

SANDRO PAPAIS

B.Eng, Honours Mechanical Engineering

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RESEARCH & TEACHING EXPERIENCE

Robotics Visiting Researcher, Mission Design and Analysis NASA Jet Propulsion Laboratory | Mobility & Robotic Systems Section

07/2019 – 10/2019 Pasadena, California

- Performed systems engineering, mission analysis and design for autonomous interplanetary smallsat mission concept to rendezvous with a Small Body.
- Determined key mission drivers by performing design trade space studies, sensitivity analysis, and technology feasibility assessment.
- Developed and validated a proof-of-concept mission point design with trajectory optimization, spacecraft architecture, and subsystem modelling.

Undergraduate Research Assistant

McGill University | Aerospace Robotics Dynamics, Estimation & Control Lab

09/2017 – 06/2019 Montreal, Canada

- Implemented launch vehicle trajectory and staging design optimization algorithms using direct transcription and Nonlinear Programming.
- Investigated usage of novel nano-g IMU technology for low-thrust interplanetary spacecraft through trajectory and navigation modelling.
- Resulting operations cost reduction of \$1M due to reduced DSN usage.

Robotics Intern, Perception and Mapping

European Space Agency | European Space Research and Technology Centre

05/2018 – 08/2018 Noordwijk, Netherlands

- Developed software and hardware prototype for localization and 3D mapping using rover stereo camera and drone camera – validated in field campaigns.

Undergraduate Teaching Assistant

McGill University | Mathematics & Statistics, Mechanical Engineering Depts.

09/2015 – 05/2016 Montreal, Canada

- Instructed 3 semesters of tutorials for 50-80 undergraduate students each in advanced calculus, differential equations, and computer aided design.

INDUSTRY R&D EXPERIENCE

Guidance, Navigation, and Control Software Specialist

NGC Aerospace

11/2019 – Present Sherbrooke, Canada

- Developed and integrated lunar lander software for visual-inertial navigation and hazard detection for safe landing – Monte Carlo and lab test validated.
- Designed and coded control, guidance, and vehicle management software modules for a tandem-rotor helicopter and an eVTOL air-taxi.
- Created automation scripts for GNC validation of PROBA-3 sun-monitoring spacecraft Phase C/D & coverage analysis for VMMO lunar cubesat Phase A.

Guidance, Navigation, and Control Intern

Reaction Dynamics Laboratory

09/2018 – 12/2018 Montreal, Canada

- Performed preliminary high-level feasibility studies and architecture design for launch vehicle Guidance, Navigation, and Control (GNC) system.
- Primary author of successful R&D funding applications for \$1M – sections written include technology development plan of GNC and related systems.

PROFILE

Mechanical engineer with 4 years of research and development experience in aerospace and robotics. Experienced in state estimation, control systems, trajectory optimization, computer vision, and systems engineering.

EDUCATION


B.Eng Honours Mechanical (Thesis)

McGill University May 2019


May 2019


- Advisor: James R. Forbes
- Thesis title: *Spacecraft Interplanetary Navigation Using Radiometric Tracking and Accelerometer Measurements*
- Cumulative GPA: 3.54/4. Major GPA: 3.65/4.
- GRE: Q 167 (89%), V 159 (82%), W 4 (92%).
- Deans Honour List 2014-15.
- Advanced Courses:
 - MECH 513 Control Systems,
 - MECH 579 Multidiscipl. Design Optimization,
 - MECH 533 Subsonic Aerodynamics,
 - MECH 536 Aerospace Structures,
 - MATH 447 Stochastic Processes,
 - MECH 419 Advanced Mechanics of Systems.

TOP AWARDS

 **Elvie Smith Award 2019**
\$5000 for contributions to aerospace, by Canadian Aeronautics and Space Institute.

 **Research Experience Award 2018**
\$4500 to conduct R&D project, by Natural Sciences and Engineering Research Council.

 **Spaceport America Genesis Cup 2018**
1st/124 international universities at Intercollegiate Rocket Engineering Comp.

 **McCaig Engineering & John Howard Ambrose Scholar 2016**
\$1500 for 2015 academic performance.

RESEARCH INTERESTS

Solutions for the future of autonomous mobility.

- Machine learning – dynamic event prediction, intelligent control, semantic understanding
- Systems analysis – design optimization and safety assurances for robotic systems
- State estimation – nonlinear estimation, SLAM, vision-based estimation
- Control theory – nonlinear control, stability analysis, robust and optimal control

PUBLICATIONS

Refereed Conference Papers

- S. Papais, B. Hockman, S. Bandyopadhyay, R. Karimi, S. Bhaskaran, and I. Nesnas (2020). "Architecture Trades for Accessing Small Bodies with an Autonomous Small Spacecraft." In: *41st IEEE Aerospace Conference, Big Sky, MT, USA, March 12, 2020*.

Abstract Refereed Conference Presentations

- H. Jean-Francois, D. Neveu, M. Minville, G. Mercier, L. Sobiesiak, S. Papais, and D. Beadette (2020). "Autonomous Moon Landing Guidance, Navigation and Control Systems Development and Validation." In: *20th CASI Astro Conference, Date TBD (Postponed)*.
- S. Papais, C. Cosette, and J. Forbes (2019). "Launch Vehicle Design and Trajectory Optimization Using Direct Collocation and Nonlinear Programming." In: *19th CASI Astro Conference, Laval, QC, Canada, May 18, 2019*. Laval, Canada.
- S. Papais, K. Carroll, and J. Forbes (2018). "Low-Thrust Spacecraft Interplanetary Navigation Using Radiometric Tracking and Accelerometer Measurements." In: *18th CASI Astro Conference, Toronto, ON, Canada, May 16, 2018*.
- S. Papais and B. Foing (2018). "3D Vision Studies for ESA EuroMoonMars 2018 Campaign". In: *2nd Montreal Space Symposium, Montreal, QC, Canada, 17 October 2018*.

Thesis

- S. Papais (2018). "Low-Thrust Spacecraft Interplanetary Navigation Using Radiometric Tracking and Accelerometer Measurements." Bachelor's Thesis, McGill University, Montreal, Canada, April 2018.

PROJECTS AND LEADERSHIP

Director, Aerostructures Lead

📅 09/2015 - 09/2018 📍 McGill Rocket Team

- Managed a team of 100+ students to design, manufacture, and launch 6 sounding rockets up to 30,000 feet, and win an international competition.
- Performed design, analysis, manufacturing, and testing of components for hybrid rocket engine, airframe, and autonomous landing deployment systems.

📄 J. Nishihata (2018). "McGill Rocket Team Soars to First Place at Spaceport America Cup". In: *McGill Faculty of Engineering, July 13, 2018*.

Co-founder, Chair

📅 05/2017 - 12/2018 📍 Montreal Space Symposium

- Formed and oversaw organizing committee for two-day space conference with 400+ attendees and 52 speakers to highlight the Canadian space sector.

📄 M. Boucher (2017). "The Emergence of the Montreal Space Symposium". In: *SpaceQ Media, October 17, 2017*.

Founder, President

📅 05/2017 - 08/2018 📍 Canadian Rocketry Consortium

- Formed consortium of 16 university rocket engineering organizations from across Canada for technical collaboration and joint funding opportunities.

Board of Governors

📅 09/2016 - 04/2018 📍 McGill Engineering Undergraduate Society

- Established oversight and long term vision through policy review, financial management, and funding allocation for \$1M+ total annual budget.

AWARDS & DISTINCTIONS

🏆 **NASA JPL Visiting Student Researcher Program 2019**
Awarded temporary research position.

🏆 **Next Generation Scholarship 2018**
\$3000 for leadership and academics, by Ordre des Ingénieurs du Québec.

🏆 **Forces Avenir Science and Technology Award 2018**
\$2000 for community impact of Montreal Space Symposium.

🏆 **McGill Design Team of the Year 2017**
For collaborations and contributions made at McGill Rocket Team.

🏆 **Director of the Year 2017**
McGill EUS recognition for new initiatives as funding director.

SKILLS

Control Theory State Estimation
Path Planning Systems Analysis
Computer Vision Numerical Optimization
Sensor Fusion Object Detection
Dynamical Modelling and Simulation
Embedded Systems Software Development
Mechanical Design Structural Analysis

Programming:

C C++ Python MATLAB Simulink
ROS Git Linux R SQL VBA

PROFESSIONAL AFFILIATIONS

Institute of Electrical and Electronics Engineers (IEEE)

Member 📅 2018 - Present

American Institute of Aeronautics and Astronautics (AIAA)

Member 📅 2018 - Present

Canadian Aeronautics and Space Institute (CASI)

Member 📅 2018 - Present

Canadian Space Society (CSS)

Montreal Treasurer 📅 2017 - 2018