

# Atilla Saadat

Toronto, Ontario, Canada

✉ [atilla.saadat@mail.utoronto.ca](mailto:atilla.saadat@mail.utoronto.ca) <https://atillasaadat.me> [researchgate.net/profile/atilla-saadat](https://www.researchgate.net/profile/atilla-saadat)  
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## Education

### M.A.Sc. - Aerospace Science & Engineering

Sept 2020 – expected Aug 2022

University of Toronto

Toronto, Ontario, Canada

- Attitude Control Systems (ACS) and Guidance, Navigation, and Control (GNC) research and development at the [Institute for Aerospace Studies \(UTIAS\) Space Flight Laboratory \(SFL\)](#)
- GPA: 4.0/4.0, Research Supervisor: [Dr. Robert E. Zee](#)

### B.A.Sc. - Honour's Mechanical Engineering w/ Aerospace Option

Sept 2015 - Aug 2020

University of Windsor

Windsor, Ontario, Canada

- Dean's List - 2016, 2017, 2020
- Research Supervisor: [Dr. Afshin Rahimi](#)

## Relevant Coursework

- Microsatellite Design I & II
- Spacecraft Dynamics & Control
- Computational Optimization
- Control Theory
- Flight Dynamics & Control
- Aerospace Structures
- Aerodynamics & Performance
- Aerospace Propulsion
- Aerospace Materials & Mfg.

## Research Experience

### Graduate Researcher

Sept 2020 – present

[UTIAS Space Flight Laboratory](#)

University of Toronto

- Improved and automated Attitude Control Sensor (ACS) testing with procedural optimizations for sensor functional tests, thermal acceptance, and data analysis. Using software, networking, and hardware automation decreased overall testing time by >80% on 13+ satellites for the [HawkEye 360 constellation missions](#), whilst simultaneously standardizing and increasing collected test data quality
- Researched and developed a novel in-situ inertia tensor estimation method for in-orbit satellites and validated through attitude simulation software and [Kepler satellite](#) telemetry
- Programmed a novel model-based Solar Power Generation Analysis software with Python & STK for new satellite missions, developed for the [NASA StarBurst mission](#). The software uniquely accounts for photo-voltaic shadowing effects using the CAD model of the satellite. Coupled with cosine loss and considerations for implemented power management systems, it produces a higher-fidelity and accurate power generation analysis report for the satellite's power budget. The software also automates the test of various attitude/orbital cases
- Researched and developed an novel Earth Horizon Sensor using SFL hardware and a custom Nadir vector estimation algorithm. The software has been validated through simulation with STK Electro-Optical & Infrared (EOIR) images and in-orbit [NorSat-2](#) images, resulting in a simulation Nadir vector estimate with a 1° RSME

### Undergraduate Researcher

Mar 2019 – Oct 2020

[Intelligent Control, Analysis, and Modeling \(iCAM\) Laboratory](#)

University of Windsor

- Researched and developed a novel ensemble-based machine learning (ML) algorithm for fault detection and isolation of fault states for reaction wheels on in-orbit satellites
- Determined optimal approaches for data-set generation, handling, and analysis methods for fault cases. Time-series feature extraction for ML classifier input was also researched and various features and extraction packages were determined optimal for time-series classification
- Implemented various machine learning classification techniques from Scikit-learn, TensorFlow, and Keras for comparison, utilizing Hyperopt for ML hyperparameter optimization and cross-validation techniques
- Collaborated with iCAM research team members to produce an effective ML-based fault detection method for a high-quality research publication (referenced below) and various conference papers/presentations

## Publications

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Rahimi, A., & **Saadat, A.** (March, 2020). Fault isolation of reaction wheels onboard three-axis controlled in-orbit satellite using ensemble machine learning. *Aerospace Systems*, 3(2), 119-126. [doi.org/10.1007/s42401-020-00046-x](https://doi.org/10.1007/s42401-020-00046-x)

## Patents

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**Saadat, A.**, & Usui, K. (May, 2020). Method And Computing System For Estimating Parameter For Robot Operation. Patent pending in USA [[US Patent App. 20210347049](#)], Japan, and China

**Saadat, A.**, & Usui, K. (May, 2020). Method And Computing System For Determining A Value Of An Error Parameter Indicative Of Quality Of Robot Calibration. Patent pending in USA [[US Patent App. 20210347054](#)], Japan, and China

## Conference Papers and Oral Presentations

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**Saadat, A.** Novel In-Situ Inertia Tensor Estimation method for Nanosatellites. *International Astronautical Congress 2022* (In Preparation)

**Saadat, A.** Novel Earth Horizon Sensor development with simulation-based Nadir vector estimate validation. *Small Satellite Conference 2022* (In Preparation)

Folami, F.O., Rahimi, A. & **Saadat, A.** (March, 2020). Fault Isolation of Reaction Wheels on-board 3-axis Controlled in-orbit Satellite Using Machine Learning Techniques. IAC-20.B4.9-GTS.5.10, *International Astronautical Congress 2020*, Dubai (Online), United Arab Emirates, [[PDF](#)]

Rahimi, A., & **Saadat, A.** (July, 2019). Fault isolation of reaction wheels on-board 3-axis controlled in-orbit satellite using ensemble machine learning techniques. *The International Conference on Aerospace System Science and Engineering*, Toronto, ON, [[PDF](#)]

## Poster Presentations

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**Saadat, A.** (March, 2019). [CryoRoute - Generating Globally-Optimized Naval Routes in Arctic Ocean](#). *UWillDiscover Conference*, University of Windsor, Windsor, ON

**Saadat, A.** (January, 2019). [CryoRoute - Generating Globally-Optimized Naval Routes in the Arctic Ocean](#). *ESA's Atlantic from Space Workshop*, National Oceanographic Centre, South Hampton, UK

## Industry Experience

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### Hardware Functional Safety Tools Engineering Intern

May 2022 – present

*NVIDIA Corporation*

*Santa Clara, CA*

- Developing software to automate and scale safety analysis for Failure Mode and Effects Analysis (FMEA), Failure Mode, Effects, and Diagnostic Analysis (FMEDA), and Fault Tree Analysis (FTA) on the world's most complex Systems on a Chip (Jetson AGX Orin), GPUs, and autonomous vehicle computers
- Acquired exposure to the functional safety engineering execution for autonomous vehicles at NVIDIA, following ISO 26262 Road Vehicles Functional Safety standards

### Robotic Systems Engineering Intern II

Sept 2019 – Jan 2020

*Mujin Inc.*

*Tokyo, Japan*

- Designed a novel torque model validation algorithm with custom metrics and fault detection for torque coefficient estimates, improving estimate confidence by over 70%
- Completed development on novel dynamics identification method for the Mujin Controller to calculate torque model coefficients for Mujin-supported industrial robots
- Collaborated with Mujin patent lawyers to submit 2 software patent applications, pending in USA, Japan, & China

### Robotic Systems Engineering Intern I

May 2017 – May 2018

*Mujin Inc.*

*Tokyo, Japan*

- Developed a novel dynamics identification method for the Mujin Controller to calculate Friction, Center of Mass, and Inertia tensor coefficients. The results are used to improve the robot's torque model
- Validated experimental test results and developed production code for the feature, currently shipped on Mujin controllers for use by industry, improving robot performance during high accelerations by over 85%
- Integrated robot armature trajectory generation, data analysis tools, and localized UX/UI data visualization

### Space Systems Engineering Intern (Lunar Exploration)

May 2016 – Sept 2016

*Canadensys Aerospace Corp.*

*Toronto, Ontario*

- Developed a remotely-controlled lunar rover prototype with various camera modules (3D, stereo camera, fisheye) and interactive software features, managing a budget of >\$10k
- Designed the concept of the rover, with a successful build and test campaign
- Constructed a companion ground station GUI with vehicle controls and live camera feed

## ⚙️ Co-Curricular Experience and Projects

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### President / Founder / Lead Space Systems Engineer

2018 – 2020

*University of Windsor Space & Aeronautics Team (WinSAT)*

- Founded and managed a university engineering design team competing in the [Canadian Satellite Design Challenge \(CSDC\)](#) against 15+ top university teams across Canada. [WinSAT achieved 1<sup>st</sup> place in the CSDC-5 Critical Design Review \(CDR\)](#)
- Led the project management and systems engineering of WinSAT's Space Systems division to design a 3U Cube Satellite for Low Earth Orbit, encompassing over 20 recruited interdisciplinary graduate & undergraduate students, with a total awarded funding of over \$40,000
- Coordinated the development and engineering of all satellite subsystem teams: Attitude Determination & Control Systems, Radio Communications, Structural & Thermal, Command & Data Handling, Electrical Power Systems, Payload, Business, & Earth Observation analysis
- Hosted multiple satellite engineering and Amateur Radio Operator (ARO) certificate workshops to over 30+ students to teach satellite engineering practices and ARO exam preparation

### Lead Avionics Engineering - Sounding Rocket

2015 – 2019

*WinSAT Rocketry Payload Division for UWindsor Rocketry Team*

- Designed a [custom aerodynamics data acquisition module](#), using a Raspberry Pi and various sensors, for aerodynamic analysis and performance verification
- Designed the circuit board, programmed the software, and parsed large data volumes with software redundancy modes for rocket acceleration, angular rates, barometric pressure, temperature, and altitude data

### CryoRoute - Globally Optimized Naval Routes in North Arctic Ocean

Nov 2019

*Self-interest Research Project*

- [Developed a novel software implementation to generate globally-optimized naval routes in the North Arctic ocean](#)
- Programmed a python script using CryoSat-2's sea ice thickness data from the Center for Polar Observation and Modelling (CPOM). The script uses a specialized A\* path-finding algorithm to optimize for minimal sea ice thickness, distance, and travel time
- Presented research outcomes at NASA Space Apps Waterloo, UWillDiscover conference, and ESA's Atlantic from Space Workshop

### Demo. Inertial Electrostatic Confinement (IEC) Nuclear Fusion Reactor

Aug 2015

*Self-interest Research Project*

- [Developed a vacuum chamber capable of atmospheric gas ionization and plasma synthesis, simulating an deuterium-fueled IEC nuclear fusion reaction](#)
- Handled the safe operation of a high-voltage power supply (15kV)
- Designed and tested correlation between inner grid geometry and plasma synthesis rates using visual luminescence, simulating neutron radiation production for future fusion verification

### Electrical Lead / Safety Captain

2014 – 2015

*FIRST Robotic's Competition (FRC) - Team 4903*

*Vincent Massey Secondary School*

- Led a team of 8 students to design, test, and build the electrical and power distribution subsystem for the FRC
- Enforced safe engineering practices across the entire FRC team as the team's safety captain and held presentation teaching safe practices related to robotics
- [Awarded 1<sup>st</sup> place team at FRC Windsor-Essex Great Lakes Regional 2015](#), accepted into and competed in the FRC World Championship 2015 in St. Louis, MO

## Technical Skills

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**Languages:** Python, MATLAB, Java, C/C++, JavaScript, PHP, HTML/CSS, MySQL, PostgreSQL

**Engineering Tools:** AGI STK, SolidEdge, Siemens NX including Space Systems Thermal, SolidWorks, Catia V5, Simulink, KiCad, Altium

**Frameworks/Packages:** Numpy, Scipy, Matplotlib, Scikit-learn, OpenCV, Node.js, TensorFlow, Keras, TSfresh, Hyperopt, Django

**Developer Tools/APIs:** Google Cloud Platform, AWS, Docker, Twilio, Wit.ai, DigitalOcean, MongoDB, VS Code, Eclipse, Android Studio, SublimeText

**Technologies/Other:** Linux, Windows, Mac OSX, Git, Bash, Raspi/Arduino/BBB, Office Suite, Latex

## Awards

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**Research Fellowship & Internal Student Fellowship** | [University of Toronto](#) **Sept 2020**

- Awarded fully-funded tuition and stipend for admittance into [UTIAS Space Flight Laboratory](#)

**First place team in Critical Design Review** | [Canadian Satellite Design Challenge](#) **Oct 2019**

- Presented CDR-level designs for a 3U Cube Satellite to CSA, MDA, and ABB spacecraft engineers

**Ontario Aerospace Council scholarship** | [Ontario Aerospace Council](#) **May 2019**

- Awarded 1 of 4 awards to Ontario aerospace engineering students for academic and extra-curricular achievements related to aerospace studies

**ESA North-American CryoSat-2 Science Meeting Student award** | [Canadian Space Agency](#) **Mar 2017**

- Awarded to select students across Canada to travel to ESA CryoSat-2 meeting as a student representative for the CSA, used to gaining research, resources, and connections for [CryoRoute](#)

**P.E.O. Windsor-Essex Chapter Bursary** | [Professional Engineers of Ontario \(P.E.O\)](#) **Mar 2016**

- Awarded to 1<sup>st</sup> year engineering students who have demonstrated excellent academic achievement

**Dean of Engineering Conference Grant** | [University of Windsor - Dean of Engineering](#) **Jan 2019**

- Awarded directly by the Dean of Engineering to attend the ESA Atlantic from Space Workshop

### **Various University of Windsor Scholarships & Bursaries**

*Awarded for undergraduate academic achievement and/or extra-curricular activities, unless otherwise stated:*

- Student Access Bursary | Jun 2020 & Jun 2019
- Ontario First Generation Bursary | Jun 2019 & Sept 2018
- UWindsor In-Course Bursary | Jun 2019
- Student Life Enhancement Fund | Jan 2019 | Awarded to attend ESA Atlantic from Space Workshop
- Helen Norma Laframboise Scholarship | Sept 2018
- Faculty Retirees' Scholarship | Sept 2018
- Ontario Student Opportunity Trust Fund (OSOTF) Scholarship | Sept 2018
- Marian McLean Campus Spirit Scholarship | Sept 2018 | Awarded for WinSAT event's held on campus
- International COOP Bursary | Jan 2018 | Awarded for having a COOP Internship in a foreign country (Japan)
- Duronio Family Scholarship | Jan 2017
- Golden Key International Honour Society (Nomination) | Sept 2016
- University of Windsor Entrance Scholarship | Sept 2015

## Professional Training & Certification

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**Canadian Amateur Radio Operator Certificate - Callsign: [VA3UWS](#)** **Jan 2019**

*Industry Canada - Government of Canada*

- Basic with Honours - Access to all amateur radio frequency bands

**Siemens NX Space Systems Thermal Training** **Feb 2019**

*CSDC Structural & Thermal Analysis Workshop*

*Magellan Aerospace, Winnipeg, Manitoba*

- Learned state-of-the-art Structural and Thermal analysis techniques for small satellites in Siemens NX

## 🔗 Hackathon Projects & Awards

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### Gateway

2015

Facebook Global Hackathon

Facebook HQ, Menlo Park, CA

- Improved developments on an iOS Messaging App with embedded API search query responses and natural language processing

### Gateway

2015

MHacks 6

University of Michigan, Ann Arbor, MI

- Developed an iOS Messaging App with embedded API search query responses and natural language processing
- **Awards: Best Use of Facebook Parse API (Invitation to Facebook Global Hackathon), Best iOS App (sponsored by Apple Inc.), Best Use of Expedia API**

### Lubdub

2017

SpartaHacks III

Michigan State University, East Lansing, MI

- Programmed a web application to records and detect heart defect using a novel audio wave analysis algorithm and a stethoscope as audio input
- **Awards: SpartaHacks 2<sup>nd</sup> Place Winner, ThoughtWorks Honorable Mention**

### GeoRisk

2017

Winter Hackathon

University of Windsor, Windsor, ON

- Developed a Google Maps web-based application to analyze client data for a sponsoring insurance company
- **Awards: EpiCentre Startup Series-A Funding (\$6000) – Funds diverted to [WinSAT](#)**

## 📰 Media Coverage

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[UWindsor satellite design leading student competition](#) | University of Windsor Engineering Dept. Nov 2019

[WinSAT wins critical satellite design review](#) | Windsor Star – News Outlet Nov 2019

[Aerospace engineering student aiming high](#) | University of Windsor Engineering Dept. Aug 2019

[Mujin Inc. Internship - Student Spotlight](#) | University of Windsor Co-operative Education Dept. Oct 2018

[CryoRoute Feature - NASA Space Apps Challenge Waterloo](#) | SkyWatch Youtube Ch. Aug 2018

## 👤 References

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- Dr. Robert E. Zee, Ph.D.  
Director, Space Flight Laboratory (SFL)  
Microsatellite Science and Technology Center (MSTC)  
University of Toronto Institute for Aerospace Studies  
4925 Dufferin Street  
Toronto, Ontario, Canada, M3H 5T6  
Tel: +1 (416) 667-7864  
Email: [rzee@utias-sfl.net](mailto:rzee@utias-sfl.net)  
Web: [utias-sfl.net](http://utias-sfl.net)
- Dr. Afshin Rahimi, Ph.D., P.Eng.  
Assistant Professor  
Mechanical, Automotive & Materials Engineering  
University of Windsor  
CEI 2174, 401 Sunset Ave  
Windsor, ON, Canada N9B 3P4  
Tel: +1 (519) 253-3000 x5936  
Email: [afshin.rahimi@uwindsor.ca](mailto:afshin.rahimi@uwindsor.ca)  
Web: [arahimi.ca](http://arahimi.ca)
- Dr. Rashid Rashidzadeh, Ph.D., P.Eng., SMIEEE  
Adjunct Professor & Academic Planning Liaison  
Electrical & Computer Engineering  
University of Windsor  
CEI 2168, 401 Sunset Ave  
Windsor, ON, Canada N9B 3P4  
Tel: +1 (519) 253-3000 x3931  
Email: [rashidza@uwindsor.ca](mailto:rashidza@uwindsor.ca)  
Web: [vlsi.uwindsor.ca/rashidz](http://vlsi.uwindsor.ca/rashidz)