# MASc Position Available at Dalhousie University

Project Title**: Automatic Sail: AI-Driven Optimization for Sustainable Maritime Navigation and Wind Assisted Propulsion**

Position: **Master of Applied Science Candidate**

MASc subject: **Data-Driven Control for Autonomous Sailing**

Supervisor: Prof. **Ya-Jun Pan**, Dept. of Mechanical Engineering at Dalhousie University, Canada

Co-supervisor: Prof. **Janarthanan Rajendran**, Faculty of Computer Science, Dalhousie University, Canada

## POSITION OVERVIEW

We are seeking a research student to work on the model-based and AI-driven optimal navigation and control methods for automatic sail decision-making under variable environmental conditions. Experimental validation of the control method will be conducted based on the small-scale sailboat and 6-meter Birdie Sailboat available in the Advanced Control and Mechatronics Lab (ACM Lab: http://acm.me.dal.ca) at Dalhousie University. The student may have the opportunity to work as a visiting research graduate student in the research group located at the Université Grenoble Alpes – CNRS/GIPSA-lab, Grenoble, France. The project website is as: https://autosail-194045.gricad-pages.univ-grenoble-alpes.fr/

The MASc candidate will be fully supported at a comparable annual stipend up to 2 years supported by the Natural Sciences and Engineering Research Council of Canada (NSERC). The overall project is co-funded by the Canada-France CFP on Artificial Intelligence by NSERC and French National Research Agency (ANR) in France.

Dalhousie University is strongly committed to fostering diversity and inclusion. We encourage women, Indigenous BIPOC students, as well as researchers with disabilities students, racialized scientists as well as researchers with disabilities and from LGBTQ2+ communities to submit their application.

## QUALIFICATIONS

- Bachelor in Mechanical Engineering, Electrical Engineering, or a related field.
- Background knowledge in one or multiple fields: dynamic modeling, advanced control, reinforcement learning, robotics, and mechatronics, robot operating systems (ROS) simulation and implementation.
- Technical writing skills for scientific publications. Communication skills in English.
- A problem-solving-oriented mindset, self-motivation, initiative, resourcefulness, and dependability. Ability to both work independently and as part of a team.
- For international student, a minimum IELTS score of 7.0 or TOEFL iBT score of 92 is required.

## SCOPE OF THE MASc THESIS

CO2 emissions of shipping contributed to 2.9% of global emissions induced by human activities in 2018 and may be increased by 44% in 2050 as reported by International Maritime Organization (IMO) in 2024. The greenhouse gas emitted by the maritime transport sector is one of the three steps towards reducing emissions from the shipping sector. While the environmental impacts of shipping are well documented, the “adaptation efforts are only at the planning stage”, as mentioned by the latest Intergovernmental Panel on Climate Change (IPCC) report in 2022. The IPCC also reports that sustainable shipping is a key ingredient for the economic

system associated with the oceans.

The title of this MASc is “Data-driven control for autonomous sailing”. The objective of the thesis is to develop a model-free AI-driven methods such as **Reinforcement Learning** (RL) for decision making and feedback for the sailboat’s safe navigation. The convergence of the AI-driven methods will be addressed. The MASc candidate will work closely with one PhD to integrate the data-driven control approach to develop a hybrid control approach, where model-based and AI-driven methods are integrated to provide robust decision-making **under variable environmental conditions**. Given the limitations of pure data-driven approaches in extrapolating outside training distributions, physics-based constraints must be embedded into AI models to ensure feasible and physically consistent routing decisions.

The MASc student will work on the instrumentation of the **autonomous sailboat platforms** - DragonFlite 95, MiniJI, and full-size Birdie Sailboat, as well as carry out in-water test in Halifax Harbour. The actuation unit will be tested using the integrated data-driven control and optimal approach for feedback control. Our autonomous sailing platforms equipped with real-time weather sensors, GPS-tracked drift analysis, and onboard AI-driven decision-making systems will provide empirical insights into the performance of different adaptation strategies. By integrating advanced control techniques, PDE-based environmental modeling, and real-time optimization, the next generation of autonomous sailing vessels can achieve unprecedented efficiency in harnessing wind energy while navigating dynamically evolving oceanic conditions.

## HOW TO APPLY

Interested applicants, please send your CV, copies of transcripts, and previous publications (if any) to **Prof. Ya-Jun Pan (yajun.pan@dal.ca) and Prof. Janarthanan Rajendran (Janarthanan.Rajendran@dal.ca)** using the subject line “MASc Position Application – Automatic Sail”.

## OTHER DETAILS

All qualified applicants are encouraged to apply. However, only candidates under consideration will be contacted. The starting date is May/September 2026.