

# Karime Pereida Pérez

ROBOTICS, CONTROL, MACHINE LEARNING

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## Experience

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### Machine Learning and Controls Researcher • Kindred

Toronto, Canada

ENGINEERING • AI TEAM

2021 - Present

- Develop modeling and control frameworks for robotic manipulators for automated online retail.
- Coordinating across teams to deliver on technical goals.

### Postdoctoral Fellow • University of Toronto

Toronto, Canada

INSTITUTE FOR AEROSPACE STUDIES • DYNAMIC SYSTEMS LABORATORY

2020 - 2021

- Theoretical analysis of the choice of model in a model reference adaptive controller and its impact on performance.
- Develop and analyze the intersection of tracking controllers with online neural network learning.

### Graduate Researcher • University of Toronto

Toronto, Canada

INSTITUTE FOR AEROSPACE STUDIES • DYNAMIC SYSTEMS LABORATORY

2014 - 2020

- Develop control frameworks that guarantee high-accuracy trajectory tracking in changing environments, where robots must handle model uncertainties, unknown disturbances, and changing dynamics.
- Design control methods that use learning to improve trajectory tracking performance over iterations.
- Use learning and control theory to develop transfer learning techniques that include a multi-robot, multi-task transfer learning framework.
- Design and provide performance guarantees for a robust and adaptive optimal control framework that achieves high-accuracy trajectory tracking in changing environments.
- Validate the proposed controllers with simulations and extensive experiments on quadrotors subject to disturbances.

### Invited Course Instructor • University of Toronto

Toronto, Canada

DIVISION OF ENGINEERING SCIENCE

2020

- AER1217: Development of Autonomous UAS

### Teaching Assistant • University of Toronto

Toronto, Canada

DIVISION OF ENGINEERING SCIENCE

2015 - 2018

- ROB301: Introduction to Robotics

### Graduate Researcher • University of New South Wales

Sydney, Australia

SCHOOL OF MECHANICAL AND MANUFACTURING ENGINEERING

2012 - 2014

- Develop efficient path planning techniques in dense contexts and time-varying environments through the use of dynamic programming.
- Design hybrid algorithms based on dynamic programming and particle swarm optimisation that take advantage of partitioning the environment to provide significant speed ups.
- Test proposed algorithms under different conditions such as multiple degree of freedom platforms, cluttered environments and dense contexts.

### Teaching Assistant • University of New South Wales

Sydney, Australia

SCHOOL OF MECHANICAL AND MANUFACTURING ENGINEERING

2012 - 2014

- MTRN4110: Robot Design
- MTRN4010: Advanced Autonomous Systems

### Summer Research Intern • Massachusetts Institute of Technology

Cambridge, MA, USA

DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS • SPACE PROPULSION LAB

Summer 2010

- Investigate the microfabrication of electro-spray ion sources through nickel electro-deposition as a method to produce micron sized high aspect-ratio pillars as electro-spray ion sources.
- Test electroplating baths under different voltages and observe different plating regimes. Certain regimes will plate the inside of pores, closing the materials porosity at precise points while others form solid structures on top of porous media.

### Undergraduate Researcher • Tecnológico de Monterrey

Cuernavaca, México

ESCUELA DE INGENIERÍA Y CIENCIAS • ROBOTICS AND AUTOMATION LABORATORY

2007 - 2011

- Design embedded controllers and electronic circuits used in various robotic projects under the PROFIL (Spanish for: Undergraduate Research Promotion Program) scheme, which include an agricultural and a firefighting robot.

## Education

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### Doctor of Philosophy • University of Toronto

Toronto, Canada

INSTITUTE FOR AEROSPACE STUDIES • DYNAMIC SYSTEMS LABORATORY

2014 - May 2020

- Thesis title: "Adaptive and Learning Controllers for High-Accuracy Trajectory Tracking in Changing Conditions"
- Research focus on robust, optimal and adaptive control, and iterative and transfer learning.
- Supervisor: Prof. Angela Schoellig

## M.Eng (Research) • University of New South Wales

Sydney, Australia

SCHOOL OF MECHANICAL AND MANUFACTURING ENGINEERING

2012 - 2014

- Research focus on path planning algorithms.
- Supported by University International Postgraduate Award (UIPA).
- Supervisor: Senior Lecturer José Guivant

## B.Sc. in Mechatronics Engineering • Tecnológico de Monterrey

Cuernavaca, México

ESCUELA DE INGENIERÍA Y CIENCIAS

2007 - 2011

- Graduating average: 99.033/100.
- Ranked 1st in graduating class.
- Received *Mejor Promedio de la Generación* Award for graduating with the highest average of all undergraduate degrees in the class of 2011.

## Professional Activities & Community Service

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### Organizer • Women in Robotics

Toronto, Ontario

ONTARIO CHAPTER

2022- Present

- Started the Women in Robotics Ontario Chapter with other women in Ontario and organized their kick-off event in Toronto with 30-40 members.

### Invited Participant • Women in Aerospace Symposium

Cambridge, MA, USA

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

2019

- The Women in Aerospace symposium is an annual MIT event during which invited doctoral candidates from around the world present their work and network with each other and with invited leading professionals from academia, industry, and government.

### Social Coordinator • Aerospace Student's Association

Toronto, Canada

UNIVERSITY OF TORONTO INSTITUTE FOR AEROSPACE STUDIES

2015 - 2017

- The ASA represents graduate students at UTIAS. Social events are organized to foster a sense of community.

### Student Member • UTIAS Student Experience Committee

Toronto, Canada

UNIVERSITY OF TORONTO INSTITUTE FOR AEROSPACE STUDIES

2015 - 2016

- The SEC gathers data about the UTIAS student's body experiences at the Institute and makes a report to the Director summarizing the data and suggesting improvements.

## Mentorship

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[1] Bryan Chan. Ph.D. Student at the University of Alberta. Internship, 2023.

[2] Junjiang Li. Msc.AC. Student at the University of Toronto. Internship, 2022.

[3] Flora Huo. Undergraduate Student at the University of British Columbia. Internship 2021, 2022.

## Technical Skills

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**Languages:** Spanish(Native), English (Fluent), French (Conversational)

**Programming:** C++, Python, Matlab

**Tools:** Linux, git, ROS, gcc compiler

## Presentations

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[1] K. Pereida, "Enabling robots to handle groceries, parcels and apparel," presentation at the *Conference on Robots and Vision (CRV)*, Montreal, Canada, 2023.

[2] K. Pereida, "From Simulation to Production: Reinforcement Learning in Industry," presentation at the *Releasing Robots into the Wild: Simulations, Benchmarks, and Deployment Workshop at the IEEE Conference on Robotics and Automation (ICRA)*, Pittsburgh, USA, 2022.

[3] K. Pereida, "Adaptive and Learning Controllers for High Accuracy Trajectory Tracking in Changing Environments," presentation at the *Women in Robotics and Control Robotics Seminar (IEEE RAS Bolivia Chapter)*, Online, 2021.

[4] K. Pereida, and A.P. Schoellig, "Robust Adaptive Model Predictive Control for High-Accuracy Trajectory Tracking in Changing Conditions," presentation at the *Algorithms and Architectures for Learning in-the-Loop Systems in Autonomous Flight Workshop at the IEEE Conference on Robotics and Automation (ICRA)*, Montreal, Canada, 2019.

[5] K. Pereida and M. Greeff, "Bias In, Bias Out - Diversity In, Diversity Out," lightning talk at the *Debates on the Future of Robotics Research at the IEEE Conference on Robotics and Automation (ICRA)*, Montreal, Canada, 2019.

[6] K. Pereida, M.K. Helwa and A.P. Schoellig, “Data-efficient multi-robot, multi-task transfer learning for trajectory tracking,” poster at the *Resilient Robot Teams: Composing, Acting, and Learning Workshop at the IEEE Conference on Robotics and Automation (ICRA)*, Montreal, Canada, 2019.

[7] K. Pereida, “High-accuracy trajectory tracking in changing environments,” technical talk at the *Women in Aerospace Symposium*, Cambridge, MA, USA, 2019.

## Publications

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[1] S. Zhou, K. Pereida, W. Zhao, and A. P. Schoellig, “Bridging the Model-Reality Gap With Lipschitz Network Adaptation” *IEEE Robotics and Automation Letters (RA-L)*, 2021.

[2] K. Pereida, L. Brunke, and A. P. Schoellig, “Robust adaptive model predictive control for guaranteed fast and accurate stabilization in the presence of model errors” *International Journal of Robust and Nonlinear Control*, 2021.

[3] K. Dong, K. Pereida, F. Shkurti, and A. P. Schoellig, “Catch the ball: accurate high-speed motions for mobile manipulators via inverse dynamics learning” in *Proceedings of the IEEE International Conference on Intelligent Robots and Systems (IROS)*, 2020.

[4] K. Pereida, D. Kooijman, R.R.P.R. Duivenvoorden, and A.P. Schoellig, “Transfer learning for high-precision trajectory tracking through adaptive feedback and iterative learning,” *International Journal of Adaptive Control and Signal Processing*, 2019.

[5] K. Pereida and A.P. Schoellig, “Adaptive Model Predictive Control for High-Accuracy Trajectory Tracking in Changing Conditions,” in *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2018.

[6] K. Pereida, M.K. Helwa and A.P. Schoellig, “Data-efficient multi-robot, multi-task transfer learning for trajectory tracking,” *IEEE Robotics and Automation Letters (RA-L)*, 2018.

[7] K. Pereida, R.R.P.R. Duivenvoorden and A.P. Schoellig, “High-Precision Trajectory Tracking in Changing Environments Through  $\mathcal{L}_1$  Adaptive Feedback and Iterative Learning,” in *Proceedings of the IEEE Conference on Robotics and Automation (ICRA)*, 2017.

[8] K. Pereida, J.E. Guivant and A. Lohr, “PWL Approximation for Dense Mapping and Associated Hybrid PSO-Dijkstra Processes for Path Planning,” in *Proceedings of the Australasian Conference on Robotics and Automation (ACRA)*, 2014.

[9] K. Pereida, and J.E. Guivant, “PWL Approximation for Dense Mapping and Associated Dijkstra Processes for the Concurrent Synthesis of Multiple Full Cost-to-Go Functions,” in *Proceedings of the Australasian Conference on Robotics and Automation (ACRA)*, 2013.

[10] K. Pereida, and J.E. Guivant, “Hybrid Dijkstra-PSO algorithm for motion planning of non-holonomic multiple-trailer platforms in dense contexts,” in *Proceedings of the IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)*, 2013.

[11] J.E. Guivant, S. Marden, and K. Pereida, “Distributed multi-sensor data fusion for autonomous 3D mapping,” in *Proceedings of the IEEE International Conference on Indoor Positioning and Indoor Navigation (IPIN)*, 2012.