reduction, robust control, and state estimation for systems over finite alphabets; Verified-by-design finite state machine based control; Control of hybrid systems; Robustness of finite alphabet logistic networks; Structural decomposition of dynamic programming problems; Finite alphabet paradigms for mobile autonomy.
◇ Courses developed: Control Systems (Undergraduate); Introduction to Linear Systems Theory (Graduate); Hybrid Systems (Graduate); Introduction to Robust Control (Graduate); Independent studies in dynamic programming and differential games (Graduate).

3/2007-5/2008 **California Institute of Technology**
Postdoctoral Scholar, Division of Control & Dynamical Systems
◇ Research project: Study of properties of a class of evolving networks.
◇ Course developed: Introduction to Modern Control (Graduate).

8/2006-2/2007 **Massachusetts Institute of Technology**
Postdoctoral Associate, Laboratory for Information & Decision Systems
◇ Research project: Relaxations of word problems.

VISITING APPOINTMENTS

9/2015-present **Massachusetts Institute of Technology**
Visiting Scholar, MIT Institute for Data, Systems and Society

7/2013-6/2015 **University of Maryland, College Park**
Visiting Assistant Research Professor, Institute for Systems Research

AWARDS & HONORS

2015 Air Force Office of Scientific Research Summer Faculty Fellowship for the project "A Control Theoretic Framework for Verified-by-Design Spacecraft Autonomy."

2012 Johns Hopkins University Alumni Excellence in Teaching Award, awarded by the Whiting School of Engineering.

2011 Air Force Office of Scientific Research Young Investigator (YIP) Award for the project "Towards an Integrative Theory of Control and Computation."

2010 National Science Foundation CAREER Award for the project "Analysis and Synthesis of Systems over Finite Alphabets: Theoretical Foundations, Analytical Methods and Algorithmic Tools."

LEADERSHIP & ENTREPRENEURSHIP

◇ As Principal Investigator:
- Raised $1,060,702 in external grant funding to date.
- Interfaced with program managers at sponsoring agencies to communicate project progress and results.
- Recruited and mentored team of student researchers including: 1 Postdoctoral scholar in 2010-2011; 3 Ph.D. students, theses in progress; 2 visiting Ph.D. students; 2 M.S. thesis students, graduated in 2012 and 2013; 1 undergraduate student, who recently won the Muly Family Undergraduate Research Award.

◇ Editor of the volume "Control of Cyber-Physical Systems," Lecture Notes in Control and Information Sciences, vol. 449, Springer, 2013.
◇ Associate Editor for "Nonlinear Analysis: Hybrid Systems," an Elsevier journal (2014-2015).
◇ Workshop organizer: Workshop on Control of Cyber-Physical Systems, Johns Hopkins University (2013); National Control Engineering Student Workshop, University of Maryland, College Park (2011); 6th NSF/Northeast Control Workshop, Johns Hopkins University (2010).

SERVICE

◇ Panelist/proposal reviewer: National Science Foundation (7/2014, 12/2013, 4/2012, 12/2011, 7/2011, 6/2009); Natural Sciences and Engineering Research Council of Canada (2012); Romanian National Council for Scientific Research (2012); Air Force Office of Scientific Research (2008).
◇ Technical Program Committee member: ACM/IEEE International Conference on Cyber-Physical Systems (2014, 2015); IFAC Workshop on Distributed Estimation and Control in Networked Systems (2010, 2012, 2013, 2015); International Conference on Hybrid Systems: Computation & Control (2011, 2015); IFAC Conference on Analysis and Design of Hybrid Systems (2015); IEEE Conference on Decision and Control (2014).
◇ Committee member: JHU Whiting School of Engineering Graduate Committee (2010-2013); JHU ECE Strategic Planning Committee (2013-2014); JHU ECE Curriculum Committee (2012-present).

SKILLS

◇ Language Skills: English (bilingual proficiency), Arabic (bilingual proficiency), French (working proficiency).
◇ Computer Skills: Matlab (current), C++ (past experience).

INVITED TALKS (SELECTED)

◇ "Less is more: A new paradigm for control," USC Workshop on Future Directions in Networks, Optimization & Control, Ming Hsieh Institute, University of Southern California (12/2014).
◇ "Certified-by-design control of systems over finite alphabets," Schloss Dagstuhl - Leibniz Center for Informatics, Germany (3/2014).
◇ "Control under finite alphabet and memory constraints," Electrical Engineering Seminar Series, Harvard University (10/2013).
◇ "Finite state ρ/μ approximations for control design," Automatic Control Laboratory, ETH Swiss Federal Institute of Technology, Switzerland (6/2012).
◇ "Robust control of networks under discrete disturbances and control," Invited talk at International Conference on Network Games, Control and Optimization, Paris Descartes University, France (9/2011).
◇ "Control of systems over finite alphabets," Center for Control, Dynamical Systems & Computation Seminar Series, University of California, Santa Barbara (2/2008).
◇ "Analysis and control of systems over finite alphabets," Department of Aeronautics & Astronautics, Stanford University (12/2007).
◇ "Control of hybrid systems: A robust finite state machine approach," Center for Hybrid & Embedded Software Systems (CHESS), University of California, Berkeley (9/2006).
◇ "Automata theory, robust control and hybrid systems design," Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign (9/2006) and Department of Aeronautics & Astronautics, Massachusetts Institute of Technology (4/2006).

PEER-REVIEWED PUBLICATIONS (SELECTED)

Google Scholar Profile: `http://scholar.google.com/citations?user=D-SMlOoAAAAJ&hl=en&oi=ao`
ResearchGate Profile: `http://www.researchgate.net/profile/Danielle_Tarraf`
Students I supervised are marked as graduate[g], undergraduate[u], or postdoctoral[p].

◇ M. C. Tsakiris[g] and D. C. Tarraf, "Algebraic decompositions of DP problems with linear dynamics," Systems & Control Letters, vol. 85, pp. 46-53, November 2015.
◇ V. Yan[u] and D. C. Tarraf, "Efficiently detecting lack of robustness in finite alphabet logistic networks," Proceedings of the Conference on Information Sciences and Systems, Baltimore, MD, March 2015, pp. 1-6.
◇ D. C. Tarraf, "An input-output construction of finite state ρ/μ approximations for control design" IEEE Transactions on Automatic control, Special Issue on Control of Cyber-Physical Systems, vol. 59, no.12, pp. 3164-3177, December 2014.
◇ D. Fan[g] and D. C. Tarraf, "On finite memory observability of switched LTI systems with quantized outputs," Proceedings of the 53^{rd} IEEE Conference on Decision and Control, Los Angeles, CA, December 2014, pp. 3884-3891.
◇ X. Zhang[g], G. Kamali[g] and D. C. Tarraf, "Optimizing the scaling parameter for ρ/μ approximation based control synthesis," Proceedings of the IEEE Multi-Conference on Systems and Control, Antibes, France, October 2014, pp.1527-1532.
◇ X. Zhang[g] and D. C. Tarraf, "On synchronizing sampling and quantization for stabilizing the double integrator under binary sensing," Proceedings of the 22^{nd} Mediterranean Control Conference, Palermo, Italy, June 2014, pp.531-538.
◇ D. C. Tarraf and D. Bauso, "Finite alphabet control of logistic networks under discrete uncertainty," Systems & Control Letters, vol. 64, pp.20-26, February 2014.
◇ M. C. Tsakiris[g] and D. C. Tarraf, "On subspace decompositions of finite horizon DP Problems with switched linear dynamics," Proceedings of the 52^{nd} IEEE Conference on Decision and Control, Florence, Italy, December 2013, pp.5315-5320.
◇ D. C. Tarraf, "On exploiting algebraic structure in control of finite state machines," Proceedings of the Allerton Conference on Communication, Control and Computing, Allerton, Il, October 2013, pp.962-965.
◇ D. C. Tarraf, "Bounding the smallest robustly control invariant set in networks with discrete disturbances and controls," Proceedings of the ACM International Conference on High Confidence Networked Systems, Philadelphia, PA, April 2013, pp.111-115.
◇ D. C. Tarraf, "A control-oriented notion of finite state approximation," IEEE Transactions on Automatic Control, vol.57, no.12, pp.3197-3202, December 2012.
◇ F. Aalamifar[g] and D. C. Tarraf, "An iterative algorithmic implementation of input-output finite state approximations," Proceedings of the 51^{st} IEEE Conference on Decision and Control, Maui, HI, December 2012, pp.6735-6741.
◇ D. C. Tarraf and L. A. Duffaut Espinosa[p], "On finite memory approximations constructed from input/output snapshots," Proceedings of the 50^{th} IEEE Conference on Decision and Control and European Control Conference, Orlando, Fl, December 2011, pp.3966-3973.
◇ D. C. Tarraf, A. Megretski and M. A. Dahleh, "Finite approximations of switched homogeneous systems for controller synthesis," IEEE Transactions on Automatic Control, vol.56, no.5, pp.1140-1145, May 2011.
◇ C. K. Enyioha[u], D. C. Tarraf, L. Li and J. C. Doyle, "On the graph of trees," Proceedings of the IEEE Multi-Conference on Systems and Control, St Petersburg, Russia, July 2009, pp.246-248.
◇ D. C. Tarraf, A. Megretski and M. A. Dahleh, "A framework for robust stability of systems over finite alphabets," IEEE Transactions on Automatic Control, vol.53, no.5, pp.1133-1146, June 2008.
◇ D. C. Tarraf and P. A. Parrilo, "Solving commutative relaxations of word problems," Proceedings of the 46^{th} IEEE Conference on Decision and Control, New Orleans, LA, December 2007, pp.5575-5580.
◇ D. C. Tarraf, A. Megretski and M. A. Dahleh, "Finite state controllers for stabilizing switched systems with binary sensors," Editors: G. Buttazzo, A. Bicchi and A. Bemporad, Lecture Notes in Computer Science, vol. 4416, pp.543-557, Springer, April 2007.
◇ D. C. Tarraf and H. Asada, "On the nature and stability of differential-algebraic systems," Proceedings of the American Control Conference, Anchorage, AK, May 2002, pp.3546-3551.