

Karime Pereida

PH.D. CANDIDATE - ROBOTICS, CONTROL, MACHINE LEARNING

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Education

Institute for Aerospace Studies - Dynamic Systems Laboratory

Toronto, Canada

PH.D. CANDIDATE - UNIVERSITY OF TORONTO

2014 - May 2020

- Research focus on robust and adaptive control, and iterative and transfer learning.
- Supported by CONACYT Scholarship (Mexican government).
- Supervisor: Prof. Angela Schoellig

University of New South Wales

Sydney, Australia

M.ENG (RESEARCH)

2012 - 2014

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

Instituto Tecnológico y de Estudios Superiores de Monterrey

Cuernavaca, México

LICENCIATURA (EQUIVALENT TO BACHELOR) IN MECHATRONICS ENGINEERING

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.

University of New South Wales

Sydney, Australia

EXCHANGE PROGRAM

2011

- Exchange program - Mechatronics Engineering.
- FEMSA scholarship - Covered part of the exchange expenses.

Research Experience

University of Toronto

Toronto, Canada

PH.D. CANDIDATE

2014 - Present

- 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 extensive experiments on quadrotors subject to disturbances.

University of New South Wales

Sydney, Australia

GRADUATE RESEARCHER

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.

Massachusetts Institute of Technology

Cambridge, MA, USA

SUMMER RESEARCH INTERN - 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.

ITESM - Robotics and Automation Laboratory (LARA)

Cuernavaca, México

UNDERGRADUATE RESEARCHER

2007 - 2011

- Design 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.

Work Experience

Mediatec

Ciudad de México, México

PRODUCT MANAGER

2012

- Design, market, implement and manage Robotics and Artificial Intelligence laboratories that satisfy the needs of higher education in Mexico.
- Present our solutions to potential clients: university chancellors, heads of school and professors.
- Design and teach the training course for technical staff in the use of Aldebaran Robotics NAO robot.

Teaching Experience

AER1217: Development of Autonomous UAS

Toronto, Canada

INVITED INSTRUCTOR - UNIVERSITY OF TORONTO

2020

- Taught linear and nonlinear control techniques and modelling for quadrotors.

ROB301: Introduction to Robotics

Toronto, Canada

TEACHING ASSISTANT - UNIVERSITY OF TORONTO

2015 - 2018

- Aid undergraduate students in the learning process of the course material (sensor data fusion, path planning and control) and the preparation of projects.
- Design laboratory tasks that allow students to implement the material learned in class.

MTRN4110: Robot Design

Sydney, Australia

TEACHING ASSISTANT - UNIVERSITY OF NEW SOUTH WALES

2012 - 2014

- Assist students with laboratory tasks that cover robot design, mechanisms and kinematic of robots, sensors, perception, and motion planning and control in cluttered contexts.

MTRN4010: Advanced Autonomous Systems

Sydney, Australia

TEACHING ASSISTANT - UNIVERSITY OF NEW SOUTH WALES

2012 - 2014

- Assist students with laboratory tasks that cover stochastic processes, state estimation, sensor data fusion, nonlinear control, optimal control, stochastic control, behaviour-based control, and machine learning techniques.

Professional Activities & Community Service

University of Toronto Institute for Aerospace Studies

Toronto, Canada

SOCIAL REPRESENTATIVE - AEROSPACE STUDENT'S ASSOCIATION

2015 - 2017

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

University of Toronto Institute for Aerospace Studies

Toronto, Canada

STUDENT MEMBER - UTIAS STUDENT EXPERIENCE COMMITTEE

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.

Skills

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

Programming: C++, Python, Matlab

Tools: Linux, git, ROS

Presentations

[1] 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.

[2] 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.

[3] 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.

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

Publications

- [1] 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.
- [2] 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.
- [3] 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.
- [4] 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.
- [5] 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.
- [6] 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.
- [7] 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.
- [8] 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.