

# THOMAS ROCHEFORT-BEAUDOIN

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## EDUCATION

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### Polytechnique Montréal

2020 - 2024

PhD in Mechanical Engineering

- Thesis subject: *Accelerating Structural Optimization through Deep Reinforcement Learning*

### Technical University of Denmark

2023

Visiting PhD student

### Polytechnique Montréal

2016 - 2020

BEng in Aerospace Engineering

## EXPERIENCE

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### Mount Murray Investment

2021 - 2023

Data Science Intern

Montréal, Canada

- Implemented an automated back-office system in Python for institutional client reporting, saving approximately 250 hours annually in manual labor.
- Built a real-time ESG portfolio monitor using a custom DistilRoBERTa model, enriching portfolio managers' insights into 70+ holdings across 8 emerging markets. Integrated multi-lingual news in 7 languages for a global investment view.

### Polytechnique Montréal

2019 - 2023

University Lecturer

Montréal, Canada

- Delivered engaging lectures for *Finite Elements in Thermofluids* (MEC8270) and *Mechanical Components* (MEC8254) courses to over 100 undergraduate and graduate engineering students.
- Received a 97% approval rating from student feedback.

### Defence Research & Development Canada

2018 - 2019

Student Researcher, Directed Energy Section

Valcartier, Canada

- Conducted numerical simulations on 10 unmanned aerial vehicle models and executed 2 large-scale experimental tests to assess the effects of high-powered lasers, gaining insights into UAV vulnerabilities.
- Research results and publications helped refine defensive protocols to enhance the protection of Canadian troops against unmanned aerial threats in conflict zones.

## ML PROJECTS

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- **bettercallBLOOM** (Personal project): *Pytorch, Gradio, BLOOM-3B, bitsandbytes*  
Finetuned the open-source BLOOM-3B model on the *Pile of Law* dataset for legal question answering. Established an interactive AI-legal assistant interface using *Gradio* on HuggingFace Spaces. Explored prompt engineering to improve the model response accuracy. **Featured in a [DeepLearning.AI workshop](#).**
- **so-gym** (PhD project): *Python, Gym, Stable-baselines3, PyTorch, SciPy*  
Created an open-source reinforcement learning environment integrating structural analysis for the development of structural optimization RL agents. Used the open-source *Gym* library to build the environment based on finite element analysis, and *stable-baselines3* to benchmark deep reinforcement learning algorithms like PPO and SAC on the task.
- **cerebro** (@Mount Murray Investment): *Python, AWS, HF Transformers, NLTK, pandas, dash*  
Built a serverless Python-based news analysis pipeline using *AWS Lambda*. Finetuned RoBERTa models for sentiment and topic classification, achieving a 20% improvement in F1 score over public models. Doubled news coverage by integrating *GoogleTranslate* and presented insights on a *Dash* dashboard, supported by *AWS SES* email alerts.

## AWARDS

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- Doctoral Canadian Graduate Scholarship, NSERC (63 000\$)** **2022**
- Doctoral scholarship offered by the federal government for high performing PhD candidates. Selected as 1 of 387 recipients from 1721 applicants.
- Academic Excellence Scholarship, Hydro-Québec (21 000\$)** **2021**
- Awarded for outstanding academic performance and research quality in sustainable development at the doctoral level.
- Da Vinci Scholarship, Polytechnique Montréal** **2020**
- Awarded by Polytechnique Montréal in recognition of distinguished academic achievement and societal engagement.

## PEER-REVIEWED PUBLICATIONS

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- **Supervised Deep Learning for the Moving Morphable Components Topology Optimization Framework.** (2023). T. Rochefort-Beaudoin, A. Vadean, J.-F. Gamache, S. Achiche. *Engineering Applications of Artificial Intelligence*.
- **Comparative Study of First-Order Moving Asymptotes Optimizers for the Moving Morphable Components Topology Optimization Framework.** (2022). T. Rochefort-Beaudoin, A. Vadean, J.-F. Gamache, S. Achiche. Presented at *ASME-IDETC 2022* in St-Louis, Missouri.
- **Complexity-driven layout exploration for aircraft structures.** (2023). J.-F. Gamache, A. Vadean, M. Capo, T. Rochefort-Beaudoin, N. Dodane, S. Achiche. *Design Science*.
- **A Novel Use of the Ground Structure Topology Optimization for the Design of Pressurized Stiffened Panels.** (2021). M. Capo, J.-F. Gamache, T. Rochefort-Beaudoin, A. Vadean, S. Achiche. Presented at *ICTAM Milan 2020+1*.
- **Aerodynamics of an Unmanned Aerial Vehicle Damaged by Small Caliber Projectiles and a High Energy Laser.** (2021). T. Rochefort-Beaudoin, D. Pudo, A. Sirois. [Defense Research Report].
- **Preliminary Study of UAV Vulnerability under High Power Laser Irradiation.** (2020). T. Rochefort-Beaudoin, J.-F. Daigle. [Defence Research Report].

## TECHNICAL SKILLS

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- Programming languages: Python, C++, SQL
- Frameworks & Tools: PyTorch, Gym, Stable-baselines3, Git, Linux, Slurm, Ray
- Cloud platforms: AWS (Lambda, Elastic Beanstalk, S3, DynamoDB) - AWS Certified Cloud Practitioner
- Other Technologies: Familiar with TensorFlow and Jax

## EXTRACURRICULAR

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- Vice-president & President, PolyFinances** **2018 - 2020**
- Managed a 65,000\$ student investment fund, overhauled investment policy for future continuity, and promoted financial literacy among engineering students. Coordinated 28 students across 5 teams, and fostered ties with the financial industry. Instituted a responsible investment approach better reflecting Polytechnique's sustainable values.
- Private Pilot Licence**
- Completed Transport Canada theoretical (88%) and practical exams (19/20) with distinction in September and November 2018, respectively.

## LANGUAGES

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- Fluent in English and French