Isaac Tunney

Isaac.Tunney@USherbrooke.ca

Address
161, Louise-Campagna Boulevard
Gatineau, QC J9A 3W4, Canada
Cell: (819) 210-0611

EDUCATION

PhD in Mechanical Engineering (Fast-track entry from Masters) – GPA: 4.3/4.3 2021-2025
Project focused on aerial robotics
Université de Sherbrooke

Bachelor degree in Mechanical Engineering (Coop Program) – GPA: 4.01/4.3 2016-2020
Aeronautic Concentration
Université de Sherbrooke

KNOWLEDGE

Linguistic	French (first language), English (oral 4/5, written 4/5)
Software	• Programming: C++, Python, MATLAB, Simulink, Arduino / Windows and Linux (Ubuntu) • Design: AutoCAD, OnShape, SolidWorks • Dynamics/Robotics: Motion Genesis, Gazebo Simulator, ROS, Simscape Multibody • Motion Tracking: Optitrack / MOCAP (motion tracking), Phantom High-Speed camera
Professional Development	• Advanced Dynamics Course (*Université de Sherbrooke)* • Aerial Robotics Course on *Coursera* – online certificate • C++ Course on *Udemy* – online certificate • Canadian pilot certificate for basic drone operations – 40h+ of flight time with multirotors • EASA pilot license for Iceland's A1/A3 drone category – 5h of flight time with multirotors • General health and safety on construction sites (*ASP Construction*)

DOCTORAL PROJECT (2021-2025)

Objective: *Develop a landing technology combining friction-based shock absorbers (hardware) and reverse thrust (software) to enable small drones to land rapidly and reliably in extreme outdoor conditions.*

Key Contributions:

- Designed a novel landing gear using friction-based shock absorbers for high-speed impacts (>3m/s)
- Developed custom landing algorithms in C++ (ArduPilot), integrating reverse thrust to prevent flipping
- Built an electronic circuit that automatically adjusts landing gear friction to adapt to landing conditions
- Sized and built a high-power drone (Thrust/Weight ratio of 8) designed for extreme landing conditions
- Ran Monte Carlo simulations in MATLAB with realistic 2D drone model to predict landing success rate
- Designed retractable, cat-inspired spiked feet to enable landings on steep, ice surfaces like icebergs
- Demonstrated landings in harsh real-world conditions: Rooftops inclined up to 60° at descent speeds up to 3 m/s (2022), moving pickup truck at 120 km/h (2023), moving boat at 30 km/h (2024)
- Conducted field trials in Iceland (2025): 24 successful landings on icebergs and glaciers with slopes up to 60° (publication forthcoming)
- Public video – Drone landing on rooftops: https://youtu.be/tG1K_63q00Y
- Public video – Drone landing on a fast canoe: https://youtu.be/E-ns-MxMJvU

Doctoral Publications and Presentations:

- Journal paper (submitted): I. Tunney, J. Bass and A. L. Desbiens, "Friction Shock Absorbers and Reverse Thrust for Landing on High-Speed Vehicles", in Journal of Field Robotics, 2025
- Poster Presentations – NSERC Canadian Robotics Network (2021, 2022, 2023, 2024): Updates on the development of the landing system and its applications to landing on rooftops, moving vehicles and ice.
- Journal paper and conference presentation: J. Bass, I. Tunney and A. L. Desbiens, "Adaptative Friction Shock Absorbers and Reverse Thrust for Fast Multirotor Landing on Inclined Surfaces," in IEEE Robotics and Automation Letters, July 2022, doi: 10.1109/LRA.2022.3176102

OTHER ACADEMIC PROJECTS

Side Research Project (in parallel with PhD) – Novel grippers for acrobatic robots 2023-2024

- Technical lead on a 1.5-year project funded by a large U.S. robotics company
- Designed and built one of two grippers enabling an acrobatic robot to release itself from a swinging bar and catch itself onto a new bar (>30G at impact) less than 1 second later, repetitively
- Oversaw the global project direction, recruited (through my lab) and partly supervised a Master's student working on the second of two grippers
- Conducted dynamic simulations (using *Working Model 2D*) to understand the key challenges and iterated over 50 mechanical designs
- Final design: single solenoid to release the bar, spring-driven passive resetting of the gripper's fingers and thumb under 0.75s, high mechanical advantage to allow releases under high loads

Senior design project – AeroStrabe: A Single-Seat Quadcopter-Type Vehicle Simulator for Urban Air Mobility 2019-2020

- Developed a dynamic model of the vehicle in Python to realistically simulate flight behavior
- Programmed the motion system (4 actuators + 1 motor) to generate realistic perceived motion
- Integrated an Oculus VR headset with a custom virtual environment built in *Unreal Engine*
- Designed a real-time software architecture to synchronize all simulator submodules
- Secured a $10,000 USD grant from *Epic Games* (Epic MegaGrants) for innovation in virtual reality
- Project completed by a group of 6 students in 12 months with a total budget of $50,000 CAD
- Simulator is currently in use at *ÉTS* (Montréal) for research on new vehicle concepts.
- Project video**:** https://www.facebook.com/watch/?v=3886459841378560

5th semester integration project: Fully motorized heightening system to help attendants in care centers to raise their patients with reduced mobility 2018

4th semester integration project: Rocket flight simulation on Mars and geometric optimization to maximize distance traveled (in MATLAB) 2018

WORK EXPERIENCES

Walt Disney Imagineering Intern, Disney Research (California, US) – 4-month internship 2023

- Developed first prototype of an acrobatic robot performing mid-air maneuvers
- Programmed embedded software in Python on a Raspberry Pi CM4 with multithreaded architecture (>250 Hz control loops)
- Designed and built a custom 2-DOF robot using metal laser cutting and 3D printing
- Contributed to electronics system design: radio system, power module, motors, sensors, and wiring
- Simulated robot dynamics and control using Simscape Multibody (MATLAB)
- Integrated and fused sensor data (IMU, motion capture) for real-time tracking
- Created the global system architecture including synchronization between robot, both pendulums and motion capture system

WORK EXPERIENCES (CONTINUED)

Software specialist in flight aerodynamics, *CAE* (Montreal, Qc) – 4-month internship 2019

- Developed flight dynamics programs in C++ for Boeing B747 Simulator
- Implemented/modified simulator features such as in-simulation aircraft repositioning behavior
- Automated flight database updates with Python, reducing task time from >35h to <1min

Aerial Robotics Designer, *Outreach Robotics / Createk* (Sherbrooke, Qc) – 4-month internship 2019

- Designed 4 core mechanical/robotic components – from concept to prototype: main grippers, orientation-locking serrated joint, emergency release, and carbon fiber structural assembly
- Contributed to the *DeLeaves* product now commercialized by *Outreach Robotics*
- Rapidly evaluated designs through iterative prototyping (3D printing, laser cutting, machining)

Staff Coordinator, Department of Production, *ArcelorMittal Produits Longs Canada* (Contrecœur, Qc) – 4-month internship 2018

- Managed day-to-day operations of the steel casting department, overseeing ~30 employees
- Handled equipment failures, enforced safety procedures, responded to injuries, etc.

Mechanical Engineering Intern, *Cycles Devinci* (Chicoutimi, Qc) – 4-month internship 2017

- Designed and built an automated corrosion bath to test anti-corrosion products on bike parts
- Improved a test bench used to compare stiffness between different bicycle frames

RECOGNITIONS

- Recipient of the CAMAQ scholarship for the next generation in aeronautics (small money prize) 2024
- First place at the CIADI Capstone Project Competition, an aeronautics presentation competition hosted by Concordia University (small money prize and invitation to the 2024 ICAO Symposium on Advanced Air Mobility in Montréal) 2024
- UTILI Scholarship / inclusion in the UTILI program (https://carleton.ca/utili/isaac-tunney/) 2023
- Certificates of academic excellence (top 10%) from the Université de Sherbrooke 2019, 2020
- NSERC and FRQNT scholarships for internship in research at the Createk Design Lab 2019

PERSONAL PROJECTS AND INTERESTS

- Simulation of two drones (using Ardupilot) controlled simultaneously with ROS in the Gazebo Simulator
- Small-distance radar with a graphic interface (programmed in Java)
- Programs in C++ and Python, including graphical animations and a financial web scraper
- **Personal interests:** rock climbing, running, tennis, coffee/latte art design, and everything related to robots!