

Xudong Chen

- CONTACT INFO.** **Mail:** 425 UCB #1B55, Boulder, CO 80309
Phone: 303-735-4935
Email: xudong.chen@colorado.edu
- ACADEMIC EXPERIENCE** Aug. 2016 — present, Assistant Professor, Department of Electrical, Computer, and Energy Engineering (ECEE), University of Colorado Boulder (CU Boulder)
- Sept. 2014 — Aug. 2016, postdoc research associate, Coordinated Science Lab, University of Illinois at Urbana-Champaign. Advisors: Tamer Başar and Mohamed-Ali Belabbas
- EDUCATION** **Harvard University**, Cambridge, MA, U.S.
Division of Engineering and Applied Sciences
Ph.D. in Electrical Engineering May 2014
Dissertation topic: “Multi-agent systems with reciprocal interaction laws”
Advisor: Roger W. Brockett
- Tsinghua University**, Beijing, China
Bachelor of Science in Electronic Engineering June 2009
- AWARD** Awardee of 2020 Air Force Office of Scientific Research Young Investigator Program
- TEACHING EXPERIENCE** **ECEE Department, CU Boulder** (* indicates new courses developed by me)
1. ECEN 3810: Intro to Probability, Fall 2019
 2. ECEN 5448: Advanced Linear Systems, Falls 2016, 2017, 2018, 2019
 3. ECEN 5008: Special Topic: Geometric Control Theory*, Springs 2017, 2020
 4. ECEN 5008: Special Topic: Stochastic Control Theory*, Spring 2019
- RESEARCH MENTORING EXPERIENCE** **Primary advisor of Ph.D. students at ECEE Department, CU Boulder**
1. Muhammad Umar Javed, Aug. 2017 — present. Co-advisor: Jorge Poveda, ECEE Department, CU Boulder. Research topic: Control of complex systems. Publications: One conference paper and two journal papers under review
 2. Thomas Dearing, Aug. 2018 — present. Co-advisor: Marco Nicotra, ECEE Department, CU Boulder. Research topic: Optimal network control. Award: NSF Graduate Research Fellowship (May 2020). Publications: One conference paper and one journal paper
- Primary advisor of Master students (MS with thesis)**
1. Vishal Shenoy, Department of Mechanical Engineering, CU Boulder. Sept. 2020 - present. Thesis topic: Sparse linear ensemble systems.
- Mentor of other Ph.D. students on research projects**
1. Erica Jenson, Department of Aerospace Engineering Sciences, CU Boulder, Jan. 2019 — present. Research topic: Optimal stochastic control. Publication: one journal paper published and one journal paper under review

2. Michael Sinner, ECEE Department, CU Boulder, Jan. 2020 — present. Research topic: Satellite formation control. Publication: One journal paper conditionally accepted
3. Zuguang Gao, University of Chicago Booth School of Business, Oct. 2014 — present. Research topic: Boolean networks with applications in gene regulation. Publications: Three journal papers and three conference papers
4. Khaled Alshehri, University of Illinois at Urbana-Champaign (Ph.D. in 2019), Jan. 2015 — June 2019. Research topic: Demand response management in smart grid. Publications: One journal paper

Member of comprehensive exam committees

1. Farhad Pourkamali Anaraki, Department of Applied Mathematics. Thesis advisor: Stephen Becker. Thesis topic: “Randomized Algorithms for Large-scale Data Analysis.” Exam date: 03/22/2017
2. Roger Arnold Braker, ECEE Department. Thesis advisor: Prof. Lucy Pao. Thesis topic: “Control Methods for Compressive Sensing in Atomic Force Microscopy.” Exam date: 11/17/2017
3. Michael Sinner, ECEE Department. Thesis advisor: Prof. Lucy Pao. Thesis topic: “Optimal Control of Wind Turbines.” Exam date: 07/08/2020
4. Chandrakanth Venigalla, Department of Aerospace Engineering Sciences. Thesis advisor: Prof. Daniel Scheeres. Thesis topic: “Multi-spacecraft Trajectory Optimization.” Exam date: 08/17/2020

- FUNDING SUPPORT
1. Project: “Foundations of Ensemble Estimation Theory.” Funds: \$450,000. Period: 07/01/2020 — 06/30/2023. Funding source: AFOSR. Project role: PI.
 2. Project: “Collaborative Research: Foundations of secure multi-agent networked systems.” Funds: \$440,000. Period: 09/01/2018 — 08/31/2021. Funding source: NSF. Project role: PI. (This is a collaborative project with PI Mohamed-Ali Belabbas from University of Illinois Urbana-Champaign. Portion for CU Boulder: \$220,000.)

PUBLICATIONS * indicates students advised by me on the corresponding works

Preprints (currently under review):

- [P1] **X. Chen.** *Sparse Linear Ensemble Systems and Structural Controllability.* Submitted to IEEE Transactions on Automatic Control.
- [P2] **X. Chen.** *Controllability Issues of Linear Ensemble Systems.* Submitted to SIAM Journal on Control and Optimization.
- [P3] M.-A. Belabbas and **X. Chen.** *Triangulated Laman Graphs, Local Stochastic Matrices, and Limits of Their Products.* Submitted to Linear Algebra and its Applications.
- [P4] M.-A. Belabbas and **X. Chen.** *On Integer Balancing of Digraphs.* Submitted to Bulletin of the London Mathematical Society.
- [P5] E. Jenson*, **X. Chen**, and D. Scheeres. *Optimal Spacecraft Guidance with Asynchronous Measurements and Noisy Impulsive Controls.* Submitted to IEEE System Control Letters (joint submission to 2021 American Control Conference).
- [P6] M. U. Javed*, J. I. Poveda, and **X. Chen.** *Distributed Adaptive Parameter Estimation over General Digraphs: Sufficient and Necessary Excitation Conditions for UES.* Submitted to IEEE System Control Letters (joint submission to 2021 American

Control Conference).

[P7] M. U. Javed*, J. I. Poveda, and **X. Chen**. *Scalable Resetting Algorithms for Synchronization of Pulse-Coupled Oscillators over Rooted Directed Graphs*. Submitted to Automatica.

[P8] M. Sinner*, **X. Chen**, and L. Pao. *Controllability of Formations Systems on Special Orthogonal Groups over Directed Graphs*. Conditionally accepted by IEEE Transactions on Control of Network Systems.

[P9] Q. Ma, J. Huang, T. Başar, J. Liu, and **X. Chen**. *Reputation and Pricing Dynamics in Online Markets*. IEEE/ACM Transactions on Networking. Conditionally accepted.

[P10] **X. Chen** and B. Ghahesifard. *Distinguished Sets of Semi-simple Lie Algebras*. Journal of Algebraic Combinatorics. Conditionally accepted.

Journal papers after 08/15/2016:

[J1] K. Alshehri*, J. Liu, **X. Chen**, and T. Başar. *A Game-Theoretic Framework for Multi-Period-Multi-Company Demand Response Management in the Smart Grid*. IEEE Transactions on Control Systems Technology, 2020. Appeared online.

[J2] T. Dearing*, **X. Chen**, and M. Nicotra. *Stabilizing Formation Systems with Nonholonomic Agents*. IEEE System Control Letters, 5(2), 2021, pp. 403-408.

[J3] E. Jenson*, **X. Chen**, and D. Scheeres. *Optimal Control of Sampled Linear Systems with Control-Linear Noise*. IEEE System Control Letters, 4(3), 2020, pp. 650-655.

[J4] **X. Chen**. *Ensemble Observability of Bloch Equations with Unknown Population Density*. Automatica, 2020. Appeared online.

[J5] **X. Chen**. *Controllability of Continuum Ensemble of Formation Systems over Directed Graphs*. Automatica, 2019. Appeared online.

[J6] **X. Chen**, Z. Gao*, and T. Başar. *Asymptotic Behavior of Conjunctive Boolean Networks over Weakly Connected Digraphs*. IEEE Transactions on Automatic Control, 65(6), 2019, pp. 2536-2549.

[J7] **X. Chen**. *Structure Theory for Ensemble Controllability, Observability, and Duality*. Mathematics of Control, Signals, and Systems, 31(2), 2019, pp. 1-40.

[J8] **X. Chen**, M.-A. Belabbas, and T. Başar. *Controlling and Stabilizing a Rigid Formation Using a Few Agents*. SIAM Journal on Control and Optimization, 57(1), 2019, pp. 104-128.

[J9] M.-A. Belabbas and **X. Chen**. *Sensor Placement for Optimal Estimation of Vector-valued Diffusion Processes*. Systems & Control Letters, 121, 2018, pp. 24-30.

[J10] Z. Gao*, **X. Chen**, and T. Başar. *Stability Structures of Conjunctive Boolean Networks*. Automatica, 89, 2018, pp. 8-20.

[J11] **X. Chen**, M.-A. Belabbas, and T. Başar. *Controllability of Formations over Directed Time-varying Graphs*. IEEE Transactions on Control of Network Systems, 4(3), 2017, pp. 407-416.

[J12] **X. Chen**, J. Liu, M.-A. Belabbas, Z. Xu, and T. Başar. *Distributed Evaluation and Convergence of Self-appraisals in Social Networks*. IEEE Transactions on Automatic Control, 62(1), 2017, pp. 291-304.

[J13] **X. Chen**. *Swarm Aggregation with Fading Attractions*. IEEE Transactions on Automatic Control, 62(10), 2017, pp. 5198-5204.

- [J14] **X. Chen**, M.-A. Belabbas, and T. Başar. *Global Stabilization of Triangulated Formations*. SIAM Journal on Control and Optimization, 55(1), 2017, pp. 172-199.
- [J15] **X. Chen**, M.-A. Belabbas, and T. Başar. *Cluster Consensus with Point Group Symmetries*. SIAM Journal on Control and Optimization, 55(6), 2017, pp. 3869-3889.
- [J16] **X. Chen**, M.-A. Belabbas, and T. Başar. *Optimal Capacity Allocation for Sampled Networked Systems*. Automatica, 85, 2017, pp. 100-112.
- [J17] Z. Gao*, **X. Chen**, and T. Başar. *Controllability of Conjunctive Boolean Networks with Application to Gene Regulation*. IEEE Transactions on Control of Network Systems, 5(2), 2018, pp. 770-781.
- [J18] J. Liu, **X. Chen**, T. Başar, and M.-A. Belabbas. *Exponential Convergence of the Discrete- and Continuous-time Altafini Models*. IEEE Transactions on Automatic Control, vol. 62(12), 2017, pp. 6168-6182.

Journal papers before 08/15/2016:

- [J19] **X. Chen**, M.-A. Belabbas, and T. Başar. *Distributed Averaging with Linear Objective Maps*. Automatica, 70, 2016, pp. 179-188.

Conference papers after 08/15/2016:

- [C1] T. Dearing*, **X. Chen**, and M. Nicotra. *Stabilizing Formation Systems with Non-holonomic Agents*. IEEE Conference on Decision and Control, 2020 (joint submission to IEEE System Control Letters).
- [C2] E. Jenson*, **X. Chen**, and D. Scheeres. *Optimal Control of Sampled Linear Systems with Control-Linear Noise*. IEEE Conference on Decision and Control, 2020 (joint submission to IEEE System Control Letters).
- [C3] T. Dearing*, C. Petersen, M. Nicotra, and **X. Chen**. *Fuel-Balanced Formation Flight Control of Underactuated Satellites*. American Control Conference, 2020.
- [C4] M. U. Javed*, J. I. Poveda, and **X. Chen**. *Global Synchronization of Clocks in Directed Rooted Acyclic Graphs: A Hybrid Systems Approach*. IEEE Conference on Decision and Control, 2019 (pp. 7352-7357).
- [C5] M.-A. Belabbas and **X. Chen**. *Optimal Sensor Design for Secure Cyber-physical Systems*. The 8th IFAC Workshop on Distributed Estimation and Control in Networked Systems, 2019 (pp. 387-390).
- [C6] **X. Chen**. *Joint Actuator-sensor Design for Stochastic Linear Systems*. IEEE Conference on Decision and Control, 2018 (pp. 6668-6673).
- [C7] **X. Chen** and B. Ghahsifard. *Distinguished Vector Fields over Smooth Manifolds with Applications to Ensemble Control*. IEEE Conference on Decision and Control, 2017 (pp. 1963-1968).
- [C8] **X. Chen**, Z. Gao*, and T. Başar. *Asymptotic Behavior of a Reduced Conjunctive Boolean Network*. IEEE Conference on Decision and Control, 2017 (pp. 4404-4409).
- [C9] **X. Chen** and M.-A. Belabbas. *Optimal Actuator Placement for Minimizing the Worst-case Control Energy*. 20th IFAC World Congress, 2017 (pp. 9991-9996).
- [C10] Z. Gao*, **X. Chen**, and T. Başar. *State-controlling Sets for Conjunctive Boolean Networks*. 20th IFAC World Congress, 2017 (pp. 14290-14295).
- [C11] Z. Gao*, **X. Chen**, and T. Başar. *Orbit-controlling Sets for Conjunctive Boolean Networks*. 2017 American Control Conference (pp. 4989-4994).

- [C12] **X. Chen**, M.-A. Belabbas, and T. Başar. *Controlling a Rigid Formation from a Triangle*. IEEE Conference on Decision and Control, 2016 (pp. 57-62).
- [C13] Z. Gao*, **X. Chen**, and T. Başar. *Periodic Behavior of a Diffusion Model over Directed Graphs*. IEEE Conference on Decision and Control, 2016 (pp. 37-42).

Conference papers before 08/15/2016:

- [C14] **X. Chen**, M.-A. Belabbas, and T. Başar. *Cluster Consensus over Strongly Connected Voltage Graphs*. International Symposium on Mathematical Theory of Networks and Systems (MTNS), 2016.
- [C15] J. Liu, **X. Chen**, and T. Başar. *Stability of the Continuous-time Altafini Model*. American Control Conference, 2016 (pp. 1930-1935).
- [C16] J. Liu, **X. Chen**, T. Başar, and A. Nedić. *A Continuous-time Distributed Algorithm for Solving Linear Equations*. American Control Conference, 2016 (pp. 5551-5556).
- [C17] **X. Chen**, M.-A. Belabbas, and T. Başar. *Controllability of Formations over Directed Graphs*. IEEE Conference on Decision and Control, 2015 (pp. 4764-4769).
- [C18] **X. Chen**, M.-A. Belabbas, and T. Başar. *Formation Control with Triangulated Laman Graphs*. IEEE Conference on Decision and Control, 2015 (pp. 4115-4120).
- [C19] **X. Chen**, M.-A. Belabbas, and T. Başar. *Consensus with Linear Objective Maps*. IEEE Conference on Decision and Control, 2015 (pp. 2847-2852).
- [C20] **X. Chen**, J. Liu, Z. Xu, and T. Başar. *Distributed Evaluation and Convergence of Self-appraisals in Social Networks*. IEEE Conference on Decision and Control, 2015 (pp. 2895-2900).
- [C21] J. Liu, **X. Chen**, T. Başar, and M.-A. Belabbas. *Stability of Discrete-time Altafini's Model: A Graphical Approach*. IEEE Conference on Decision and Control, 2015 (pp. 2835-2840).
- [C22] K. Alshehri*, J. Liu, **X. Chen**, and T. Başar. *A Stackelberg Game for Multi-period Demand Response Management in the Smart Grid*. IEEE Conference on Decision and Control, 2015 (pp. 5889-5894).
- [C23] **X. Chen**. *Decentralized Formation Control with a Quadratic Lyapunov Function*. American Control Conference, 2015 (pp. 4362-4367).
- [C24] **X. Chen**. *Gradient Flows for Organizing Multi-agent System*. American Control Conference, 2014 (pp. 5109-5114).
- [C25] **X. Chen** and R. W. Brockett. *Centralized and Decentralized Formation Control with Controllable Interaction Laws*. IEEE Conference on Decision and Control, 2014 (pp. 601-606).

SERVICE

Activities in the ECEE Department and the Engineering College

1. Member of the graduate studies committee of the ECEE Department, Aug. 2016 — May 2017. Committee chair: Dejan Filipovic
2. Member of the faculty search committee in the “Robotics, Dynamics, and Control” area for the college, Aug. 2017 — May 2018. Committee chair: Sean Humbert
3. Representative of the Systems and Controls groups, ECEE Department, for graduate student orientation, Aug. 2017 and Aug. 2018
4. Representative of the Autonomous Systems Interdisciplinary Research Theme for

participating in the “IRT Research Blitz and Poster Session” hosted by the college, Mar. 2020

5. Co-organizer of the “1st Rocky Mountain Workshop on Decisions, Autonomous Systems, and Controls,” Aug. 2019 — present
6. Member of the marketing and outreach committee of the ECEE Department, Aug. 2020 — present. Committee chair: Bart Van Zeghbroeck

Activities in the systems and controls community

1. Co-organizer of an invited session, titled “Sensor and Actuator Placement for Large-Scale Systems,” at the 2018 IEEE Conference on Decision and Control
2. Co-organizer of a 5-day control workshop, titled “Geometry, Topology and their Applications in Control System Design,” at the Banff International Research Station, Feb. 21—26, 2021 (dates may be subject to change due to COVID-19)
3. NSF panelist for the “Energy, Power, Control, and Networks” program, July 2019
4. Active reviewer of multiple journals and conferences
5. Chair of multiple conference sessions