

Ali Pakniyat

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EDUCATION

McGill University, Montreal, Canada 2011 – 2016
Doctor of Philosophy, Electrical Engineering *Supervisor: Peter E. Caines*
Thesis: “Optimal control of deterministic and stochastic hybrid systems: theory and applications”

Sharif University of Technology, Tehran, Iran 2008 – 2010
Master of Science, Mechanical Engineering *Supervisors: Hassan Salarieh & Aria Alasty*
Thesis: “On the nonlinear dynamics and bifurcations in a new class of MEMS gyroscopes with parametric resonance”

Shiraz University, Shiraz, Iran 2004 – 2008
Bachelor of Science, Mechanical Engineering *Supervisor: Mohammad Eghtesad*
Thesis: “Solving differential equations using Wavelet transform”

ACADEMIC APPOINTMENTS

Georgia Institute of Technology, Atlanta, USA 2019 - present
Postdoctoral Research Fellow, Institute for Robotics and Intelligent Machines *Supervisor: Panagiotis Tsiotras*

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

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

RESEARCH AREAS

Control Theory: Optimization and 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

Journal Papers

- [J6] **A. Pakniyat** and P. E. Caines, “On the Minimum Principle for Hybrid Systems,” *arXiv:1710.05521v2*, 2019, Accepted for publication by the IEEE Transactions on Automatic Control
- [J5] **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
- [J4] **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
- [J3] 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
- [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

Journal/Conference Papers

- [JC4] **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, also appeared in Proceedings of the International Federation of Automatic Control 20th World Congress, Toulouse, France
- [JC3] **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, also appeared in Proceedings of the 5th IFAC Conference on Analysis and Design of Hybrid Systems, Atlanta, GA, USA
- [JC2] **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, also in Proceedings of the 5th IFAC Conference on Analysis and Design of Hybrid Systems, Atlanta, GA, USA
- [JC1] **A. Pakniyat** and P. E. Caines, “On the Minimum Principle and Dynamic Programming for Hybrid Systems,” *IFAC-PapersOnLine*, vol. 47, no. 3, pp. 9629–9634, 2014, also appeared in Proceedings of the International Federation of Automatic Control 19th World Congress, Cape Town, South Africa

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

Conference Papers

- [C12] **A. Pakniyat** and R. Vasudevan, “A Convex Duality Approach to Optimal Control of Killed Markov Processes,” in *(to appear in) the Proceedings of the 58th IEEE Conference on Decision and Control, Nice, France, 2019*
- [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 53rd IEEE Conference on Decision and Control, Los Angeles, CA, 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)

Under Review and In-Preparation Journal Papers

- [U5] D. Firoozi, **A. Pakniyat**, and P. E. Caines, “A Hybrid Optimal Control Approach to LQG Mean Field Games with Switching and Stopping Strategies,” *arXiv:1810.02920*, 2018
- [U4] **A. Pakniyat** and P. E. Caines, “The Stochastic Hybrid Minimum Principle.”
- [U3] **A. Pakniyat** and R. Vasudevan, “A Convex Duality Approach to Hybrid Dynamic Programming.”
- [U2] K. P. Hawkins, **A. Pakniyat**, E. Theodorou, and P. Tsiotras, “Forward Backward RRT: Solving Stochastic Optimal Control Problems with Branched Sampled Forward Backward SDEs.”
- [U1] **A. Pakniyat** and P. Tsiotras, “Steering of Linear Stochastic Hybrid Systems: A Minimum Principle Approach.”

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 2 nd among 57 students in the program of Applied Mechanics, and 3 rd among 130 students in the M.Sc. program of Mechanical Engineering at Sharif University of Technology	2008–2010
▷ Ranked 1 st among 80 students in the B.Sc. program of Mechanical Engineering at Shiraz University	2004–2008

TEACHING EXPERIENCES

Course Lecturer

McGILL UNIVERSITY,

ECSE 493 **Control and Robotics Laboratory**,
ECSE 205 **Probability and Statistics for Engineers**,

COURSE INSTRUCTOR

Winter 2016, 2017
Fall 2016, Winter 2017

Teaching Assistant

McGILL UNIVERSITY,

ECSE 516 **Nonlinear and Hybrid Control Systems**,
ECSE 506 **Stochastic Control and Decision Theory**,
ECSE 500 **Mathematical Foundations of Systems**,
ECSE 493 **Control and Robotics Laboratory**,
ECSE 443 **Introduction to Numerical Methods in Electrical Engineering**,
ECSE 404 **Control Systems**,

TEACHING ASSISTANT

Winter 2013, 2017
Winter 2014
Fall 2013, 2015
Winter 2014, 2015
Winter 2014, 2015
Fall 2013, 2014, 2015, 2016

SHARIF UNIVERSITY OF TECHNOLOGY,

MECH 28586 **Robust Control**,
MECH 28416 **Automatic Control**,

TEACHING ASSISTANT

Fall 2010
Spring 2010, Fall 2010

SHIRAZ UNIVERSITY,

MECH 100531241 **Mechanical Vibrations**,
MECH 100531221 **Dynamics of Machinery**,
MECH 100531171 **Machine Design II**,
MECH 100531161 **Machine Design I**,
MECH 100531071 **Dynamics**,

TEACHING ASSISTANT

Spring 2008
Spring 2008
Fall 2007
Spring 2007
Fall 2006

INVITED TALKS

2019-05-30 CIM – GERAD Informal Systems Seminar (ISS),	Montreal, Canada
2019-05-27 Queen's University Control Theory Seminar,	Kingston, Canada
2019-04-09 Center for Control, Dynamical Systems, and Computation (CCDC) Seminar,	Santa Barbara, 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, USA
2018-01-30 Michigan Robotics Colloquium,	Ann Arbor, USA
2017-09-08 University of California, Santa Barbara, Department of Mechanical Engineering,	Santa Barbara, USA
2017-09-05 Stanford University, Department of Aeronautics and Astronautics,	Stanford, USA
2017-01-30 University of Michigan, Department of Mechanical Engineering,	Ann Arbor, USA
2017-01-06 University of California, Irvine, Aeronautics, Dynamics and Control Lab Seminar	Irvine, USA
2016-07-21 IEEE Montreal – Concordia University,	Montreal, Canada
2016-05-11 The 7th Biannual Meeting on System and Control Theory,	Kingston, Canada
2014-05-05 The 6th Biannual Meeting on System and Control Theory,	Waterloo, Canada

SELECTED LEADERSHIP AND VOLUNTEER EXPERIENCES

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
Charity Fundraiser , Omid Group - Hope for Children with Cancer	2013–2016

SELECTED TRAINING EXPERIENCES

Teaching Training

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

General Training

2017 <i>Academic Identity Management</i> ,	University of Michigan
2017 <i>Research Integrity Workshop</i> ,	McGill University
2016 <i>NASA Engineering and Science Activities</i> ,	IEEE–Montreal
2016 <i>Workshop on How to Organize an IEEE Event</i> ,	IEEE Panel of Conference Organizers (POCO)
2014 <i>Workshop on Basic Business Skills for Non-Business Graduate Students</i> ,	McGill University
2010 <i>Workshop on Invention: Technology Development and Commercialization</i> ,	University of Southern California and Sharif University of Technology

Technical Research Training

2019 <i>Southeast Controls Conference</i> ,	Georgia Institute of Technology
2018 <i>Stochastic Control and its Application</i> ,	IEEE Control Systems Society
2018 <i>Midwest Optimization Meeting</i> ,	Miami University
2018 <i>Princeton Day of Optimization</i> ,	Princeton University
2018 <i>Midwest Robotics Workshop</i> ,	Toyota Technological Institute at Chicago
2018 <i>Meeting on System and Control Theory</i> ,	University of Toronto
2018 <i>Midwest Workshop on Control and Game Theory</i> ,	Michigan State University
2017 <i>Mean Field Games Workshop</i> ,	Institute for Pure and Applied Mathematics, Univ. of California, Los Angeles
2016 <i>Aerospace Summer School</i> ,	Concordia University
2016 <i>Meeting on System and Control Theory</i> ,	Queen's University
2015 <i>Workshop on Dynamic Games in Management Science</i> ,	GERAD – HEC Montréal
2015 <i>Mathematical Cybernetics: Hybrid, Stochastic and Decentralized Systems</i> ,	Carlton University
2014 <i>Symposium on Advanced Electric Vehicle Drivetrains</i> ,	McGill University – IEEE
2014 <i>Meeting on System and Control Theory</i> ,	University of Waterloo

REVIEW SERVICES

Journals:	IEEE Transactions on Automatic Control (TAC) Automatica SIAM Journal on Control and Optimization (SICON) Systems & Control Letters (SCL) IEEE Control Systems Letters (L-CSS) Nonlinear Analysis: Hybrid Systems (NAHS) IEEE Transactions on Systems, Man, and Cybernetics: Systems (SMC) Nonlinear Dynamics (NODY) Sensors - MDPI
Conferences:	IEEE Conference on Decision and Control (CDC) IFAC World Congress IEEE American Control Conference (ACC) ACM Conference on Hybrid Systems: Computation and Control (HSCC) IEEE European Control Conference (ECC)

SELECTED REFERENCES

Peter E. Caines , Professor, peterc@cim.mcgill.ca	Department of Electrical and Computer Engineering, McGill University (+1) 514 398 7129
Panagiotis Tsiotras , Professor, tsiotras@gatech.edu	School of Aerospace Engineering, Georgia Institute of Technology (+1) 404 894 9526
Ramanarayan Vasudevan , Assistant Professor, ramv@umich.edu	Department of Mechanical Engineering, University of Michigan (+1) 734 647 5560
Aditya Mahajan , Associate Professor, aditya.mahajan@mcgill.ca	Department of Electrical and Computer Engineering, McGill University (+1) 514 398 8088