
Anthony Beca

Toronto, Ontario | anthony.beca@robotics.utias.utoronto.ca | linkedin.com/in/anthonybeca | becaant.github.io

Research Interests

- Generalizable schemes for the control/localization/planning of WMRs in complicated environments
 - Prior experience in defence, mining automation, and autonomous vehicles
- Specialized experience:
 - Path following control of redundant WMR (kinematics, feedback linearization, PD/MPC)
 - Full stack system design and integration of an autonomous vehicle
 - Realtime multi LiDAR-Camera fusion (incl. custom algorithm, integration, drivers, mount design, etc.)
 - Experience with ROS2, Python, Git, Linux, LaTeX, QGIS, CAN, Arduino/C++, CAD, and more

Education

University of Toronto Institute of Aerospace Studies, MSc Candidate Sept 2025 – August 2027
• **Autonomous Space Robotics Lab**, supervised by **Dr. Timothy Barfoot**

Queen's University, BSc in Mechatronics and Robotics Engineering Sept 2021 – May 2025
• **3rd/4th year GPA:** 4.06/4.3, **Cumulative GPA:** 3.85/4.3
• **Coursework:** ELEC446 Mobile Robotics (A+), MTHE430 Control Theory (A+), ELEC475 Computer Vision (A)

Honours and Achievements

- **NSERC CGS-M** (\$27,000, merit based) with Dr. Timothy Barfoot; ASRL/UTIAS
- **Vector Scholarship in AI** (\$17,500, merit based), for students in AI/ML based Master's programs
- **Medal in Mechatronics and Robotics Engineering** for highest academic standing in the graduating class
- **NSERC USRA** (\$6,000, merit based) with Dr. Joshua Marshall; Offroad Robotics/Ingenuity Labs
- **Dean's Scholar Award** for highest GPA in Mechatronics and Robotics Engineering Class of 2025
- Awarded **Principal's Admission Scholarship** (\$4,000)

Publications and Major Reports

Academic

- **Beca, A., Marshall, J. A.** "Path-Following Controller Designs for Autonomous and Semi-Autonomous Industrial Motor Graders." Accepted at Canadian Conference on Robots and Vision, Calgary, Alberta May 2025

Competitions

- Concept Design Report (90/100), AutoDrive Challenge II Year 3 May 2024
- Project Leadership Report (4th of 10), AutoDrive Challenge II Year 3 May 2024

Presentations

- On the Beaten Track: Autonomous Navigation of Offroad Networks with Satellite Imagery, presented for defence scientists at DRDC Suffield August 2025
- On Track: Path Following Controller Designs for Autonomous and Semi-Autonomous Industrial Motor Graders, lighting talk at Canadian Conference on Robots and Vision, Calgary, Alberta May 2025
- Towards Autonomous Path Following for Motor Graders, presented for Robotics Cluster at Ingenuity Labs Research Institute August 2024
- Path Following Control of Motor Graders, presented for MacLean Engineering July 2024

- Concept Design Event (87/100), AutoDrive Challenge II Year 3 June 2024
- Project Leadership Event (4th of 10), AutoDrive Challenge II Year 3 June 2024
- Design Reviews (I, II, III), Queen's AutoDrive Year 3 October 2023 - March 2024
- Mobility Innovation 0-0-0 Challenge (4th of 10), AutoDrive Challenge II Year 3 February 2024
- Concept Design Event, AutoDrive Challenge II Year 2 June 2023

Conferences and Seminars Attended

- Canadian Conference on Robots and Vision, Calgary, Alberta. May 2025
- "How can Machine Learning Help Mathematicians?", Guest lecture by Amaury Hayat, hosted by the L. Lorne Campbell Lecture Series, Kingston, Ontario October 2024
- Canadian Conference on Electrical and Computer Engineering, Kingston, Ontario August 2024
- Robotics and AI Symposium (RAIS), Ingenuity Labs, Kingston, Ontario August 2024
- AutoDrive Challenge Series II Workshops (4x), Ann Arbor Michigan October 2023 - May 2024
- "Let It Snow! Teaching Self-Driving Cars to Handle Adverse Weather and Know Their Perception Limitations." Guest lecture by Dr. Steven Waslander, hosted by Queen's School of Computing, Kingston, Ontario May 2023

Professional Experience

- Autonomous Robotics Researcher**, DRDC Suffield May 2025 - August 2025
- Designed and implemented a novel system for autonomously navigating offroad networks using satellite imagery (Python, C++ , ROS2), supervised by Jack Collier
 - Configured Argo Atlas J8 as an experimental platform to validate the approach, with 7 km driven autonomously
 - Conducted 40 km of autonomous experimentation for a partner lab
- Teaching Assistant, MREN320**, Queen's Mechanical and Materials Engineering January 2025 - April 2025
- MREN320: Machine Design and Control provides an overview of modern automation techniques and design
 - Graded assignments and supervised PLC lab sessions with Siemens TIA portal and Festo equipment
- Undergraduate Researcher, Offroad Robotics**, Kingston, ON May 2024 - August 2024
- NSERC USRA under supervision of Dr. Joshua Marshall, Offroad Robotics @ Ingenuity Labs Research Institute
 - Derived vehicle kinematics and feedback linearization scheme for an overactuated WMR
 - Presented insights to MacLean Engineering, to be included in future grader autonomy efforts (GR5, GR8 models)
- Autonomous Vehicle Intern, GM-AutoDrive/Queen's University**, Kingston, ON May 2023 - August 2023
- Designed and mentored 3 capstone proposals, addressing specific weaknesses in the AV stack
 - Secured \$25,000 in investments; managed a portfolio of 15 sponsors cumulatively valued at \$250,000
 - Expanded outreach, and instituted a novel team structure, resulting in 196 new applications
- Teaching Assistant, APSC143**, Queen's Electrical and Computer Engineering Sept. 2022 - Dec. 2022
- APSC143: Intro. to Programming for Engineers provided an introduction to algorithms and data structures in C
 - Supervised lab sessions, graded 50+ assignments and midterms
- Robotics Summer Research Intern, CADMech Inc**, Markham, ON May 2022 - August 2022
- Designed and implemented a mobile robot to autonomously navigate a mapped indoor facility

Associations and Affiliations

- Mentor, Queen's AutoDrive** July 2024 - Present
- Team Captain, Queen's AutoDrive** June 2023 - June 2024
- Led 93-member team developing an SAE-Level 4 AV as part of a 5-year international competition sponsored by GM, SAE, Intel, Komatsu, and more. Undertook complete overhaul of culture and personnel (14 h+/wk)
 - Placed 3rd of 10 teams in the Intersection (self-driving) Challenge; all systems from scratch
 - Primary author for Concept Design, Software Design Specifications, Project Leadership Reports (all top 5)
 - Implemented novel approach for 3-LiDAR, 4-Camera fusion (± 15 cm at 40 m) and 3x speed (90 Hz)
 - Developed Global Planner with Python, ROS2, QGIS, worked first try on the AV

Technical Lead, Queen's AutoDrive

October 2022 - June 2023

- Responsible for system design and integration of (all) 11 points of failure with ROS2, Python (10+ h/wk)
- Configured and modified ROS2 (C++) drivers for LiDAR, camera, and GNSS
- Developed Autonomous Mode indicator via CAN with Arduino microcontroller
- Developed projection-based 3-LiDAR, 4-Camera fusion to obtain 3D position of detected classes

General Member, Queen's AutoDrive

March 2022 - October 2022

- Collected and annotated approximately 5,000 images for dataset manually; designed UI for Mobility Innovation

Athlete, Queen's Men's Tennis Team (3x)

October 2021 - March 2023

- Played at the collegiate level; 4 h/wk practice commitment;

Relevant Skills

- **Software:** Python, ROS2, Linux, Git, LaTeX, MATLAB, Arduino/C++
- **Control Theory:** WMR Kinematics, Feedback Linearization, Path Following, Theory (MTHE430/MATH830)
- **Computer Vision:** LiDAR-Camera Fusion, CNNs

References

References available upon request.