CHARLES C. **COSSETTE**

PhD Candidate | Robotics and Autonomous Systems

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Researcher at McGill University supervised by Prof. James R. Forbes and Prof. David Saussié. I specialize in estimation, planning, and control algorithms for multi-robot teams, specifically how to best use ultra-wideband radio to enable collaboration between robots.

Education

present **Doctor of Philosophy**, McGill University, Mechanical Engineering
2019 **Master of Engineering**, McGill University, Mechanical Engineering
2017 **Bachelor of Engineering**, McGill University, Mechanical Engineering

Skills

Coding: Python | Embedded C | Matlab | C++
Other software: Robot Operating System (ROS) | FreeRTOS | Pytorch | OpenCV | git | Linux
Math: State Estimation | SLAM | Bayesian Inference | Probability Theory | Machine Learning | Control Theory | Graph Theory | Optimization

Work

December 2018 – July 2019 — **Guidance, Navigation, and Control Consultant, Reaction Dynamics, Montreal, Canada.**
Built 3D flight dynamics simulator and designed control algorithms for an orbital launch vehicle.
Python | Matlab | Dynamic simulation | PID Control | LQR Control

July 2018 – November 2018 — **Senior Technical Specialist, CAE, Montreal, Canada.**
Developed and fixed customer issues for airplane engine simulation software.
C/C++

September 2017 – May 2018 — **Research Intern, ARA Robotics, Montreal, Canada.**
As part of Master's degree, developed an adaptive notch filter for vibration filtering for quadcopters.
Embedded C | Matlab | Kalman Filtering | FFT

Featured Publications

Optimal Multi-robot Formations for Relative Pose Estimation Using Range Measurements — IROS 2022
C. C. Cossette, M. A. Shalaby, D. Saussie, J. L. Ny et J. R. Forbes Paper

Localization with Directional Coordinates — IROS 2021
C. C. Cossette, M. Shalaby, D. Saussie et J. R. Forbes Paper Video

Relative Position Estimation between Two UWB Devices with IMUs — RAL/ICRA 2021
C. C. Cossette, M. Shalaby, D. Saussie, J. R. Forbes et J. Le Ny (Best Paper Nomination) Paper Video

Cascaded Filtering Using the Sigma Point Transformation — RAL/ICRA 2021
M. Shalaby, C. C. Cossette, J. Le Ny et J. R. Forbes (Best Paper Finalist) Paper Video

The Complex-Step Derivative Approximation on Matrix Lie Groups — RAL/ICRA 2020
C. C. Cossette, A. Walsh et J. R. Forbes Paper

Calibration and Uncertainty Characterization for Ultra-Wideband Two-Way-Ranging Measurements — Preprint 2022
M. A. Shalaby, C. C. Cossette, J. R. Forbes et J. L. Ny Paper

Other Publications

Reducing Two-way Ranging Variance by Signal-Timing Optimization — Preprint 2022
M. A. Shalaby, C. Champagne Cossette, J. R. Forbes et J. Le Ny Paper

Ultra-Wideband Teach and Repeat — Preprint 2022
M. A. Shalaby, C. C. Cossette, J. L. Ny et J. R. Forbes Paper

Relative Position Estimation in Multi-Agent Systems Using Attitude-Coupled Range Measurements — RAL/ICRA 2021
M. Shalaby, C. C. Cossette, J. R. Forbes et J. Le Ny Paper Video

Heading Estimation Using Ultra-wideband Received Signal Strength and Gaussian Processes — RAL/IROS 2021
D. Lisus, C. C. Cossette, M. Shalaby et J. R. Forbes Paper Video

Modular derivation of the equations of motion of a flexible launch vehicle with propellant slosh — SciTech 2020
C. C. Cossette, J. R. Forbes et D. Saussié Paper

Lagrangian Derivation of Variable-Mass Equations of Motion using an Arbitrary Attitude Parameterization — JASS 2020
C. C. Cossette, J. R. Forbes et D. Saussié Paper

Successful Grant Proposals

2022 **NSERC Alliance Grant ($440K).** *"Infrastructure inspection using a team of unmanned aerial vehicles."* Co-authored with James Forbes, Mohammed Shalaby, Jérôme Le Ny, David Saussié, Gunes Kurt.
2020 **FRQNT Personal Doctoral Scholarship ($63K).** *"Formation control of robotic systems using ultra-wideband radio for self-localization."*
2019 **NSERC Engage Award ($25K).** *"Control, Navigation and Guidance Concept Studies for a Venture Class Orbital Launch Vehicle."* Co-authored with James Forbes, Bachar Elzein.
2019 **Mitacs Accelerate Scholarship ($15K).** *"Research and Experimental Testing of Liquid-Injection Thrust Vector Control Actuator."* Co-authored with James Forbes, Julien Otis-Laperrière.
2019 **Canadian Space Agency Space Technology and Development Program ($539K).** *"Development of Guidance, Navigation, and Control Technologies for a Hybrid Engine Small Satellite Launch Vehicle."* Co-authored with Sandro Papais, Bachar Elzein.

Awards

2020 **Best Presentation Award** at GERAD Student Research Day
2018 **Spaceport America Cup Champions** - 1st out of 124 universities at rocket engineering competition
2018 **1st place in 10000ft COTS motor category** - Spaceport America Cup rocket engineering competition
2017 **1st place at McGill Engineering Research Showcase**
2016 **Teaching Assistant of the Year** - McGill Association of Mechanical Engineers
2016 **Outstanding Contribution to Design Teams** - McGill Engineering Undergraduate Society

Teaching Experience

2018 **Teaching Assistant - MECH 383 - Applied Electronics and Instrumentation**, McGill University
2015-2018 **Crash Course Instructor - Visual Basic for Applications (Excel)**, McGill University
2015-2016 **Teaching Assistant - MATH264 - Advanced Calculus for Engineers**, McGill University

Projects

Technical Director - Spaceport America Cup Champions - McGill Rocket Team — 2015 - 2018
Competition Video Manufacturing Video www.mcgillrocketteam.com
1st place of 124 international universities, 1st place in 10000ft off-the-shelf motor category at rocket engineering competition. Designed and built 11-foot-tall supersonic rocket with carbon-fiber airframe, automated parachute recovery, avionics, telemetry, and scientific payload. Led the 100+ student team as Technical Director.

Embedded C | Matlab | Solidworks | Manufacturing | Systems Engineering | Project Management | Fundraising | Onboarding | Hours of sanding

Interests

Home-brewing beer, sharing my homebrew, triathlons, golf, wakeboarding, poker, skiing, rocketry.