Xudong Chen

CONTACT INFO	**Mail:** 425 UCB #1B55, Boulder, CO 80309
	Phone: 303-735-4935
	Email: xudong.chen@colorado.edu
	Website: https://www.colorado.edu/faculty/chen/

ACADEMIC EXPERIENCE

Assistant Professor　　　　　　　　　　　　　　Aug. 2016 – present
Department of Electrical, Computer, and Energy Engineering, CU Boulder

Affiliate Faculty　　　　　　　　　　　　　　Nov. 2022 – present
Department of Applied Mathematics, CU Boulder

Postdoctoral Research Associate　　　　　Sept. 2014 – Aug. 2016
Coordinated Science Laboratory
University of Illinois at Urbana-Champaign
　　Advisors: Tamer Başar and Mohamed-Ali Belabbas

EDUCATION BACKGROUND

Harvard University, Cambridge, MA, U.S.
Division of Engineering and Applied Sciences
　　Ph.D. in Electrical Engineering　　　　　　　　May 2014
　　Dissertation: "Multi-agent systems with reciprocal interaction laws"
　　Advisor: Roger W. Brockett

Tsinghua University, Beijing, China
　　Bachelor of Science in Electronic Engineering　　June 2009

MAJOR AWARDS

Donald P. Eckman Award, American Automatic Control Council　　2021
　　Citation: For contributions to control, estimation, and analysis of large-scale multi-agent systems, including ensemble control theory, ensemble estimation theory, ensemble system identification, and networked control theory

Outstanding Research Award, ECEE Department, CU Boulder　　2021

NSF Career Award　　2021

AFOSR Young Investigator Award　　2020

TEACHING EXPERIENCE

ECEE Department, CU Boulder (* indicates new courses developed)
　　ECEN 3810: Intro to Probability　　Spring 2021, 2022 and Fall 2019
　　ECEN 5448/MCEN 5228: Advanced Linear Systems　　Fall 2016 – 2021
　　ECEN 5488: Geometric Control Theory*　　Fall 2022 and Spring 2017, 2020
　　ECEN 5498: Stochastic Control Theory*　　Fall 2020 and Spring 2019

MENTORING EXPERIENCE

Advisor of Ph.D. students (all at ECEE Department)
　　Labib Sharrar　　Aug. 2022 – present
　　Henry Titus　　Aug. 2021 – present

Sara Kamali	Aug. 2021 – present
Thomas Dearing (under NSF Graduate Research Fellowship)	Aug. 2018 – present
Muhammad Umar Javed	Aug. 2017 – Dec. 2022
will join Amazon as an Applied Scientist in January 2023	

Advisor of Master students with thesis

Vishal Shenoy, Mechanical Engineering, CU Boulder	Sept. 2020 – July 2021

PUBLICATIONS   * indicates students advised by Dr. Chen on the corresponding work

Preprints

[1] T. Dearing*, J. Hauser, C. Petersen, M. Nicotra, and *X. Chen*. Attitude Trajectory Optimization and Momentum Conservation with Control Moment Gyroscopes. arXiv: 2211.02110.

[2] M. Javed*, J. Poveda, and *X. Chen*. A Stochastic Binary Vertex-Triggering Resetting Algorithm for Global Synchronization of Pulse-Coupled Oscillators. arXiv: 2203.06707. Accepted by IEEE Transactions on Control of Network Systems.

[3] *X. Chen*. Controllability Issues of Linear Ensemble Systems over Multi-dimensional Parameterization Spaces. arXiv: 2003.04529.

[4] M.-A. Belabbas and *X. Chen*. Geometric Characterization of the H-property for Step-graphons. arXiv: 2206.00232.

[5] M.-A. Belabbas and *X. Chen*. A Sufficient Condition for the Super-linearization of Polynomial Systems. arXiv: 2301.04048.

Journal publications

[1] M.-A. Belabbas, *X. Chen*, and D. Zelazo. On Structural Rank and Resilience of Sparsity Patterns. IEEE Transactions on Automatic Control, appeared online.

[2] *X. Chen*, M.-A. Belabbas, and J. Liu. Gossip over Holonomic Graphs. Automatica, 136:110088, 2022.

[3] M.-A. Belabbas, *X. Chen*, and T. Başar. On the H-Property for Step-graphons and Edge Polytopes. IEEE Control Systems Letters, 6:1766-1771, 2022.

[4] T. Dearing*, J. Hauser, *X. Chen*, M. Nicotra, and C. Petersen. Efficient Trajectory Optimization for Constrained Spacecraft Attitude Maneuvers. Journal of Guidance, Control, and Dynamics, 45(4):638-650, 2022.

[5] *X. Chen*. Sparse Linear Ensemble Systems and Structural Controllability. IEEE Transactions on Automatic Control, 67(7):3337-3348, 2021.

[6] B. Gharesifard and *X. Chen*. Structural Averaged Controllability of Linear Ensemble Systems. IEEE Systems and Control Letter, 6:518-523, 2022.

[7] M. Javed*, J. Poveda, and *X. Chen*. Excitation Conditions for Uniform Exponential Stability of the Cooperative Gradient Algorithm over Weakly Connected Digraphs. IEEE Control Systems Letters, 6:67-72, 2021.

[8] M. Javed*, J. Poveda, and *X. Chen*. Scalable Resetting Algorithms for Synchronization of Pulse-Coupled Oscillators over Rooted Directed Graphs. Automatica, 132:109807, 2021.

[9] M.-A. Belabbas and *X. Chen*. On Integer Balancing of Directed Graphs. Systems & Control Letters, 154:104980, 2021.

[10] Q. Ma, J. Huang, T. Başar, J. Liu, and *X. Chen*. Reputation and Pricing Dynamics in Online Markets. IEEE/ACM Transactions on Networking, 29(4):1745-1759, 2021.

[11] M. Sinner*, *X. Chen*, and L. Pao. Controllability of Formations Systems on Special Orthogonal Groups over Directed Graphs. IEEE Transactions on Control of Network Systems, 8(2):872-883, 2021.

[12] M.-A. Belabbas and *X. Chen*. Triangulated Laman Graphs, Local Stochastic Matrices, and Limits of Their Products. Linear Algebra and its Applications, 619:176-209, 2021.

[13] *X. Chen* and B. Gharesifard. Distinguished Sets of Semi-simple Lie Algebras. Journal of Algebraic Combinatorics, 54:879-891, 2021.

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

[15] E. Jenson*, *X. Chen*, and D. Scheeres. Optimal Spacecraft Guidance with Asynchronous Measurements and Noisy Impulsive Controls. IEEE Control Systems Letters, 5(5):1813-1818, 2021.

[16] *X. Chen*. Ensemble Observability of Bloch Equations with Unknown Population Density. Automatica, 119:109057, 2020.

[17] 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, 29(3):1019-1034, 2020.

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

[19] *X. Chen*. Controllability of Continuum Ensemble of Formation Systems over Directed Graphs. Automatica, 108:108497, 2019.

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

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

[22] *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):104-128, 2019.

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

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

[25] 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):770-781, 2018.

[26] *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):407-416, 2017.

[**27**] *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):291-304, 2017.

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

[**29**] *X. Chen*, M.-A. Belabbas, and T. Başar. Global Stabilization of Triangulated Formations. SIAM Journal on Control and Optimization, 55(1):172-199, 2017.

[**30**] *X. Chen*, M.-A. Belabbas, and T. Başar. Cluster Consensus with Point Group Symmetries. SIAM Journal on Control and Optimization, 55(6):3869-3889, 2017.

[**31**] *X. Chen*, M.-A. Belabbas, and T. Başar. Optimal Capacity Allocation for Sampled Networked Systems. Automatica, 85:100-112, 2017.

[**32**] 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):6168-6182, 2017.

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

Conference publications

[**1**] M.-A. Belabbas, *X. Chen*, and T. Başar. On the H-Property for Step-graphons and Edge Polytopes. 2022 American Control Conference (joint submission to IEEE Control Systems Letters).

[**2**] M.-A. Belabbas, *X. Chen*, and T. Başar. The H-property of Line Graphons. The 13th Asian Control Conference (ASCC 2022), pp. 953-958.

[**3**] E. Jenson*, D. Scheeres, and *X. Chen*. Robust Spacecraft Guidance with Control-Dependent Noise: Analysis and Application. AIAA SCITECH 2022 Forum, p. 1590.

[**4**] B. Gharesifard and *X. Chen*. Structural Averaged Controllability of Linear Ensemble Systems. 2021 IEEE Conference on Decision and Control (joint submission to IEEE Control Systems Letters).

[**5**] E. Jenson*, *X. Chen*, and D. Scheeres. Optimal Spacecraft Guidance with Asynchronous Measurements and Noisy Impulsive Controls. 2021 American Control Conference (joint submission to IEEE Control Systems Letters).

[**6**] M. Javed*, J. Poveda, and *X. Chen*. Excitation Conditions for Uniform Exponential Stability of the Cooperative Gradient Algorithm over Weakly Connected Digraphs. 2021 American Control Conference (joint submission to IEEE Control Systems Letters).

[**7**] T. Dearing*, *X. Chen*, and M. Nicotra. Stabilizing Formation Systems with Nonholonomic Agents. 2020 IEEE Conference on Decision and Control (joint submission to IEEE Control Systems Letters).

[**8**] E. Jenson*, *X. Chen*, and D. Scheeres. Optimal Control of Sampled Linear Systems with Control-Linear Noise. 2020 IEEE Conference on Decision and Control (joint submission to IEEE Control Systems Letters).

[**9**] T. Dearing*, C. Petersen, M. Nicotra, and *X. Chen*. Fuel-Balanced Formation Flight Control of Underactuated Satellites. 2020 American Control Conference, pp. 4319-4324.

[10] M. Javed*, J. Poveda, and *X. Chen*. Global Synchronization of Clocks in Directed Rooted Acyclic Graphs: A Hybrid Systems Approach. 2019 IEEE Conference on Decision and Control, pp. 7352-7357.

[11] 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.

[12] *X. Chen*. Joint Actuator-sensor Design for Stochastic Linear Systems. 2018 IEEE Conference on Decision and Control, pp. 6668-6673.

[13] *X. Chen* and B. Gharesifard. Distinguished Vector Fields over Smooth Manifolds with Applications to Ensemble Control. 2017 IEEE Conference on Decision and Control, pp. 1963-1968.

[14] *X. Chen*, Z. Gao*, and T. Başar. Asymptotic Behavior of a Reduced Conjunctive Boolean Network. 2017 IEEE Conference on Decision and Control, pp. 4404-4409.

[15] *X. Chen* and M.-A. Belabbas. Optimal Actuator Placement for Minimizing the Worst-case Control Energy. The 20th IFAC World Congress, 2017, pp. 9991-9996.

[16] Z. Gao*, *X. Chen*, and T. Başar. State-controlling Sets for Conjunctive Boolean Networks. The 20th IFAC World Congress, 2017, pp. 14290-14295.

[17] Z. Gao*, *X. Chen*, and T. Başar. Orbit-controlling Sets for Conjunctive Boolean Networks. 2017 American Control Conference, pp. 4989-4994.

[18] *X. Chen*, M.-A. Belabbas, and T. Başar. Controlling a Rigid Formation from a Triangle. 2016 IEEE Conference on Decision and Control, pp. 57-62.

[19] Z. Gao*, *X. Chen*, and T. Başar. Periodic Behavior of a Diffusion Model over Directed Graphs. 2016 IEEE Conference on Decision and Control, pp. 37-42.

[20] *X. Chen*, M.-A. Belabbas, and T. Başar. Cluster Consensus over Strongly Connected Voltage Graphs. 2016 International Symposium on Mathematical Theory of Networks and Systems (MTNS).

[21] J. Liu, *X. Chen*, and T. Başar. Stability of the Continuous-time Altafini Model. 2016 American Control Conference, pp. 1930-1935.

[22] J. Liu, *X. Chen*, T. Başar, and A. Nedić. A Continuous-time Distributed Algorithm for Solving Linear Equations. 2016 American Control Conference, pp. 5551-5556.

[23] *X. Chen*, M.-A. Belabbas, and T. Başar. Controllability of Formations over Directed Graphs. 2015 IEEE Conference on Decision and Control, pp. 4764-4769.

[24] *X. Chen*, M.-A. Belabbas, and T. Başar. Formation Control with Triangulated Laman Graphs. 2015 IEEE Conference on Decision and Control, pp. 4115-4120.

[25] *X. Chen*, M.-A. Belabbas, and T. Başar. Consensus with Linear Objective Maps. 2015 IEEE Conference on Decision and Control, pp. 2847-2852.

[26] *X. Chen*, J. Liu, Z. Xu, and T. Başar. Distributed Evaluation and Convergence of Self-appraisals in Social Networks. 2015 IEEE Conference on Decision and Control, pp. 2895-2900.

[27] J. Liu, *X. Chen*, T. Başar, and M.-A. Belabbas. Stability of Discrete-time Altafini's Model: A Graphical Approach. 2015 IEEE Conference on Decision and Control, pp. 2835-2840.

[28] K. Alshehri*, J. Liu, *X. Chen*, and T. Başar. A Stackelberg Game for Multi-period Demand Response Management in the Smart Grid. 2015 IEEE Conference on Decision and Control, pp. 5889-5894.

[29] *X. Chen*. Decentralized Formation Control with a Quadratic Lyapunov Function. 2015 American Control Conference, pp. 4362-4367.

[30] *X. Chen*. Gradient Flows for Organizing Multi-agent System. 2014 American Control Conference, pp. 5109-5114.

[31] *X. Chen* and R. W. Brockett. Centralized and Decentralized Formation Control with Controllable Interaction Laws. 2014 IEEE Conference on Decision and Control, pp. 601-606.

INVITED TALKS

1. DCL Seminar, University of Illinois Urbana-Champaign   11/30/2022
2. DCL Seminar, Georgia Institute of Technology   10/21/2022
3. Department of Automation, Tsinghua University, Beijing, China   08/17/2022
4. 2022 American Control Conference (semi-plenary speaker)   06/10/2022
    Title: "Structure Theory for Control and Estimation of Nonholonomic Ensembles"
5. IFAC World Congress 2020, Workshop: "Analysis, Control, and Learning of Dynamic Ensemble and Population Systems"   07/11/2020
6. 2020 Information Theory and Applications Workshop, Invited Session: "Control and Game Theory"   02/04/2020
7. ECE Seminar, Colorado State University   11/04/2019
8. Department of Mathematics and Statistics, Queen's University, Canada 09/20/2019
9. DCL Seminar, University of Illinois Urbana-Champaign   11/14/2018
10. ESE Seminar, Washington University in St. Louis   11/09/2018
11. School of Aeronautics and Astronautics, Purdue University   03/01/2018

SERVICE

Activities in the ECEE Department and the Engineering College

1. Member of the *Executive Committee*   Aug. 2022 – present
2. Member of the *Graduate Committee*   Aug. 2022 – present
3. Member of the *Search Committee* (system and control)   Aug. 2022 – present
4. Co-organizer of the *Rocky Mountain Workshop on Decisions, Autonomous Systems, and Controls*   Aug. 2019 – present
5. Member of the *Marketing and Outreach Committee*   Aug. 2020 – May 2022
6. Judge of the *65th Annual Colorado-Wyoming Junior Academy of Science (cwjas.org) Symposium*   April 16, 2022
7. Panelist of 2022 AFOSR YIP Webinar organized by the Research & Innovation Office (as a 2020 awardee to offer advice, strategies, and information) May 6, 2021
8. Member of the faculty search committee in the *Robotics, Dynamics, and Control* area for the college (we recruited Dr. Jorge Poveda)   Aug. 2017 – May 2018
9. Graduate student orientation for *Systems and Controls*   Aug. 2017 and Aug. 2018
10. Member of the *Graduate Committee*   Aug. 2016 – May 2017

Activities in the systems and controls community

1. Committee members of 2023 and 2022 AACC O. Hugo Schuck Best Paper Award

2. Co-organizer of a 5-day control workshop: "Geometry, Topology and Control System Design," at the Banff International Research Station (Alberta, Canada). The workshop will take place during 06/11/2023 – 06/16/2023

3. Co-organizer of an invited session: "Sensor and Actuator Placement for Large-Scale Systems," at the 2018 IEEE Conference on Decision and Control, Miami

4. Active NSF panelist and evaluator of AFOSR proposals

5. Chairs and co-chairs of conference sessions (Conference on Decision and Control, American Control Conference)

6. Active reviewer of top-ranked journals and premier conferences, including (J1) IEEE Transactions on Automatic Control; (J2) IEEE Transactions on Control of Network Systems; (J3) IEEE Transactions on Signal Processing; (J4) IEEE Transactions on Cybernetics; (J5) IEEE Transactions on Control Systems Technology; (J6) IEEE Transactions on Smart Grid; (J7) IEEE Control Systems Letters; (J9) Automatica; (J10) Systems & Control Letters; (J10) SIAM Journal on Control and Optimization; (J11) Mathematics of Control, Signals, and Systems; and (C1) IEEE Conference on Decision and Control; (C2) American Control Conference; (C3) IEEE Conference on Control Technology and Applications; (C4) IFAC World Congress.