2020 POLYTECHNIQUE MONTRÉAL WINTER RESEARCH INTERNSHIP

Mitacs

POLYTECHNIQUE MONTRÉAL
TECHNOLOGICAL UNIVERSITY

Founded in 1873, **Polytechnique Montréal** is a leading Canadian university for the scope and intensity of its engineering research and industrial partnerships. It is highly ranked for the number of Canada Research Chairs in Engineering, the most prestigious research funding in the country, and is also first in Québec for the size of its student body and the scope of its research activities. Polytechnique Montréal has laboratories at the cutting edge of technology thanks to funding of nearly a quarter of a billion dollars from the Canada Foundation for Innovation over the past 10 years. Ranked #1 in 2017, Montréal still among the *best student cities* in the world.

Research Internship Program

A research internship is a research activity that is an integral part of a visiting student's academic program at the home institution. Each year, Polytechnique's research units welcome more than 250 students from other universities wishing to put into practice the technical and scientific knowledge acquired in their studies. The research conducted is supervised by a professor of Polytechnique and is always related to needs expressed by society or companies, and can be made in laboratories or *in situ*.

Duration

The recommended duration of the internship is a minimum of 4 months, usually taking place between January and May 2020. Other duration or period can be negotiated to suit your university schedule.

Financial Arrangement

- Tuition fee waiver for the duration of the internship;
- Free transportation from the airport to your place of residence upon your arrival;
- Employer Compliance Fee of $230 CAD covered by Polytechnique Montréal (once the internship is confirmed, the work permit applicant must pay the requested immigration fee).

Outstanding candidates may receive one of the 30 scholarships available ! Thanks to a partnership with Mitacs (a non-profit Canadian organization), POLY-MTL is pleased to offer a scholarship of $1500 CAD per month for a maximum of 4 months.

Eligibility Criteria

- Being enrolled in one of Polytechnique Montréal's partner universities;
- Having completed at least two years of an engineering undergraduate program or at least one year of a graduate program (Master or Ph.D.) according to projects' requirements as described in the following pages;
- Meet the specific skills required by the supervisor if any;
- Being fluent in French or in English (no language proficiency test is required).

Required Documents for Application

(in French or in English)

- Application Form;
- Letter of motivation including the following information (if you have selected 2 research projects, provide a letter of motivation for each project):
  - explanations of your interest in working in the selected project
  - your skills in respect to the project
- Curriculum vitae (CV);
- Copy of your most recent academic transcript;
- Proof of a full-time enrollment from your home institution (the letter must confirm that you are currently enrolled in a full-time program and will continue to be enrolled upon your return);
- If possible, a copy of an internship report made in the past.

To enhance your chances to be selected, choose 2 research projects. It can be 2 research projects from the list or 1 research project from the list and 1 supervisor from the Directory of Expertise !

Application Deadline

All documents must be sent electronically by July 31, 2019 to the International Relations Office of Polytechnique Montréal: *brin@polymtl.ca*. Please specify in the subject "2020 Winter Research Internship Program". Note that a conference call via Skype may be organized if needed for final selection.

Announcement

The results will be announced in September 2019 to each candidate. Selected candidates will receive an "Offer of Employment to a Foreign National Exempt from a Labour Market Impact Assessment (LMIA)" and will have to apply for a Work Permit at the Canadian Visa office that serves the area they live in. It is possible that the new *Public Policy – Short-term (120-day) work permit exemption for researchers* will allow you to be exempted from a work permit.

For any question regarding your application, please contact:
International Relations Office ■ *point@polymtl.ca*

2020 POLYTECHNIQUE MONTRÉAL SUMMER RESEARCH INTERNSHIP

LIST OF RESEARCH PROJECTS

Click on numbers to access project description

Aerospace Engineering

1 Controlling Flow-Induced Vibrations with Novel 3D-Printed Devices

2 Characterization of Advanced 3D-printed Materials for Aerospace Applications

3 Payload Transport with Drones

4 Vision System for Autonomous Racing Drones

Biomedical Engineering

5 Elastic Tendons for Artificial Fingers

6 Real-time Quantification of Muscle Forces

7 Biomimetic Design of a Prosthetic Hand

8 Control of a Robotic Arm for Assisting Patients with Musculoskeletal Disorders

9 Combined Optical Coherence Tomography and Hyper-spectral Imaging

Chemical Engineering

10 Prediction of Particle Dynamics for Additive Manufacturing

11 Catalyst Attrition Test for a Pilot Scale Fluidized Bed Reactor

12 Catalytic Degradation of PMMA in a Fluidized Bed Reactor

13 Micro Refinery Unit, GTL

14 Styrenic Polymers Debromination and Recycling

15 Catalytic Design for the Conversion of Fructose to 2,5 - Furandicarboxylic Acid

16 Oxydehydration of Fructose to FDCA in a μ-Fluidized Bed Reactor

Civil, Geological and/or Mining Engineering

17 Experimental Investigation on Transient Flow in Stormwater Systems (SWS)

18 Laboratory Experimental Testing of Partially Saturated Waste Mining Rockfill

19 Development of UHPFRC and Characterization of their Mechanical Properties

20 Acid Mine Drainage (AMD) and Contaminant Transport on Mine Sites

21 Effect of Climate Change on the Water Balance of Mine Sites

22 Scale Effects on Hydrogeotechnical Properties of Coarse Waste Rock

Computer and Software Engineering

23 High Fidelity Data Collection for Precision Agriculture with Drone Swarms

24 SwarmGIT: A Continuous Deployment Infrastructure for Robot Swarms

25 SOUL: Data Sharing for Robot Swarms

26 Failure-Tolerant Connectivity Maintenance for Robot Swarms

27 API Usability of Machine Learning Libraries

28 Supporting Early-Stage User-Centered Design

29 Securing Access to Mobile Application using Speech Recognition

30 Web Application for Management Information System of Grades

31 Securing Access to Mobile Application using Electronic Identity Card

Electrical Engineering

32 Sensors Comparison for the Detection of Movement Intent of the Upper Limb

33 Energy Optimization of Deep Learning Accelerators

Industrial Engineering and Mathematics

34 Reinforcement Learning in Combinatorial Optimization

Mechanical Engineering

35 Evolution of Bubble Clouds in Swirling Flow

36 Simulation of Aeration inside a Hydroelectric Turbine

37 Additive Manufacturing of Reinforced-polymer Composites

38 Dual Crankshaft Actuation System for Robotic Legs

39 Design and Experiment of a Bipedal Robot

40 Optimization, Fabrication and Testing of an Adaptive Vice-Grip

41 Novel Twisting String Actuation for Robotic Grippers

42 Design and Fabrication of a Cable Robot: Phase III

ADDITIONAL AREAS OF EXPERTISE

You didn't find what you were looking for?

- Browse our professors' directory by area of expertise: ***www.polymtl.ca/recherche/rc/en/expertises***
- Submit the area of expertise you would like to work on and provide the names of 2-3 professors working in this field.
- Explain in your letter of motivation why you would like to do a research internship in this area.
- The International Relations Office will try to find the appropriate match for you!

Here are some ideas:

- Aerospace Engineering
- Applied Mathematics
- Artificial Intelligence
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer and Software Engineering
- Design and Manufacturing
- Electric and Electronic Engineering
- Environmental Engineering
- Fluid Mechanics
- Fuel and Energy Technology
- Hydrology
- Industrial Engineering
- Information Technology
- Materials Science and Technology
- Mechanical Engineering
- Mining and Mineral Processing
- Nuclear Engineering
- Physics Engineering
- Robotics
- Structural Engineering

PROJECT DESCRIPTION

2020 Winter Research Internship Scholarship Program

Area of Expertise :	☒ Aerospace ☐ Biomedical ☐ Chemical ☒ Civil, Geological, Mining ☐ Computer/Software ☐ Electrical ☒ Mathematics/Industrial ☒ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Controlling Flow-Induced Vibrations with Novel 3D-Printed Devices**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Continuous flexible systems such as aircraft wings, pipelines, risers, bridges, power towers, and transmission lines are always subjected to unwanted vibrations induced by unsteady wind loading. The typical engineering solution is to add a tuned-mass damper to these structures. This typically works in removing the unwanted resonance, but it creates new problems as it adds two new natural frequencies. Here, we seek to develop a new class of dampers without a natural frequency, making them useful at damping vibrations over a broad spectrum of frequencies. Aeroelasticity, Fluid-Structure Interactions, Non-Linear Energy Sinks, Wind Tunnel Testing
Tasks during the Internship: *(max. 50 words)*	You will work with a PhD student to design, fabricate (3D-print, laser-cut, machine), and assemble new mechanisms of non-linear dampers. You will mount and test the effectiveness of these prototypes on a spring-mounted prism in the Polytechnique wind tunnel. You might contribute to modelling the dynamics of your prototypes.
Required Skills for the Internship: *(max. 50 words)*	A great interest in dynamics, vibrations and fluid-mechanics is necessary. Prior knowledge of some CAD software (Catia, Solidworks, ProE…) is necessary. Experience in manufacturing (CNC, laser-cutters, 3D-printers…) and in coding (Matlab, C, Fortran, Python…) is an asset. Curiosity is a must!
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Frédérick GOSSELIN Title: Associate Professor Department: Mechanical Engineering Website: http://www.polymtl.ca/lm2

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2020 Winter Research Internship Scholarship Program

Area of Expertise :	☒ Aerospace ☐ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☐ Electrical ☐ Mathematics/Industrial ☒ Mechanical ☒ Physics
Research Project Title : *(max. 10 words)*	**Characterization of Advanced 3D-printed Materials for Aerospace Applications**
University Cycle :	☒ 1st cycle (Undergraduate) ☐2nd cycle (Master) ☐3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	With additive manufacturing (3D printing) of composites materials (carbon fiber reinforced polymers), design strategies that depart form conventional techniques become possible. By producing parts by adding material layer-by-layer, geometries with arbitrary complexity can be obtained without incurring significant extra costs. Several hurdles remain however, before this technique reaches its full potential and becomes widely used in industry. For instance, the intricate relation between the various printing parameters, the exact makeup of the composites and the mechanical properties in service are not well understood. In addition to modeling efforts being conducted in our lab, experiments must be carried out to obtain all the relevant data against which model performances can be compared.
Tasks during the Internship: *(max. 50 words)*	The intern will assist PhD students with the experimental testing of custom-made samples. Specifically, he or she will help produce 3d printed samples for specific testing protocols, carry out testing procedures (tensile tests, digital image correlation, X-Ray micro-tomography, fracture tests), and help analyze results.
Required Skills for the Internship: *(max. 50 words)*	• Strong Mechanical/Aerospace Engineering or Material Sciences background • Interest for applied research, 3D printing technologies, modelling • Interest for material characterization • Good team worker with good communication skills
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Martin LÉVESQUE Title: Full Professor Department: Mechanical and Aerospace Engineering Website: http://www.polymtl.ca/lm2/en

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Area of Expertise :	☒ Aerospace ☐ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☒ Computer/Software ☒ Electrical ☐ Mathematics/Industrial ☐ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Payload Transport with Drones**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☐ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	The Mobile Robotics and Autonomous Systems Laboratory of Polytechnique Montréal is specialized in drone development and applications. The intern will join the team in charge of developing a payload transport system with drones.
Tasks during the Internship: *(max. 50 words)*	- Develop a simulation environment - Validate different control strategies in the simulation environment - Implement the controllers on the drones
Required Skills for the Internship: *(max. 50 words)*	- Good knowledge in mechanics/robotics - Good skills in Matlab/Simulink and ROS (Robot Operating System) - Medium knowledge in control (PID control loop, root locus, pole placement)
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: David SAUSSIÉ Title: Associate Professor Department: Electrical Engineering Website: https://www.polymtl.ca/expertises/en/saussie-david

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Area of Expertise :	☒ Aerospace ☐ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☒ Computer/Software ☒ Electrical ☐ Mathematics/Industrial ☐ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Vision System for Autonomous Racing Drones**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☐ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	The Mobile Robotics and Autonomous Systems Laboratory of Polytechnique Montréal is specialized in drone development and applications. The intern will join the team in charge of developing a vision system for autonomous racing drones
Tasks during the Internship: *(max. 50 words)*	- Complete the current simulation environment in ROS/Gazebo - Validate different vision strategies in the simulation environment - Implement the controllers on the drones
Required Skills for the Internship: *(max. 50 words)*	- Good knowledge in mechanics/robotics - Good skills in Matlab/Simulink and ROS (Robot Operating System) - Medium knowledge in control (PID control loop, root locus, pole placement)
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: David SAUSSIÉ Title: Associate Professor Department: Electrical Engineering Website: https://www.polymtl.ca/expertises/en/saussie-david

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Area of Expertise :	☐ Aerospace ☒ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☒ Electrical ☐ Mathematics/Industrial ☒ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Development of a 3D-printed Exoskeleton of the Upper Limb**
University Cycle :	☒ 1st cycle (Undergraduate) ☐ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	According to https://magicarms.org/, for the millions of children with neuromuscular disorders, debilitating weakness in the arms and shoulders makes everyday tasks nearly impossible. And no satisfying commercial solution has ever existed for them. But with the emerging innovative 3D-printed exoskeletons such as the Magic Arms, the impossible becomes possible. Magic Arms are gravity-balancing, exoskeletal devices, which become available to every child who needs it thanks to the 3D-printing (rapid prototyping). The objective of this project is to develop a 3D-printed gravity-balancing exoskeleton of the upper limb, based on our expertise and infrastructure on rapid prototyping and upper limb musculoskeletal modeling.
Tasks during the Internship: *(max. 50 words)*	Get familiarized with our 3D-printer and our upper limb musculoskeletal model (MATLAB), which is the most accurate one in the literature; Develop a 3D-printed gravity-balancing exoskeleton of the upper limb; Propose a new design and analyze it; Prepare a demo video showing the ability of the exoskeleton; Technical Report.
Required Skills for the Internship: *(max. 50 words)*	Basic knowledge of CAD Software ideally CATIA; Interest in musculoskeletal modeling (biomechanics); Knowledge of musculoskeletal modeling (biomechanics) is a plus; Priority will be given to candidates enrolled in a mechanical engineering program, a biomedical engineering program or an electrical engineering program.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☒ Others, please specify: Name: Technopole en réadaptation pédiatrique Address: 522 rue Bélanger Est, Montréal (Qc) H1T 1C9
Supervisor:	Name: Sofiane ACHICHE / Maxime RAISON Title: Full Professor / Associate Professor Department: Mechanical Engineering Website: https://www.polymtl.ca/expertises/en/achiche-sofiane https://www.polymtl.ca/expertises/en/raison-maxime

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Area of Expertise :	☐ Aerospace ☒ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☒ Electrical ☐ Mathematics/Industrial ☒ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Real-time Quantification of Muscle Forces**
University Cycle :	☒ 1st cycle (Undergraduate) ☐ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	The major problem to assess individual muscle forces is to solve the muscle force redundancy problem, as several muscles overactuate each human body joint. To solve this problem, a novel non-invasive method was proposed by the lab by using musculoskeletal modeling and electromyographic (EMG) data. The objective is to contribute to the development of a novel tool for real-time quantification of muscle forces based on musculoskeletal modeling and electromyography, by either extending the musculoskeletal model or transforming the process in real-time, or both.
Tasks during the Internship: *(max. 50 words)*	Get familiarized with our musculoskeletal modeling in MATLAB and ROBOTRAN (www.robotran.be), efficient multibody dynamics software; Contribute to the development of a novel tool for real-time quantification of muscle forces based on musculoskeletal; Extend the musculoskeletal modeling; Technical Report.
Required Skills for the Internship: *(max. 50 words)*	Basic knowledge of coding in MATLAB but C++ is a plus; Basic knowledge about musculoskeletal modeling (biomechanics); Knowledge of optimization and ordinary differential equations is a must; Priority will be given to candidates enrolled in a computer science program or an electrical engineering program.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☒ Others, please specify: Name: Technopole en réadaptation pédiatrique Address: 522 rue Bélanger Est, Montréal (Qc) H1T 1C9
Supervisor:	Name: Sofiane ACHICHE / Maxime RAISON Title: Full Professor / Associate Professor Department: Mechanical Engineering Website: https://www.polymtl.ca/expertises/en/achiche-sofiane https://www.polymtl.ca/expertises/en/raison-maxime

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Area of Expertise :	☐ Aerospace ☒ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☒ Electrical ☐ Mathematics/Industrial ☒ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Biomimetic Design of a Prosthetic Hand**
University Cycle :	☒ 1st cycle (Undergraduate) ☐ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	We seek to apply bioinspired designs (biomimetic design) to a prosthetic hand to achieve a strong grasping of objects using the lowest energy possible and the least parts possible. The goal of the project is to design, fabricate by rapid prototyping and if time allows test a newly designed prosthetic hand inspired by nature. The performances of the new hand will be compared to the one available at our lab in terms of grasping force and ease to use (simple metrics need to be defined).
Tasks during the Internship: *(max. 50 words)*	Get familiarized with Biomimetic Design Methods and available tools; Organize a small design workshop with our students to provide a group view on the design to be made, guided by biomimetic design; Propose a new design and analyses it; Technical Report.
Required Skills for the Internship: *(max. 50 words)*	Basic knowledge of CAD Software ideally CATIA; Basic knowledge about design methods; Knowledge of finite elements is a plus; Priority will be given to candidates enrolled in a biomedical engineering program or a mechanical engineering program.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☒ Others, please specify: Name: Technopole en réadaptation pédiatrique Address: 522 rue Bélanger Est, Montréal (Qc) H1T 1C9
Supervisor:	Name: Sofiane ACHICHE / Maxime RAISON Title: Full Professor / Associate Professor Department: Mechanical Engineering Website: https://www.polymtl.ca/expertises/en/achiche-sofiane https://www.polymtl.ca/expertises/en/raison-maxime

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Area of Expertise :	☐ Aerospace ☒ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☒ Electrical ☐ Mathematics/Industrial ☒ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Control of a Robotic Arm for Assisting Patients with Musculoskeletal Disorders**
University Cycle :	☒ 1st cycle (Undergraduate) ☐ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	JACOTM is a robotic arm for assistance developed by the Canadian company Kinova. The time to reach certain objects with the arm can be long and complex, causing fatigue and frustrations. It is therefore necessary to consider simplifications of the command. To achieve this, we propose the use gaze supported robotic control. The arm JACOTM is available in our research laboratory as well as a low-cost eye-tracker. The objective of this project is to semi-automate the control of the robotic arm JACOTM through the control of the orientation of the effector with respect to the user, in order to reduce the time of completion of everyday tasks. We expect to reduce the time to reach objects by over 50 %.
Tasks during the Internship: *(max. 50 words)*	Identify and categorize the most common / useful trajectories among users of the robotic arm; Determine optimal usage of a low cost eye-tracker; Develop a code to direct the end-effector in real time using the eyetracker information; Technical Report.
Required Skills for the Internship: *(max. 50 words)*	Basic knowledge of coding in MATLAB but C++ is a plus; Basic knowledge about design; Knowledge of robotics and/or image processing is a must; Priority will be given to candidates enrolled in a mechatronics program or an electrical engineering program.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☒ Others, please specify: Name: Technopole en réadaptation pédiatrique Address: 522 rue Bélanger Est, Montréal (Qc) H1T 1C9
Supervisor:	Name: Sofiane ACHICHE / Maxime RAISON Title: Full Professor / Associate Professor Department: Mechanical Engineering Website: https://www.polymtl.ca/expertises/en/achiche-sofiane https://www.polymtl.ca/expertises/en/raison-maxime

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Area of Expertise :	☐ Aerospace ☒ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☐ Electrical ☐ Mathematics/Industrial ☐ Mechanical ☒ Physics
Research Project Title : *(max. 10 words)*	**Combined Optical Coherence Tomography and Hyper-spectral Imaging**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☐ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Optical coherence tomography (OCT) is a medical imaging technique which uses laser light to image biological tissues in depth and in 3D. It allows us to visualize tissue structure below the surface up to several millimeters deep into the sample. It is very useful to detect the early development of diseases. However, OCT is less suited to detect the chemical composition of the tissue. In order to improve this, we combine OCT with another optical technique called hyper-spectral imaging (HSI), which is more adapted to detect molecular content. Both of these techniques are combined into endoscopes which can image inside the human body in a non-invasive manner. In particular we focus on imaging the esophagus to detect esophageal cancer which is a very deadly form of cancer.
Tasks during the Internship: *(max. 50 words)*	The project includes many facets including: optical design, endoscopic probe development & fabrication, software development, data processing, electronic circuits, simulations to predict light/tissue interactions, image processing to convert acquired data back into useful images
Required Skills for the Internship: *(max. 50 words)*	Basic/intermediate programming (Labview, Matlab, Python or other) for data analysis, image processing & software development, knowledge of optics (geometrical optics, wave optics, fiber optics), experimental rigor, team-work, communication
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Caroline BOUDOUX Title: Full Professor Department: Engineering Physics Website: http://www.polymtl.ca/expertises/en/boudoux-caroline

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Area of Expertise :	☐ Aerospace ☐ Biomedical ☒ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☐ Electrical ☒ Mathematics/Industrial ☒ Mechanical ☒ Physics
Research Project Title : *(max. 10 words)*	**Prediction of Particle Dynamics for Additive Manufacturing**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Additive manufacturing is an emerging technology that can revolutionize specific manufacturing sectors, but several technical issues related to flowability of metal powders remain to be resolved before its full potential can be achieved. The project aims at better characterizing and predicting the flow behavior of powders used for additive manufacturing, and improving powder flow simulation. The rheological behavior of powders will be studied in a wide range of conditions and these data will be used to develop a powder flow model that will be used to simulate key aspects of the additive manufacturing processes. The project will contribute to identifying promising avenues for powder feedstock development, better powder manipulation practices, and guidelines for equipment design.
Tasks during the Internship: *(max. 50 words)*	- Carry out simulation of powder flow in the context of powder bed fusion additive manufacturing using a high-performance code - Develop a methodology to calibrate contact models - Validate the powder model with experiments
Required Skills for the Internship: *(max. 50 words)*	- An interest in numerical simulation - Some C++, Python or Julia programming experience - Classical mechanics, discrete element method (DEM) or molecular dynamics - Basic knowledge about the Linux operating system
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Bruno BLAIS Title: Assistant Professor Department: Chemical Engineering Website: https://www.polymtl.ca/expertises/en/blais-bruno

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Area of Expertise :	☐ Aerospace ☐ Biomedical ☒ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☐ Electrical ☐ Mathematics/Industrial ☐ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Catalyst Attrition Test for a Pilot Scale Fluidized Bed Reactor**
University Cycle :	☐ 1st cycle (Undergraduate) ☐2nd cycle (Master) ☒3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Poly(methyl methacrylate) (PMMA), known as acrylic or acrylic glass as well as the Crylux, Plexiglas, and Acrylite is a transparent thermoplastic and an alternative to glass. The market size for this polymer is growing but, recycling technologies are inadequate. PMMA is usually filled with silica, quartz, aluminum hydroxide, titanium, and other inorganic fillers. In a fluidized bed reactor, it is possible to generate MMA monomer and recover expensive fillers. Industries use fluidized bed reactors due to their superior heat-and mass-transfer because of relatively larger particle-fluid contacting area compared to other types of reactors. However, the high mixing rate in these reactors attrits catalysts.
Tasks during the Internship: *(max. 50 words)*	1. Measure attrition resistance of catalysts in a jet attrition mill at 400 °C 2. Measure mixing rate in a lab scale fluidized bed reactor 3. Hydrodynamic study of a pilot-scale fluidized bed reactor
Required Skills for the Internship: *(max. 50 words)*	1- Write and speak professionally and communicate and relate well to others 2- Problem solving: ability to analyze and evaluate a situation 3- Knowledge of fluidized bed reactors 4- Knowledge of chemistry lab equipment
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Gregory S. PATIENCE Title: Full Professor Department: Chemical Engineering Website: https://www.polymtl.ca/expertises/en/patience-gregory-scott

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Area of Expertise :	☐ Aerospace ☐ Biomedical ☒ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☐ Electrical ☐ Mathematics/Industrial ☐ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Catalytic Degradation of PMMA in a Fluidized Bed Reactor**
University Cycle :	☐ 1st cycle (Undergraduate) ☐2nd cycle (Master) ☒3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Poly(methyl methacrylate) (PMMA), known as acrylic or acrylic glass as well as the Crylux, Plexiglas, and Acrylite is a transparent thermoplastic and an alternative to glass. The market size for this polymer is growing but, recycling technologies are inadequate. PMMA is usually filled with silica, quartz, aluminum hydroxide, titanium, and other inorganic fillers. In an fluidized bed, it is possible to generate MMA monomer and also separate and recover expensive fillers. We feed PMMA to the fluidized bed reactor in melted or solid form. PMMA melts and agglomerates before it decomposes, which changes the fluidized bed hydrodynamic.
Tasks during the Internship: *(max. 50 words)*	1. Operate a lab-scale fluid bed reactor at 250 to 450 °C 2. Measure the rheological properties of the PMMA 3. Analyze physiochemical properties of different catalyst
Required Skills for the Internship: *(max. 50 words)*	1- Write and speak professionally and communicate and relate well to others 2- Problem solving: ability to analyze and evaluate a situation 3- Knowledge of chemistry lab equipment 4- Basic knowledge of fluidized bed reactors
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Gregory S. PATIENCE Title: Full Professor Department: Chemical Engineering Website: https://www.polymtl.ca/expertises/en/patience-gregory-scott

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Area of Expertise :	☐ Aerospace ☐ Biomedical ☒ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☐ Electrical ☐ Mathematics/Industrial ☐ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Micro Refinery Unit, GTL**
University Cycle :	☐ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☐ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	We will produce syngas from natural gas by catalytic partial oxidation (CPOX) of methane in big scale reformet unit. This reaction is not currently in use industrially due to the fact that there is not a technology that allows to operate in an economic convenient way. You will carry on experiments at high pressure in a pilot plant to study the features of the catalyst, study the effects of the feeding temperature on the overall reaction, understand if an alternative way to feed the reactants may effect the carbon deposition on the catalyst and define an optimized coking-regeneration procedure.
Tasks during the Internship: *(max. 50 words)*	The intern will run experiment on the design lab scale plant, from the preparation of the reactor until the analysis of the product. At the same time he/she will design the integrate a new reactor for a second reaction.
Required Skills for the Internship: *(max. 50 words)*	- Problem solving and decision making - Goal oriented - Teamworking
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Gregory S. PATIENCE Title: Full Professor Department: Chemical Engineering Website: https://www.polymtl.ca/expertises/en/patience-gregory-scott

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Research Project Title : *(max. 10 words)*	**Styrenic Polymers Debromination and Recycling**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	The current feedstock of en-life high impact polystyrene (HIPS) is currently impossible to be valorized and recyled due the presence of brominated fire retardants (FRs). The presence of those Fr´s is consequence of the need from the electronic industry to compile with the security regulations. However, now those brominated compounds are to be banned due its harmful and hazardousness nature in humans and environment. Thus, a debromination process is required in order to allow HIPS recycling and valorization
Tasks during the Internship: *(max. 50 words)*	The main duties during the internship will be to be part of the daily work at the lab and to conduct the necessary analysis using the proper equipment. Additionally the assistance to develop and operate a small-scale process will be required.
Required Skills for the Internship: *(max. 50 words)*	The student should have a solid knowledge in chemistry and industrial processes. Specific background in polymers will be an advantage, but not a must. Also, since all work and research will be conducted in English a minimum level is required. Laboratory experience and the ability to work without supervision are a strong assets
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Gregory S. PATIENCE Title: Full Professor Department: Chemical Engineering Website: https://www.polymtl.ca/expertises/en/patience-gregory-scott

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Research Project Title : *(max. 10 words)*	**Catalytic Design for the Conversion of Fructose to 2,5 - Furandicarboxylic Acid**
University Cycle :	☐ 1st cycle (Undergraduate) ☐2nd cycle (Master) ☒3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Carbohydrates are promising bio-feedstocks to synthesize functionalized compounds. The US Department of Energy identified seven compounds with a high oxygen to carbon ratio as alternatives to sugar fermentation to ethanol. Transition metals oxidehydrate fructose to 2,5-furandicarboxylic acid (FDCA), a monomer for green plastic (polyethylenfuranoate). The aim of this project is to develop a micro-fluidized bed process that converts fructose to FDCA. Applying WO3/TiO2 catalyst yielded of 22% to furfural and 15% to diformyl furan. Assessing Mn-TiO2, C-TiO2 catalyst in the process is one of the targets of this project. Screening tests will determine the most important parameters to improve the yield.
Tasks during the Internship: *(max. 50 words)*	1- Sol-gel synthesizing of two catalyst (Mn-TiO2 and C-TiO2). 2- Characterization of the two catalyst. 3- Assessing the two catalyst in conversion of fructose. 4- HPLC analysis of the product.
Required Skills for the Internship: *(max. 50 words)*	1- Basic Knowledge of chemical engineering. 2- Ability to analyze and solve problem. 3-Knowledge of chemistry lab equipment.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Gregory S. PATIENCE Title: Full Professor Department: Chemical Engineering Website: https://www.polymtl.ca/expertises/en/patience-gregory-scott

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Research Project Title : *(max. 10 words)*	**Oxydehydration of Fructose to FDCA in a µ-Fluidized Bed Reactor**
University Cycle :	☐ 1st cycle (Undergraduate) ☐2nd cycle (Master) ☒3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Carbohydrates are promising bio-feedstocks for synthesizing functionalized compounds. Fructose represents a high potential feedstock to synthesize 5-hydroxymethyl furfural (HMF), 2,5-furandicarboxylic acid (FDCA), levulinic acid (LEV), furfural (FUR), dimethyl furfural (DFF), and lactic acid. The goal of our work is the oxidehydration fructose to 2,5-furandicarboxylic acid (FDCA), which is a monomer for green plastic manufacture (polyethylenfuranoate). For the first time, we developed a micro-fluidized bed process that converts fructose to FDCA. A nozzle inserted directly into the Pt-WO3/TiO2 catalytic bed atomizes an aqueous sugar solution.
Tasks during the Internship: *(max. 50 words)*	Running a micro-fluidized bed reactor Analyzing gasous and liquid products by GC, HPLC and Mass Spectrometry Write reports and mathematical modeling
Required Skills for the Internship: *(max. 50 words)*	Chemical Engineering student Familiar with laboratory protocols and safety Process analytical technology Computer Modeling
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Gregory S. PATIENCE Title: Full Professor Department: Chemical Engineering Website: https://www.polymtl.ca/expertises/en/patience-gregory-scott

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Research Project Title : *(max. 10 words)*	**Experimental Investigation on Transient Flow in Stormwater Systems (SWS)**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Current design methods for Storm Water Systems (SWS) are based on simplified representations of energy and continuity equations. This oversimplified design of the SWS has led to severe problems and costly damage to sewers (geysers, overflows, street inundations, traffic accidents and severe electrical problems). A new approach is needed in order to take note of all flow types including transient flows, the presence of air, non-permanent friction, simultaneous presence of more than one wave of pressurization/depressurization, complexity of boundary conditions and water storage in manholes and Best Mamagement Practices (BMP). The recent progress in Personal Computer advancements promote the incorporation of dynamic considerations in the transient flows modeling.
Tasks during the Internship: *(max. 50 words)*	Analyzing the occurrence conditions of the transient flow in SWS, modelling the SWS boundary conditions and analyzing the pressurized/depressurized wave front behaviour and trapped air pockets propagating in SWS
Required Skills for the Internship: *(max. 50 words)*	Excellent skills in hydraulics and in lab works
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Musandji FUAMBA Title: Full Professor Department: Civil, Geological and Mining Website: https://www.polymtl.ca/expertises/fuamba-musandji

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Research Project Title : *(max. 10 words)*	**Laboratory Experimental Testing of Partially Saturated Waste Mining Rockfill**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Rockfills are largely used in civil engineering works, such as dams, coarse drains and mine waste rock dumps, for instance. However, data on their mechanical properties are quite scarce because of the lack and high cost of the required large laboratory devices. The main scope of the project is to study particle size effects on the mechanical degradation of rockfills subjected to extreme environmental conditions. A series of shearing and compression tests will be carried out on large laboratory devices.
Tasks during the Internship: *(max. 50 words)*	A series of shearing and compression tests will be carried out on a direct shear for samples sized 300/300/150mm and a large triaxial cell for samples of 300mm in diameter and 600mm in height.
Required Skills for the Internship: *(max. 50 words)*	Basic knowledge on geotechnical engineering and laboratory testing.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Carlos OVALLE Title: Assistant Professor Department: Civil, Geological and Mining Engineering Website: https://www.polymtl.ca/expertises/en/ovalle-carlos

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Research Project Title : *(max. 10 words)*	**Development of UHPFRC and Characterization of their Mechanical Properties**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	In the last decade a new type of very durable concrete have been developed, it is named ultra-high performances fiber reinforced concretes (UHPFRC). They present very high mechanical properties, and very low porosity and permeability. One UPFRC have been developed at Polytechnique Montreal. The goal of the internship will be to modify the UHPFRC mix in order to reduce its CO2 emissions and increase its mechanical properties by using special mineral admixture. The type of activities that will be carried out will be adapted according to the background of the candidate (1st, 2nd or 3rd cycles).
Tasks during the Internship: *(max. 50 words)*	• Produce UHPFRC mixes at the laboratory • Measure UHPFRC properties at fresh and hardened states with standard lab. tests • Analysis of results • Produce a technical report
Required Skills for the Internship: *(max. 50 words)*	• Excellent leadership and be autonomous to manage technical activities • Good knowledge of concrete production and properties, lab experience is an asset • Good dexterity and be familiar with manual works to carry out lab activities • Excellent knowledge of Excel and Word software in order to analyze results
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Jean-Philippe CHARRON Title: Full Professor Department: Civil, Geological and Mining Engineering Website: https://www.polymtl.ca/expertises/charron-jean-philippe

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Research Project Title : *(max. 10 words)*	**Acid Mine Drainage (AMD) and Contaminant Transport on Mine Sites**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	One of the most critical issues for the mining industry remains the management and safe disposal of the important quantities of solid wastes (mine tailings and waste rock) produced during extraction. These materials often contain sulfides which can oxidize upon contact with oxygen (air) and water, producing acidic effluent with high concentrations of sulfates and heavy metals (known as acid mine drainage or AMD). Reclamation of reactive waste disposal sites is best achieved when it is planned in advance and integrated into the mining production cycle. Integrated mine waste management is therefore at the core of the research carried out at the Research Institute on Mines and Environment (RIME) UQAT-Polytechnique.
Tasks during the Internship: *(max. 50 words)*	Characterization of hydrogeological and geochemical properties of different mine wastes. Physical model (medium scale) experiments in the laboratory. Monitoring of water quality on site. Support to Master's and PhD students. Initiation to numerical modelling.
Required Skills for the Internship: *(max. 50 words)*	Basic knowledge in geochemistry and hydrogeology. Depending on the student's background and interests, the internship may focus on AMD generation, contaminant transport, mine site reclamation and effect of climate change on contaminant fate.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☒ Others, please specify: Name: Field work at a mine site Address:
Supervisor:	Name: Thomas PABST Title: Assistant Professor Department: Civil, Geological and Mining Engineering Website: http://www.irme.ca/en/

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Research Project Title : *(max. 10 words)*	**Effect of Climate Change on the Water Balance of Mine Sites**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Mine wastes often contain sulfides which can generate acid mine drainage (AMD), characterized by low pH and high concentrations of sulfates and metals. Management and reclamation of reactive waste disposal sites are usually very sensitive to in situ water balance. However, climate models predict an intensification of droughts during summer periods, and an increase of the frequency and intensity of extreme rain events in some regions of Canada by 2100. The objective of this project is therefore to assess the effect of climate change on the water table position on mine sites and propose solutions to improve the sustainability of reclamation. This project is part of a large research program at the Research Institute on Mines and Environment (RIME) UQAT-Polytechnique.
Tasks during the Internship: *(max. 50 words)*	Characterization of hydrogeological properties of different mine wastes. Physical model (medium scale) experiments in the laboratory, including column tests. Monitoring of water content and pore water pressure in situ. Initiation to numerical modelling. Support to Master's and PhD students. Collaboration with climatologists.
Required Skills for the Internship: *(max. 50 words)*	Basic knowledge in hydrogeology. Depending on the student's background and interests, the internship may focus on laboratory experiments, field monitoring and/or numerical simulations. Therefore, some previous experience in the laboratory, in the field or with numerical models could be useful.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☒ Others, please specify: Name: Field work at a mine site Address:
Supervisor:	Name: Thomas PABST Title: Assistant Professor Department: Civil, Geological and Mining Engineering Website: http://www.irme.ca/en/

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Research Project Title : *(max. 10 words)*	**Scale Effects on Hydrogeotechnical Properties of Coarse Waste Rock**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Waste rock can contain particles which size ranges from clay size grains to meter wide boulders. The characterization of the hydrogeotechnical properties of such material is therefore very complex. Laboratory tests usually require sieving the material which can modify its properties. To better evaluate the properties of coarse grained materials in the field, new relations between mechanical properties and maximum grain size need to be established and validated. In this project, new and relatively unique geotechnical equipment recently acquired by the Research Institute on Mines and Environment (RIME) UQAT-Polytechnique will be used. Large scale triaxial and shear tests will be carried out on various fractions of waste rock and compared to properties measured in the field.
Tasks during the Internship: *(max. 50 words)*	Characterization of hydrogeological and geotechnical properties of coarse waste rock. Large scale triaxial (30 cm diameter) and shear box (30 cm diameter, 15 cm height) tests in the RIME-laboratory at Polytechnique. Possibly field work on mine sites. Support to Master's and PhD students. Initiation to numerical modelling.
Required Skills for the Internship: *(max. 50 words)*	Basic knowledge in geotechnical engineering. Some laboratory or field experience could be useful. Depending on the student's background and interests, the internship may focus on the use of coarse waste rocks in roads, dams and/or drainage systems.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☒ Others, please specify: Name: Field work at a mine site Address:
Supervisor:	Name: Thomas PABST Title: Assistant Professor Department: Civil, Geological and Mining Engineering Website: http://www.irme.ca/en/

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Research Project Title : *(max. 10 words)*	**High Fidelity Data Collection for Precision Agriculture with Drone Swarms**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	The world needs more food. What can we do to improve the way food is produced? This project proposes to improve productivity and sustainability by increasing the precision of the data collected with the use of Artificial Intelligence (Deep Convolutional Neural Networks) powered autonomous drone swarms capable to fly among crops. There are many exciting challenges to be overcome here: SLAM, Visual Inertial Odometry, Image Segmentation (and Classification), Sensor Fusion and drone design/optimization. Much of the work developed here will be useful for other cool research fields like self-driving cars, industrial robots, search and rescue, and even space exploration!
Tasks during the Internship: *(max. 50 words)*	We will have many cool and exciting possible tasks where the intern will be able to learn more about: TensorFlow (deep learning/machine learning), dataset creation and augmentation, operating/building drones (UAVs), ROS/Robotics and electronics in general, Buzz (robot swarms), Computer Vision and Motion Tracking.
Required Skills for the Internship: *(max. 50 words)*	The skills will depend on the task, but in general terms the minimum skills are: Python (the deeper the better), C/C++ (basic knowledge is fine), sh/bash, Linux (Ubuntu/Debian), linear algebra (for computer vision and machine learning) and basic knowledge on electronics (for operating/building drones).
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Giovanni BELTRAME Title: Associate Professor Department: Computer and Software Engineering Website: http://mistlab.ca

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Research Project Title : *(max. 10 words)*	SwarmGIT: A Continuous Deployment Infrastructure for Robot Swarms
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	With the growing number of robotic devices introduced by automation and the Internet-of-Things, also comes a growth in the interest for methods and tools to deploy new code updates to active sensor arrays and swarms of robots. We have designed a mechanism to update the software on a fleet of autonomous drones while they are in operation, and we would like to extend this Over-The-Air update infrastructure to a version control system like GIT and test it on a fleet of drones equipped with long-range XBee communication boards.
Tasks during the Internship: *(max. 50 words)*	Develop a version control infrastructure within a Robot Operating System (ROS) node. Test and benchmark the version control infrastructure on DJI M100 drones equipped with XBee communication boards.
Required Skills for the Internship: *(max. 50 words)*	ROS and C/C++ skills are preferable. If you are new to either of those, don't worry, students at MIST lab help each other to learning new things.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Giovanni BELTRAME Title: Associate Professor Department: Computer and Software Engineering Website: https://mistlab.ca/

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Research Project Title : *(max. 10 words)*	SOUL: Data Sharing for Robot Swarms
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Many real-world applications require significant data transfers among robots: for instance, scanning a damaged structure using state-of-the-art RGB-D sensors and GPU-optimized algorithms can be made more efficient when distributed across multiple robots. We have designed Swarm-Oriented Upload of Large data (SOUL) with which robots can store large data by splitting them into smaller parts and placing them on multiple robots (like in BitTorrent), the problem with this approach is, if one piece of data is lost, the whole data will be lost. We want to develop a data-replication mechanism that is robust to data loss.
Tasks during the Internship: *(max. 50 words)*	The infrastructure to store large data by distributing it on multiple robots already exists. The main task during this internship would be to design and test the data replication mechanism for the distributed data storage mechanism SOUL.
Required Skills for the Internship: *(max. 50 words)*	Programming skills in C are preferable.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Giovanni BELTRAME Title: Associate Professor Department: Computer and Software Engineering Website: https://mistlab.ca/

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Research Project Title : *(max. 10 words)*	Failure-Tolerant Connectivity Maintenance for Robot Swarms
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	In many real-world applications, robots need communication between each other to coordinate. For the information to propagate, robots need to be connected, i.e. there has to be a communication path between all the robots in a team. We have designed a decentralized connectivity-preserving algorithm and validated using the ARGoS multi-robot simulator. The connectivity-preserving algorithm has to be ported on to a fleet of Khepera IV (ground robots) and CrazyFlies (small indoor drones).
Tasks during the Internship: *(max. 50 words)*	Develop software for a group of ground robots and small indoor drones, and port the connectivity maintenance algorithm from simulation to reality.
Required Skills for the Internship: *(max. 50 words)*	Python and/or C/C++ skills are preferable. If you are new to programming, don't worry you can learn to code with robots at MIST lab.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Giovanni BELTRAME Title: Associate Professor Department: Computer and Software Engineering Website: https://mistlab.ca/

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Research Project Title : *(max. 10 words)*	**API Usability of Machine Learning Libraries**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	**API usability specifies how easy, efficient, error-preventing, and pleasant an API of a software library is from its users' perspective. With machine learning (ML) techniques becoming increasingly powerful and pervasive, many non-programmers and casual users (e.g. domain experts in medicine or geography) started to explore ML libraries. However, many find them challenging to use because of bad API design. This project aims to investigate the API of ML libraries through the lens of user-centered design. The knowledge gathered will help developers of ML libraries improve their APIs and establish preliminary methodologies to evaluate API usability of ML libraries.**
Tasks during the Internship: *(max. 50 words)*	**The project will focus on conducting usability analysis (e.g. heuristic evaluation, usability testing) of one or more popular machine learning libraries (e.g. TensorFlow, scikit-learn, spaCy). The project will begin with a review of literature and blog posts on API usability and challenges in using ML libraries.**
Required Skills for the Internship: *(max. 50 words)*	**- Motivated learner** **- Programming skill in python** **- Knowledge about one or more machine learning library** **- Knowledge and/or interests about API usability**
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Jinghui CHENG Title: **Assistant Professor** Department: **Computer and Software Engineering** Website: **http://jhcheng.me**

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Research Project Title : *(max. 10 words)*	**Supporting Early-Stage User-Centered Design**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	**User-centered design (UCD) is widely adopted to create interactive systems that satisfy user needs and characteristics. The early stages are critical to its success. During this stage, designers create and access a large number of design artifacts, including sketches of rough designs and examples representing analogical ideas. With little tool support, however, designers are usually frustrated when managing a huge collection of artifacts. This project aims at addressing this challenge by identifying patterns and relationships among design artifacts. This knowledge will enable new technologies that help interaction designers organize, reuse, and retrieve design knowledge from these artifacts.**
Tasks during the Internship: *(max. 50 words)*	**The project will focus on conducting qualitative and quantitative analysis of design artifacts extracted (using scripts written by the student) from software and design repositories (e.g. GitHub, dribble, designspiration, etc.). The project will begin with a review of literature and blog posts on sketching and organizing design examples.**
Required Skills for the Internship: *(max. 50 words)*	**- Motivated learner** **- Knowledge and/or interests about user-centered interaction design** **- Script programming (e.g. python) and web development (JS, HTML and CSS)**
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Jinghui CHENG Title: **Assistant Professor** Department: **Computer and Software Engineering** Website: **http://jhcheng.me**

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Research Project Title : *(max. 10 words)*	**Securing Access to Mobile Application using Speech Recognition**
University Cycle :	☐ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☐ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Nowadays, the usage of the mobile devices to achieve daily tasks, such us financial operations, is increasing rapidly. Therefore, the risk of attacks and the stolen of the information are becoming important challenges for the researchers. In this context, we propose a training over four-month period leading to implement and validate a model based on the speech recognition in order to secure the access on the mobile application, more especifically the application of payment, in efficient way.
Tasks during the Internship: *(max. 50 words)*	Literature review of the speech recognition applications; comparison of the existing methods; proposal of a model based on speech recognition technology applied on mobile application; implementation and validation of the proposed model; elaborating a document and a presentation at the end of the training period.
Required Skills for the Internship: *(max. 50 words)*	knowledge in the development of mobile application (e.g., Android Studio...), Java Applets; and software development skills like Java, Python...
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Samuel PIERRE Title: Full Professor Department: Computer and Software Engineering Website: http://www.larim.polymtl.ca/samuel-pierre

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Research Project Title : *(max. 10 words)*	**Web Application for Management Information System of Grades**
University Cycle :	☒ 1st cycle (Undergraduate) ☐2nd cycle (Master) ☐3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	The objective of this offered training, over four-month period, is to design and implement a model for a Web application in a client/server environment. The main approach is to manage the students' grades belonging to giving evaluations (e.g., homework, midterm exam, final exam, project...) for a given course. This process will be occurred by the professor or the concerned responsible who are able to access remotely (over the Internet) in order to assign the grades with possibility to import/export the grid notes from/to Excel sheets into/from the database, and to display/print the grid of notes.
Tasks during the Internship: *(max. 50 words)*	Data inventory of the management information system of grades; Designing the conceptual model and the physical database structure; implementing the application; doing the test of the application; elaborating a document and a presentation at the end of the training period.
Required Skills for the Internship: *(max. 50 words)*	knowledge in the development of Web application using PHP framework (Laravel) and MySQL database.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Samuel PIERRE Title: Full Professor Department: Computer and Software Engineering Website: http://www.larim.polymtl.ca/samuel-pierre

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Area of Expertise :	☐ Aerospace ☐ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☒ Computer/Software ☐ Electrical ☐ Mathematics/Industrial ☐ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Securing Access to Mobile Application using Electronic Identity Card**
University Cycle :	☐ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☐ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Long before the Internet became a commodity, many governments had using the identity cards for user authentication. By the time, electronic identity card promises a universal secure authentication scheme for public and private sectors. The objective of this offered training, over four-month period, is to implement and validate a model based on the electronic identity to secure the access on mobile application in efficient way. We are interested in having multiple identity cards from several countries in order to standardize this proposed model.
Tasks during the Internship: *(max. 50 words)*	Literature review of the electronic identity cards recognition applications; comparison of the existing methods; Designing and implementing a model based on electronic identity card recognition applied on mobile application; validation of the model; elaborating a document and a presentation at the end of the training period.
Required Skills for the Internship: *(max. 50 words)*	knowledge in the development of mobile application (e.g., Android Studio...), Java Applets; and software development skills like Java, Python...
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Samuel PIERRE Title: Full Professor Department: Computer and Software Engineering Website: http://www.larim.polymtl.ca/samuel-pierre

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Area of Expertise :	☐ Aerospace ☒ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☒ Electrical ☐ Mathematics/Industrial ☒ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Sensors Comparison for the Detection of Movement Intent of the Upper Limb**
University Cycle :	☒ 1st cycle (Undergraduate) ☐ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Today three main sensing technologies can be used for real-time control of many domestic dynamic systems, based on: Muscle activity sensors (e.g. the Myo from www.thalmic.com/en/myo/); Inertial measurement units or accelerometers (e.g. the Nintendo Wii); Optokinetic or depth cameras (e.g. the Microsoft Kinect); These sensing technologies and applications are available at our lab. The objective of this project is to compare the ability of these sensing technologies for the detection of movement intention of the upper limb, to have a better knowledge of their importance in regards to various applications such as prostheses, virutal reality game
Tasks during the Internship: *(max. 50 words)*	Prepare and perform an experimental protocol with the support of our team and the research ethics board, to compare the various sensing technologies on participants from the lab; Analyse the ability of these sensing technologies, based on accuracy and time latency; Prepare demo videos on funny applications; Technical Report.
Required Skills for the Internship: *(max. 50 words)*	Basic knowledge of coding in C++; Basic knowledge about instrumentation; Knowledge of clustering is a must; Priority will be given to candidates enrolled in a mechatronics program, computer science program or an electrical engineering program.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☒ Others, please specify: Name: Technopole en réadaptation pédiatrique Address: 522 rue Bélanger Est, Montréal (Qc) H1T 1C9
Supervisor:	Name: Sofiane ACHICHE / Maxime RAISON Title: Full Professor / Associate Professor Department: Mechanical Engineering Website: https://www.polymtl.ca/expertises/en/achiche-sofiane https://www.polymtl.ca/expertises/en/raison-maxime

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Area of Expertise :	☐ Aerospace ☐ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☒ Computer/Software ☒ Electrical ☐ Mathematics/Industrial ☐ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Energy Optimization of Deep Learning Accelerators**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Algorithms based on deep neural networks achieve outstanding performance on a long list of difficult tasks such as image classification and segmentation, speech recognition, playing the game of Go, and many others. However, to obtain such outstanding results, very large networks are required, containing several million parameters or more. As a result, such algorithms require a significant amount of energy to run, making it difficult to deploy them on portable systems, as well as being an economic and environmental burden due to their fast increasing adoption. Our research work seeks to dramatically reduce this energy consumption by building deep learning accelerators based on energy-efficient but unreliable circuits.
Tasks during the Internship: *(max. 50 words)*	Your tasks during the internship will be adjusted based on your level and preference for software- or hardware-level work, and can include developping custom training routines and/or new deep neural network architectures, and developping and analyzing hardware architectures.
Required Skills for the Internship: *(max. 50 words)*	You must be already familiar with either: python programming and training deep neural networks OR digital system design, verification and VHDL/verilog coding. Knowledge of introductory statistics (random variables, probability distributions, etc.) is also required.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: François Leduc-Primeau Title: Assistant Professor Department: Department of Electrical Engineering Website: http://f.leduc-primeau.info

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Area of Expertise :	☐ Aerospace ☐ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☐ Electrical ☒ Mathematics/Industrial ☐ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Reinforcement Learning in Combinatorial Optimization**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	As optimization-based software tends to solve similar problems over and over again, we want to investigate the use Machine Learning (ML) techniques to help Reinforcement Learning allows to learn over many examples what is the best action to be taken given the state of a system. It has recently been applied successfully in the largely mediatized win of Google's AlphaGo over the European Champion of the game Go. In many combinatorial solvers (mixed integer programming, constraint programming, SAT, etc.), one needs to traverse some version of a branch and bound tree. The question is whether RL models can be trained to improve solver performances over time. The objective of this internship will be to validate this idea and to build a first prototype of this concept.
Tasks during the Internship: *(max. 50 words)*	Experiments will be conducted most likely on a set of problems arising from the scheduling or transportation problem arising in the healthcare sector. The intern will have to apply RL technique within a combinatorial optimization framework (MP, CP or SAT) and we hope to be able to demonstrate the usefulness of this approach.
Required Skills for the Internship: *(max. 50 words)*	Programming skills in C++ or Java, background knowledge of at least one combinatorial optimization paradigm based on a branching tree.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Louis-Martin ROUSSEAU Title: Full Professor Department: Mathematics and Industrial Engineering Website: hanalog.ca/person/louis-martin-rousseau/

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Research Project Title : *(max. 10 words)*	**Evolution of Bubble Clouds in Swirling Flow**
University Cycle :	☒ 1st cycle (Undergraduate) ☐2nd cycle (Master) ☐3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	The NSERC-GE Industrial Research Chair in two-phase flow established in the mechanical engineering department of Polytechnique Montréal offers internships. Successful applicants will receive a scholarship from Polytechnique Montréal and the Research Team to complete their studies and research. The research is aimed at improving the oxygenation of water downstream of hydroelectric dams; one of the issues being to preserve the aquatic fauna. The goal is to develop the fundamental understanding and applied technology needed by industry in the field of two-phase flows. Experimental and numerical tools are developed to design similar laws, to obtain validation data for numerical simulation of aerodynamic wind turbines.
Tasks during the Internship: *(max. 50 words)*	The candidate will perform experimental measurements of the interaction between bubble flow and vorticity. Thanks to high-speed camera recordings and optical probes measurements, the candidate will quantify the migration and break-up of bubbles inside a vortex and assess the dispersive effect of bubbles on vorticity .
Required Skills for the Internship: *(max. 50 words)*	The candidate shall have skills in fluid mechanics, mathematics and more generally physics. The candidate shall demonstrate abilities to propose original experiments to qualify and quantify bubble-vortex interactions.
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Cédric BÉGUIN Title: Assistant Professor Department: Mechanical Engineering Website: https://www.polymtl.ca/expertises/en/beguin-cedric

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Area of Expertise :	☐ Aerospace ☐ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☐ Electrical ☐ Mathematics/Industrial ☒ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Simulation of Aeration inside a Hydroelectric Turbine**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	The NSERC-GE Industrial Research Chair in two-phase flow established in the mechanical engineering department of Polytechnique Montréal offers internships. Successful applicants will receive a scholarship from Polytechnique Montréal and the Research Team to complete their studies and research. The research is aimed at improving the oxygenation of water downstream of hydroelectric dams; one of the issues being to preserve the aquatic fauna. The goal is to develop the fundamental understanding and applied technology needed by industry in the field of two-phase flows. Experimental and numerical tools are developed to design similar laws, to obtain validation data for numerical simulation of aerodynamic wind turbines.
Tasks during the Internship: *(max. 50 words)*	The candidate will perform numerical simulations of the two-phase flow characteristic of those encountered in aerating hydroelectric turbines. The candidate will perform numerical analysis (verification, validation) of the computations, analyze results such as the total air-water interface area critical for oxygenation efficicency.
Required Skills for the Internship: *(max. 50 words)*	The candidate shall have skills in fluid mechanics, mathematics and more generally physics. The candidate shall demonstrate abilities to use CFD tools (CFX, in-house, Fortran).
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Stéphane ETIENNE Title: Full Professor Department: Mechanical Engineering Website: https://www.polymtl.ca/expertises/en/stephane-etienne

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Research Project Title : *(max. 10 words)*	**Additive Manufacturing of Reinforced-polymer Composites**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☒ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Additive manufacturing, or three-dimensional (3D) printing, of composites is a grouping of different shaping processes that allows the fabrication of structures through robotic deposition of material by means of a computer model. This technology is a very promising avenue for the implementation of many mechanical and aerospace systems. My research team focuses on the development of advanced composite materials offering multiple functionalities (where multiple properties are desired for a given application) for additive manufacturing (e.g., FDM, SLA, solvant assisted, extrusion-based). My research team innovates with freeform, multi-material and multi-functional printing of complex mechanical/aerospace systems.
Tasks during the Internship: *(max. 50 words)*	The intern will assist a senior graduate student (MS or PhD) with the realization of his or her research project. The main tasks are: design of composites, mixing of fillers, characterization of various material properties, tailoring of printing parameters, design of experiments, CAD design, robot programming, and 3D printing.
Required Skills for the Internship: *(max. 50 words)*	• Strong Mechanical/Aerospace Engineering or Material Sciences background • Interest for applied research, 3D printing technologies, CAD, robot programming • Interest for material characterization (e.g., optical microscopy, SEM, mechanical) • Good team worker with good communication skills
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Daniel THERRIAULT Title: Full Professor Department: Mechanical and Aerospace Engineering Website: http://www.polymtl.ca/lm2/en

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Area of Expertise :	☐ Aerospace ☒ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☐ Electrical ☐ Mathematics/Industrial ☒ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Dual Crankshaft Actuation System for Robotic Legs**
University Cycle :	☒ 1st cycle (Undergraduate) ☐2nd cycle (Master) ☐3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	The aim of this project is optimize and experiment with a type of actuation for a robotic leg where all the motors are attached to the body and their powers transmitted to the joints of the leg witn a dual crankshaft mechanism. This mechanism is envisioned as a possible alternative for one of our walking machine. The intern will be in charge of implementing the kinematic, static, and possibly dynamic (if needed) equations modeling the mechanism. Then, simulations and optimizations will be conducted. If the results appear promising, a prototype will be manufactured and experimented with.
Tasks during the Internship: *(max. 50 words)*	- Modeling of the mechanism - Optimization - Fabrication of a prototype
Required Skills for the Internship: *(max. 50 words)*	- Solid mechanics and mechanical design (Catia or Inventor preferred) - Excellent math and programming skills (Matlab) - Familiarity with hobbyist prototyping
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Lionel BIRGLEN Title: Full Professor Department: Mechanical Engineering Website: http://www.polymtl.ca/labrobot/en/

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Area of Expertise :	☐ Aerospace ☒ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☐ Electrical ☐ Mathematics/Industrial ☒ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Design and Experiment of a Bipedal Robot**
University Cycle :	☒ 1st cycle (Undergraduate) ☐2nd cycle (Master) ☐3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	The aim of this project is to improve the design of one of our robotic leg (see https://youtu.be/2zo5aSJEjhY). This leg is able to mechanically adapt its walking pattern in reaction to a collision without any sensor or high-level control. The objective of this internship is to update the mechanical design of the leg (reinforcements and stiffeners are needed) and duplicate this revised version to obtain a bipedal robot. Then, a testbed consisting of various simple terrains will be needed to evaluate the efficiency of the resulting robot when traversing these terrains. Experiments will be conducted to collect data about the most efficient walking gaits and robot configuration.
Tasks during the Internship: *(max. 50 words)*	- CAD, solid mechanics and stress of materials - Dynamic simulations (possibly) - Prototyping and data collection
Required Skills for the Internship: *(max. 50 words)*	- Mechanical Design (Catia or Inventor preferred) - Dynamic and FEM Simulations (MSc Adams / Ansys preferred) - Good practical skills (mechanical assembly, electronic soldering, etc.) - Excellent analytical skills
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Lionel BIRGLEN Title: Full Professor Department: Mechanical Engineering Website: http://www.polymtl.ca/labrobot/en/

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Area of Expertise :	☐ Aerospace ☐ Biomedical ☐ Chemical ☐ Civil, Geological, Mining ☐ Computer/Software ☐ Electrical ☐ Mathematics/Industrial ☒ Mechanical ☐ Physics
Research Project Title : *(max. 10 words)*	**Optimization, Fabrication and Testing of an Adaptive Vice-Grip**
University Cycle :	☒ 1st cycle (Undergraduate) ☐2nd cycle (Master) ☐3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	The aim of the project is to create a mechanical clamp inspired by a vice-grip mechanisms with the ultimate aim of reaching a design that could be adapted to surgical operations on human tissue. The design will using a compliant (flexible) transmission and therefore should be possible to produce from a single piece of material (no assembly required). It will also embody the design principles of underactuated grasping which mean that the final two-finger design will be able to adapt itself to the shape of the objects it seizes.
Tasks during the Internship: *(max. 50 words)*	- Design optimisation of a one-element bistable compliant underactuated finger (lengths of linkage, geometry of flexure hinge,...). - Fabrication of prototypes - Benchmark and experiments.
Required Skills for the Internship: *(max. 50 words)*	- Solid mechanics and mechanical design (Catia or Inventor preferred) - Excellent math and programming skills (Matlab) - Mechanics of materials (Ansys preferred) - Good practical skills for prototype manufacturing and assembly
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Lionel BIRGLEN Title: Full Professor Department: Mechanical Engineering Website: http://www.polymtl.ca/labrobot/en/

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Research Project Title : *(max. 10 words)*	**Novel Twisting String Actuation for Robotic Grippers**
University Cycle :	☒ 1st cycle (Undergraduate) ☐2nd cycle (Master) ☐3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	A twisting string actuation (TSA) transmission uses wire(s) to transmit power from a motor on one side to a load on the other side. When the motor rotates the wires are twisting themselves, and thus provide a pulling force on the load. The aim of the project is to add to an existing TSA unit previously designed in out lab some design refinements to improve performances. The first of which is a variable radius rod which changes the speed rate and the output force. The application will be to drive a two-finger robotic gripper.
Tasks during the Internship: *(max. 50 words)*	- Design of the mechanical elements (deformable cylinder, etc.). - Modeling of the resulting system - Fabrication and experiments with a test bench.
Required Skills for the Internship: *(max. 50 words)*	- Solid mechanics and mechanical design (Catia or Inventor preferred) - Excellent math and programming skills (Matlab) - Good practical skills (mechanical assembly, electronic soldering, etc.)
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Lionel BIRGLEN Title: Full Professor Department: Mechanical Engineering Website: http://www.polymtl.ca/labrobot/en/

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Research Project Title : *(max. 10 words)*	**Design and Fabrication of a Cable Robot: Phase III**
University Cycle :	☒ 1st cycle (Undergraduate) ☒ 2nd cycle (Master) ☐ 3rd cycle (Ph.D.)
Background Information: *(max. 100 words)*	Cable robots are a new type of robotic systems in which the end-effector is connected to the ground through a series of cables instead of rigid links. The most well-known example of cable robot is the Skycam used to film athletes during competitions in stadium. Cable robots allow to produce larger forces over much larger workspaces than conventional devices. We have designed in our lab a prototype of a 4-wire planar cable robot that we want to improve upon. These improvements, to be handled by the intern, range from mechanical updates to reduce friction to integration of force and position sensors as well as controller tuning. If time permits we will explore expanding the system to a spatial version.
Tasks during the Internship: *(max. 50 words)*	- Excellent practical skills - Revisions of mechanical and electrical designs - Experiments
Required Skills for the Internship: *(max. 50 words)*	- Solid mechanics / CAD (Inventor preferred) - Excellent electronics and programming skills (soldering and Arduino language) - Good practical skills for experimenting with the prototype The depth of the work will be adjusted depending on the intern level (undergr./MSc)
Location:	☒ Polytechnique's Building (Main, Lassonde, Bombardier, Aisenstadt) ☐ Others, please specify: Name: Address:
Supervisor:	Name: Lionel BIRGLEN Title: Full Professor Department: Mechanical Engineering Website: http://www.polymtl.ca/labrobot/en/

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