Ali Pakniyat

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ACADEMIC APPOINTMENTS

University of Alabama, Tuscaloosa, AL   *2021 - present*
Assistant Professor, Department of Mechanical Engineering

Georgia Institute of Technology, Atlanta, USA   *2019 - 2021*
Postdoctoral Research Fellow, Institute for Robotics and Intelligent Machines

University of Michigan, Ann Arbor, USA   *2017 - 2019*
Postdoctoral Research Fellow, Department of Mechanical Engineering

McGill University, Montreal, Canada   *2016 - 2017*
Lecturer, Department of Electrical and Computer Engineering

EDUCATION

McGill University, Montreal, Canada   *2011 – 2016*
Doctor of Philosophy, Electrical Engineering

Sharif University of Technology, Tehran, Iran   *2008 – 2010*
Master of Science, Mechanical Engineering

Shiraz University, Shiraz, Iran   *2004 – 2008*
Bachelor of Science, Mechanical Engineering

RESEARCH AREAS

Control Theory: Optimal Control, Hybrid Systems, Stochastic Processes, Multi-Agent Systems, Mean-Field Games
Control Practice: Autonomous Driving, Vehicle Electrification, Robotics, Micro Electrical-Mechanical Systems (MEMS), Mathematical Finance, Large-Scale Networks

PUBLICATIONS

Patent

[P1] B. Boulet, M. S. R. Mousavi, H. V. Alizadeh, and **A. Pakniyat**, "Seamless Transmission Systems and Methods for Electric Vehicles," Jul. 11 2017, US Patent US 9,702,438 B2

Published Journal Papers

[J18] K. P. Hawkins, **A. Pakniyat**, E. Theodorou, and P. Tsiotras, "Solving Feynman-Kac Forward Backward SDEs Using McKean-Markov Branched Sampling," *IEEE Transactions on Automatic Control, DOI: 10.1109/TAC.2023.3349173*, vol. 69, no. 9, pp. 5695–5710, 2024

[J17] T. Yasini and **A. Pakniyat**, "Hybrid Optimal Control of a Flying+Sailing Drone: Flying with 6 and Sailing with 5 Degrees of Freedom," *IFAC-PapersOnLine*, vol. 58, no. 11, pp. 69–74, 2024

[J16] **A. Pakniyat**, "Theoretical Guarantees for Satisfaction of Terminal State Constraints for Nonlinear Stochastic Systems," in *IUTAM Bookseries*.   Springer Cham, 2024, vol. 40, ch. 9, pp. 1–29

[J15] K. P. Hawkins, **A. Pakniyat**, and P. Tsiotras, "Value Function Estimators for Feynman–Kac Forward–Backward SDEs in Stochastic Optimal Control," *Automatica*, vol. 158, p. 111281, 2023

[J14] **A. Pakniyat** and P. E. Caines, "The Minimum Principle of Hybrid Optimal Control Theory," *Mathematics of Control, Signals, and Systems*, pp. 1–50, 2023

[J13] T. Yasini and **A. Pakniyat**, "Hybrid Optimal Control of a Flying+Sailing Drone," *ASME Letters in Dynamic Systems and Control*, vol. 3, no. 3, pp. 031 008–1 − 031 008–7, 2023

[J12] **A. Pakniyat**, "A Convex Duality Approach for Assigning Probability Distributions to the State of Nonlinear Stochastic Systems," *IEEE Control Systems Letters*, vol. 6, pp. 3080 − 3085, 2022

[J11] D. Firoozi, **A. Pakniyat**, and P. E. Caines, "A Class of Hybrid LQG Mean Field Games with State-Invariant Switching and Stopping Strategies," *Automatica*, vol. 141, pp. 110 244, pp. 1–14, 2022

[J10] **A. Pakniyat** and P. E. Caines, "On the Hybrid Minimum Principle: The Hamiltonian and Adjoint Boundary Conditions," *IEEE Transactions on Automatic Control*, vol. 66, no. 3, pp. 1246–1253, 2021

[J9] **A. Pakniyat** and P. E. Caines, "On the Relation between the Minimum Principle and Dynamic Programming for Classical and Hybrid Control Systems," *IEEE Transactions on Automatic Control*, vol. 62, no. 9, pp. 4347–4362, 2017

[J8] **A. Pakniyat** and P. E. Caines, "Hybrid Optimal Control of an Electric Vehicle with a Dual-Planetary Transmission," *Nonlinear Analysis: Hybrid Systems*, vol. 25, pp. 263–282, 2017

[J7] **A. Pakniyat** and P. E. Caines, "A Class of Linear Quadratic Gaussian Hybrid Optimal Control Problems with Realization–Independent Riccati Equations," *IFAC-PapersOnLine*, vol. 50, no. 1, pp. 2241–2246, 2017

[J6] M. S. R. Mousavi, **A. Pakniyat**, T. Wang, and B. Boulet, "Seamless Dual Brake Transmission For Electric Vehicles: Design, Control and Experiment," *Mechanism and Machine Theory*, vol. 94, pp. 96–118, 2015

[J5] **A. Pakniyat** and P. E. Caines, "Time Optimal Hybrid Minimum Principle and the Gear Changing Problem for Electric Vehicles," *IFAC-PapersOnLine*, vol. 48, no. 27, pp. 187–192, 2015

[J4] **A. Pakniyat** and P. E. Caines, "On the Relation between the Hybrid Minimum Principle and Hybrid Dynamic Programming: A Linear Quadratic Example," *IFAC-PapersOnLine*, vol. 48, no. 27, pp. 169–174, 2015

[J3] **A. Pakniyat** and P. E. Caines, "On the Minimum Principle and Dynamic Programming for Hybrid Systems," *IFAC Proceedings Volumes*, vol. 47, no. 3, pp. 9629–9634, 2014

[J2] **A. Pakniyat** and H. Salarieh, "A Parametric Study on Design of a Microrate-Gyroscope with Parametric Resonance," *Measurement*, vol. 46, no. 8, pp. 2661–2671, 2013

[J1] **A. Pakniyat**, H. Salarieh, and A. Alasty, "Stability Analysis of a New Class of MEMS Gyroscopes with Parametric Resonance," *Acta Mechanica*, vol. 223, no. 6, pp. 1169–1185, 2012

Published Conference Papers

[C17] Y. Guan, M. Zhou, **A. Pakniyat**, and P. Tsiotras, "Shaping Large Population Agent Behaviors Through Entropy-Regularized Mean-Field Games," pp. 4429–4435, 2022

[C16] **A. Pakniyat** and P. Tsiotras, "Partially Observed Steering the State of Linear Stochastic Systems," in *Proceedings of the IEEE Conference on Decision and Control, Austin, USA*, 2021, pp. 3780–3785

[C15] K. P. Hawkins, **A. Pakniyat**, and P. Tsiotras, "On the Time Discretization of the Feynman-Kac Forward-Backward Stochastic Differential Equations for Value Function Approximation," in *Proceedings of the IEEE Conference on Decision and Control, Austin, USA*, 2021, pp. 892–897

[C14] K. P. Hawkins, **A. Pakniyat**, E. Theodorou, and P. Tsiotras, "Forward-Backward Rapidly-Exploring Random Trees for Stochastic Optimal Control," in *Proceedings of the IEEE Conference on Decision and Control, Austin, USA*, 2021, pp. 912–917

[C13] **A. Pakniyat** and P. Tsiotras, "Steering the State of Linear Stochastic Systems: A Constrained Minimum Principle Formulation," in *Proceedings of the IEEE American Control Conference, New Orleans, USA*, 2021, pp. 1300–1305

[C12] **A. Pakniyat** and R. Vasudevan, "A Convex Duality Approach to Optimal Control of Killed Markov Processes," in *Proceedings of the 58th IEEE Conference on Decision and Control, Nice, France*, 2019, pp. 8216–8223

[C11] D. Firoozi, **A. Pakniyat**, and P. E. Caines, "A Mean Field Game - Hybrid Systems Approach to Optimal Execution Problems in Finance with Stopping Times," in *Proceedings of the 56th IEEE Conference on Decision and Control, Melbourne, Australia*, 2017, pp. 433–441

[C10] **A. Pakniyat** and P. E. Caines, "On the Stochastic Minimum Principle for Hybrid Systems," in *Proceedings of the 55th IEEE Conference on Decision and Control, Las Vegas, NV, USA*, 2016, pp. 1139–1144

[C9] **A. Pakniyat** and P. E. Caines, "On the Minimum Principle and Dynamic Programming for Hybrid Systems with Low Dimensional Switching Manifolds," in *Proceedings of the 54th IEEE Conference on Decision and Control, Osaka, Japan*, 2015, pp. 2567–2573

[C8] M. S. R. Mousavi, **A. Pakniyat**, M. K. Helwa, and B. Boulet, "Observer-Based Backstepping Controller Design for Gear Shift Control of a Seamless Clutchless Two-Speed Transmission for Electric Vehicles," in *Proceedings of the IEEE Vehicle Power and Propulsion Conference (VPPC), Montreal, QC, Canada*, 2015, pp. 1–6

[C7] **A. Pakniyat** and P. E. Caines, "On the Relation between the Minimum Principle and Dynamic Programming for Hybrid Systems," in *Proceedings of the IEEE Conference on Decision and Control, Los Angeles, USA*, 2014, pp. 19–24

[C6] **A. Pakniyat** and P. E. Caines, "The Gear Selection Problem for Electric Vehicles: An Optimal Control Formulation," in *Proceedings of the 13th International Conference on Control Automation Robotics & Vision ICARCV, Marina Bay Sands, Singapore*. IEEE, 2014, pp. 1261–1266

[C5] M. S. R. Mousavi, **A. Pakniyat**, and B. Boulet, "Dynamic Modeling and Controller Design for a Seamless Two-Speed Transmission for Electric Vehicles," in *Proceedings of the 2014 IEEE Conference on Control Applications, Antibes, France*, 2014, pp. 635–640

[C4] **A. Pakniyat** and P. E. Caines, "The Hybrid Minimum Principle in the Presence of Switching Costs," in *Proceedings of the 52nd IEEE Conference on Decision and Control, Florence, Italy*, 2013, pp. 3831–3836

[C3] **A. Pakniyat**, H. Salarieh, G. Vossoughi, and A. Alasty, "A Modification on Performance of MEMS Gyroscopes by Parametro-Harmonic Excitation," in *Proceedings of the 10th ASME Biennial Conference on Engineering Systems Design and Analysis, Istanbul, Turkey*, 2010, pp. 433–441

[C2] **A. Pakniyat**, H. Salarieh, and A. Alasty, "Stability Analysis of a Novel MEMS Gyroscope Actuated by Parametric Resonance Using Floquet Theory," in *Proceedings of the 3rd Conference on Nano-Structures, Kish Island, Persian Gulf, Iran*, 2010, pp. 1219–1221

[C1] **A. Pakniyat** and M. Eghtesad, "Solving Differential Equations using Wavelet Transform," in *Proceedings of the 17th Annual International Conference on Mechanical Engineering, Tehran, Iran*, 2010, pp. 1–6, (in Persian)

TEACHING EXPERIENCES

Course Lecturer

UNIVERSITY OF ALABAMA,   COURSE INSTRUCTOR
- ME 591 **Nonlinear Optimal Control**,   Spring 2023
- ME 577 **Advanced Linear Control**,   Fall 2022, Spring 2024
- ME 562 **Intermediate Dynamics**,   Fall 2024
- ME 490 **Mechanical Engineering Design II**,   Spring 2024
- ME 489 **Mechanical Engineering Design I**,   Fall 2023
- ME 372 **Dynamic Systems**,   Fall 2021

MCGILL UNIVERSITY,   COURSE INSTRUCTOR
- ECSE 493 **Control and Robotics Laboratory**,   Winter 2016, 2017
- ECSE 205 **Probability and Statistics for Engineers**,   Fall 2016, Winter 2017

Teaching Assistant

MCGILL UNIVERSITY,   TEACHING ASSISTANT
- ECSE 516 **Nonlinear and Hybrid Control Systems**,   Winter 2013, 2017
- ECSE 506 **Stochastic Control and Decision Theory**,   Winter 2014
- ECSE 500 **Mathematical Foundations of Systems**,   Fall 2013, 2015
- ECSE 493 **Control and Robotics Laboratory**,   Winter 2014, 2015
- ECSE 443 **Introduction to Numerical Methods in Electrical Engineering**,   Winter 2014, 2015
- ECSE 404 **Control Systems**,   Fall 2013, 2014, 2015, 2016

SHARIF UNIVERSITY OF TECHNOLOGY,   TEACHING ASSISTANT
- MECH 28586 **Robust Control**,   Fall 2010
- MECH 28416 **Automatic Control**,   Spring 2010, Fall 2010

SHIRAZ UNIVERSITY,   TEACHING ASSISTANT
- MECH 100531241 **Mechanical Vibrations**,   Spring 2008
- MECH 100531221 **Dynamics of Machinery**,   Spring 2008
- MECH 100531171 **Machine Design II**,   Fall 2007
- MECH 100531161 **Machine Design I**,   Spring 2007
- MECH 100531071 **Dynamics**,   Fall 2006

INVITED TALKS

2024-07-05 CIM – GERAD Informal Systems Seminar (ISS),   Montreal (QC), Canada

2023-04-03 UCSC Applied Math Seminar,   Santa Cruz (CA), USA

2023-03-16 IUTAM Symposium on Optimal Guidance and Control for Autonomous Systems,   Honolulu (HI), USA

2022-09-23 UA Applied Math Seminar,   Tuscaloosa (AL), USA

2021-04-07 UA Mechanical Engineering Seminar,   Tuscaloosa (AL), USA

2020-03-26 Arizona State University, School for Engineering of Matter, Transport and Energy Seminar, Tempe (AZ), USA

2020-03-18 University of Michigan – Dearborn, Electrical & Computer Engineering Seminar,   Dearborn (MI), USA

2019-05-30 CIM – GERAD Informal Systems Seminar (ISS),   Montreal (QC), Canada

2019-05-27 Queen's University Control Theory Seminar,   Kingston (ON), Canada

2019-04-09 Center for Control, Dynamical Systems, and Computation (CCDC) Seminar,   Santa Barbara (CA), USA

2018-10-13 The 2018 Midwest Optimization Meeting,   Oxford (OH), USA

2018-06-07 University College Dublin, School of Electrical and Electronic Engineering,   Dublin, Ireland

2018-04-25 Michigan Postdoctoral Association of the College of Engineering (MPACE) Seminar,   Ann Arbor (MI), USA

2018-01-30 Michigan Robotics Colloquium,   Ann Arbor (MI), USA

2017-09-08 University of California, Santa Barbara, Department of Mechanical Engineering,   Santa Barbara (CA), USA

2017-09-05 Stanford University, Department of Aeronautics and Astronautics,   Stanford (CA), USA

2017-01-30 University of Michigan, Department of Mechanical Engineering,   Ann Arbor (MI), USA

2017-01-06 University of California, Irvine, Aeronatics, Dynamics and Control Lab Seminar   Irvine (CA), USA

2016-07-21 IEEE Montreal – Concordia University,   Montreal (QC), Canada

2016-05-11 The 7th Biannual Meeting on System and Control Theory,   Kingston (ON), Canada

2014-05-05 The 6th Biannual Meeting on System and Control Theory,   Waterloo (ON), Canada

SELECTED HONOURS AND AWARDS

- ▷ Canadian Marconi Graduate Award — 2017
- ▷ Automotive Partnership Canada (APC) – Natural Sciences & Engineering Research Council (NSERC) — 2012–2016
- ▷ MEDA (McGill Engineering Doctoral Award) — 2011–2014
- ▷ GERAD (Groupe d'Études et de Recherche en Analyse des Décisions) Doctoral Fellowship — 2015
- ▷ Graduate Excellence Award in Engineering – McGill University — 2011–2014
- ▷ IEEE-CSS (Control Systems Society) Travel Award — 2014
- ▷ GREAT (Graduate Research Enhancement and Travel) – McGill University — 2014
- ▷ Ranked 2nd among 57 students in the program of Applied Mechanics, and 3rd among 130 students in the M.Sc. program of Mechanical Engineering at Sharif University of Technology — 2008–2010
- ▷ Ranked 1st among 80 students in the B.Sc. program of Mechanical Engineering at Shiraz University — 2004–2008

STUDENT SUPERVISION

- **Armel Koulong**, Ph.D. candidate, *University of Alabama*, — *2021 - present*
  (simultaneous position: GNC (Guidance, Navigation and Control) Engineer at *Jacobs*)
- **Taha Yasini**, Ph.D. student, *University of Alabama*, — *2021 - present*
- **Tyler Halterman**, Ph.D. student, *University of Alabama*, — *2022 - present*
  (simultaneous position: Controls Design Engineer at *General Motors*)
- **Scott Yue Guan**, Ph.D. candidate (co-advising), *Georgia Institute of Technology*, — *2019 - present*
- **Kelsey Hawkins**, Ph.D. (co-advised), *Georgia Institute of Technology*, — *2019 - 2021*
  (now: Research Scientist at *Toyota Research Institute (TRI)*)
- **Dena Firoozi**, Ph.D. (co-advised), *McGill University*, — *2016 - 2017*
  (now: Assistant Professor at *HEC Montréal*)
- **Phillip Means**, M.Sc. , *University of Alabama*, — *2021 - 2023*
  (now: Electronic EngineerElectronic Engineer at *Defense Intelligence Agency*)
- **Saiedeh Akbari**, M.Sc. (co-advised), *University of Alabama*, — *2021 - 2023*
  (now: PhD Student at the *University of Florida*)

REVIEW SERVICES

Research Proposals:

- National Science Foundation (NSF)
- Nuclear Energy University Program (NEUP)

Journals:

- IEEE Transactions on Automatic Control (TAC),
- Automatica,
- Systems & Control Letters (SCL),
- SIAM Journal on Control and Optimization (SICON),
- IEEE Control Systems Letters (L-CSS),
- Nonlinear Analysis: Hybrid Systems (NAHS),
- IEEE Transactions on Systems, Man, and Cybernetics: Systems (SMC),
- IEEE Transactions on Control of Network Systems (CONES),
- Nonlinear Dynamics (NODY),
- Sensors - MDPI

Conferences:

- IEEE Conference on Decision and Control (CDC),
- IEEE American Control Conference (ACC),
- IFAC World Congress,
- ACM Conference on Hybrid Systems: Computation and Control (HSCC),
- IEEE European Control Conference (ECC),
- ISME International Conference on Mechanical Engineering

SELECTED LEADERSHIP AND VOLUNTEER EXPERIENCES

Program Committee Member, The Sixteenth International Conference on Adaptive and Self-Adaptive Systems and Applications (ADAPTIVE 2024), Venice, Italy   2023 – 2024
Program Committee Member, The 26th ACM International Conference on Hybrid Systems: Computation and Control (HSCC 2023), San Antonio, TX, USA   2022 – 2023
Mentor, Association for Women in Science (AWIS) - University of Michigan   2017 – 2019
Chair, Chapter 12 (Control Systems) - IEEE SEM (Southeast Michigan) Section   2018
Technical Judge, Emerging Research Competition in Engineering Graduate Symposium - Univ. of Michigan   2018
Seminar Coordinator, Informal Systems Seminars (ISS) - McGill University   2012 – 2017

SELECTED TRAINING EXPERIENCES

Technical Research Training

2022	*SEC Conference on Artificial Intelligence,*	University of Florida
2021	*Workshop on Distributed Learning and Multi-agent Learning,*	IEEE Control Systems Society
2021	*Mean Field Games on Networks Workshop,*	Pacific Institute for the Mathematical Sciences (PIMS)
2020	*ARL/UPenn/GaTech Workshop on Multi-agent Games,*	United States Army Research Laboratory
2020	*Exploring Interplay between Dynamical Systems and Function Spaces Workshop,*	IEEE Control Systems Society
2019	*Southeast Controls Conference,*	Georgia Institute of Technology
2018	*Stochastic Control and its Application,*	IEEE Control Systems Society
2018	*Midwest Optimization Meeting,*	Miami University
2018	*Princeton Day of Optimization,*	Princeton University
2018	*Midwest Robotics Workshop,*	Toyota Technological Institute at Chicago
2018	*Meeting on System and Control Theory,*	University of Toronto
2018	*Midwest Workshop on Control and Game Theory,*	Michigan State University
2017	*Mean Field Games Workshop,*	Institute for Pure and Applied Mathematics, Univ. of California, Los Angeles
2016	*Aerospace Summer School,*	Concordia University
2016	*Meeting on System and Control Theory,*	Queen's University
2015	*Workshop on Dynamic Games in Management Science,*	GERAD – HEC Montréal
2015	*Mathematical Cybernetics: Hybrid, Stochastic and Decentralized Systems,*	Carlton University
2014	*Symposium on Advanced Electric Vehicle Drivetrains,*	McGill University – IEEE
2014	*Meeting on System and Control Theory,*	University of Waterloo

Teaching Training

2018	*Postdoctoral Course on College Teaching in STEM,*	University of Michigan
2017	*Motivating Engineering Students: Strategies to Increase Engagement,*	University of Michigan
2017	*Perspectives on Teaching: A Faculty Panel,*	University of Michigan
2017	*Workshop on Graduate Supervision,*	McGill University
2011	*Graduate Teaching Workshop,*	McGill University

General Training

2022	*Getting Funded by NSF: Proposal Preparation and the Merit Review Process,*	National Science Foundation (NSF)
2022	*Overview of NSF Programs + NSF Office of International Science and Engineering (OISE),*	NSF
2022	*Laboratory Safety + Electrical Safety + Hand and Power Tool Safety + Fire Safety and Prevention + Personal Protective Equipment,*	University of Alabama
2022	*Equal Opportunity, Sexual Misconduct, and Title IX + Office of Disability Services,*	University of Alabama
2021	*Cybersecurity + Protecting Privacy + FERPA: Confidentiality of Student Records,*	University of Alabama
2021	*UA Fiscal Responsibilities + Managing Conflicts of Interest,*	University of Alabama
2021	*Child Abuse Report Training + Hazard Communication,*	University of Alabama
2019	*NSF Responsible Conduct of Research Research,*	Georgia Institute of Technology
2017	*Academic Identity Management,*	University of Michigan
2017	*Research Integrity Workshop,*	McGill University
2016	*NASA Engineering and Science Activities,*	IEEE–Montreal
2016	*Workshop on How to Organize an IEEE Event,*	IEEE Panel of Conference Organizers (POCO)
2014	*Workshop on Basic Business Skills for Non-Business Graduate Students,*	McGill University
2010	*Workshop on Invention: Technology Development and Commercialization,*	University of Southern California and Sharif University of Technology