

## Multiple Master's, PhD and postdoctoral positions at Polytechnique Montréal

### POSITIONS SUMMARY



Prof. Therriault



Prof. Bodkhe



Prof. Levesque



Prof. Keivanpour



Prof. Gosselin



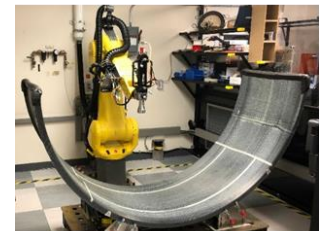
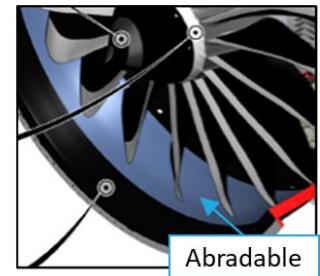
Prof. Melancon

The Laboratory for Multiscale Mechanics (LM<sup>2</sup>) (<https://www.polymtl.ca/lm2/en>) in the Department of Mechanical Engineering (<http://www.polymtl.ca/meca/>) and Prof. Keivanpour from the Department of Mathematical and Industrial Engineering at Polytechnique Montreal seek candidates for a 5-year large-collaborative project.

More specifically, the team is recruiting to fill 3 master's, 8 PhD and 2 postdoctoral fellowship positions in the interdisciplinary field of additive manufacturing for the project entitled "Additive manufacturing technologies for high-performance and high-productivity of multifunctional composite structures and their sustainability for aerospace applications".

The recruited candidates will join a vibrant and collaborative environment within the LM<sup>2</sup> research group, co-directed by Prof. Daniel Therriault, Prof. Martin Levesque, Prof. Frederick Gosselin, Prof. Sampada Bodkhe and Prof. David Melancon. The candidates will be involved in a 5-year large-collaborative project at the heart of a diversified academic research team at Polytechnique Montreal and three industrial partners: Safran Group (France), Dyze Design Inc. and ORS Inc.

The project covers both experiments and numerical modeling for the design, manufacturing and characterization of reinforced polymer composites using advanced additive manufacturing processes for aerospace applications.



### MAIN RESPONSIBILITIES

The chosen candidates will be expected to:

- Carry out pro-actively their research projects under the supervision of the professors;
- Participate in meetings (e.g., individual meetings with the supervisors, LM<sup>2</sup> group meetings, videocalls and in-person meetings with the industrial partners) and other activities related to the well-being of the lab;
- Prepare technical reports, write peer-reviewed journal publications, participate to international conferences, etc.;
- Participate in visits or internships at the industrial partners.

### TARGETED LEVEL OF STUDIES

Three (3) master's and eight (8) PhD students as well as two (2) postdoctoral fellows (PDFs) will be recruited for the desired starting date of January or May 2024.

Table 1. Project titles and competencies required for each project.

<b>Student/PDF</b>	<b>Area of expertise / Essential qualifications</b>
<b>PhD-1</b> Development of an advanced and fully instrumented FFF (fused filament fabrication) manufacturing platform for high temperature polymer composites	Hands-on attitude with mechanical or aerospace engineering background or very strong interest in mechatronics, polymer composites and their characterization techniques and additive manufacturing
<b>PhD-2</b> Design and optimization of a high-flow pellet-extrusion head for a 6-axis robotic additive manufacturing process	Background in materials science and be familiar with rheology behavior of polymer composites and numerical modeling and simulations. Being familiar with commercial software Fluent is an asset.
<b>PhD-3</b> Development of a fully instrumented FGF manufacturing platform and in situ process monitoring	Background in mechanical or electrical engineering with a background in mechatronics with solid programming skills and numerical modeling
<b>PhD-4</b> Prediction of interfacial behavior of filaments in 3D printed fiber-reinforced composites	Background in mechanical or aerospace engineering with strong knowledge in numerical modelling. Knowledge on polymer composites is an asset.
<b>PhD-5</b> Investigation of the multi-scale modelling of fracture in additively manufactured composites - phase field modeling approach	Mechanical or aerospace engineering with strong background in numerical modeling and hands-on attitude
<b>PhD-6</b> Investigation of the interfacial strength properties of additively manufactured composites	Background in engineering physics or mechanical engineering with a hands-on attitude and strong knowledge in numerical simulations and programming skills
<b>PhD-7</b> Investigation of the rheological behavior and printability by Direct-Ink Writing of thermosetting materials using a multinozzle printing head	Background in chemical/polymer engineering or materials science and be familiar with computer-aided modeling and rheology of polymer composites
<b>PhD-8</b> Development of a customized tool for assessing and optimizing the circularity of the printed parts in FFF and FGF processes	Strong background in chemical/polymer or industrial engineering and familiar with mechanical testing, rheology, melt-mixing of polymer composites and their additive manufacturing and characterization. Knowledge on recycling and life cycle analysis of polymers is an asset.
<b>MSc-1</b> Additive manufacturing and characterization of composite materials in FFF/FGF processes	Mechanical or aerospace engineering background with a hands-on attitude and basic knowledge in additive manufacturing
<b>MSc-2</b> Realization of the scientific study on the interface strength with respect to the fabrication process conditions	Background in materials science or chemical engineering with a hands-on attitude and familiar with mechanical and microscopy characterization

<b>MSc-3</b> Realization of the new generation of multinozzle printing systems for thermosets	Hands-on attitude and knowledge in mechanical design and fabrication of parts (with a mechanical or aerospace engineering background)
<b>PDF-1</b> Development of the thermal management infrastructure: using FE numerical methods to simulate the heat transfer during the FFF process	PhD in mechanical or aerospace engineering or engineering physics with a strong expertise in numerical modeling and mechanical design, and a hands-on attitude
<b>PDF-2</b> Development of a novel deposition approach for thermoset materials to manufacture more complex features for the realization of the acoustic demonstrator	PhD in mechanical engineering with an expertise in mechanical design and programming and hands-on attitude

### FINANCIAL SUPPORT FOR RECRUITED STUDENTS AND POSTDOCTORAL FELLOWS

Level of studies	Master's	PhD*	Postdoctoral fellowship
Annual financial support (Canadian dollar CAD)	\$22,000	\$26,000	\$70,000 (including social benefits)

\*International PhD students will be able to secure an additional scholarship offered as a reduction of the registration fees

### HOW TO APPLY

LM<sup>2</sup> promotes diversity, equity and inclusion within a lively and open-minded environment. We encourage applications from all qualified candidates, including students from diverse backgrounds, gender identities, sexual orientations, cognitive and physical abilities, religions, etc.

To apply, interested candidates should complete an online Google form (<https://forms.gle/ytm3exaWbmZb5PVt8>) and submit an application package consisting of:

- Cover/motivation letter (1 page)
- Curriculum vitae
- Copy of up to 3 most significant research contributions (e.g., journal papers, conference proceedings, if any)
- Names and contact information of 2 references
- Most recent undergraduate and graduate transcripts

To:

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Research Associate in the Department of Mechanical Engineering, Polytechnique Montreal  
[rouhollah.farahani@polymtl.ca](mailto:rouhollah.farahani@polymtl.ca)

**\*THE SCREENING PROCESS WILL BEGIN IMMEDIATELY AFTER RECEIVING THE APPLICATIONS. HOWEVER, ONLY SELECTED CANDIDATES WILL BE CONTACTED.**



## ABOUT LM<sup>2</sup>

LM<sup>2</sup> values collaboration, respect, openness, teamwork and continuous improvement. We believe that considering a wide range of ideas and viewpoints, as well as creating an environment where everyone feels valued and able to fully participate, leads to more robust and innovative research outcomes.

The research conducted at LM<sup>2</sup> mainly deals with metals, polymers, polymer composites, nanocomposites, living matter and smart systems. It covers manufacturing, service performance, fluid-structure interactions and mechanical instabilities. The highly qualified personnel (e.g., students) of LM<sup>2</sup> is trained by carrying out both fundamental high-risk high-payoff research as well as industrially-relevant research with numerous SMEs, as well as with local and international OEMs in the fields of aerospace and energy. The LM<sup>2</sup> labs host many equipment and facilities related to processing, manufacturing and characterization of nano, micro, and macro-systems including, but not limited to, several commercial and industrial 3D printers, advanced custom-built additive manufacturing platforms (i.e., 6-axis robot-assisted printing, multi-material multi-process printing), dispensing robots, mixing equipment (e.g., micro-extruder), optical microscopes, and several tensile machines.

The LM<sup>2</sup> team currently consists of approximately 50 permanent members (PhD and master's students, technicians, research associates, postdoctoral fellows and professors) from different backgrounds and nationalities, as well as many international interns (e.g., China, India, Ireland).

At LM<sup>2</sup>, we offer an inclusive and safe space as well as learning and development opportunities for all our HQP. We encourage a healthy work/life balance for our research team (e.g., no mandatory activities and no meetings during evenings or weekends to respect HQP with family responsibilities). All trainees are treated with fairness and equity. We communicate all conference, bursary, and teaching assistantship opportunities with the whole team.

## ABOUT OUR INDUSTRIAL PARTNERS

### SAFRAN GROUP

Safran is an international high-technology group operating in the fields of aeronautics (propulsion, equipment and interiors), space and defense ([www.safran-group.com](http://www.safran-group.com)). Established on all continents, Safran has over 83,000 employees and a sales turnover of 19 billion euros in 2022. Safran, on its own or with its partners, stands as a tier-one player on the European and global market. In order to remain a leader in a market in constant evolution, Safran undertakes ambitious R/D programs, including expenditures above 1.54 billion euros in 2022 alone, with a significant portion aiming at improving environmental performance of air transport. Part of Safran's commitment to the project will be through Safran and SAE, a Materials and Processes expertise dedicated to R&D activities in the field of polymers and composites additive manufacturing, in order to identify the scientific and technical levers that can greatly improve the quality and mechanical performance of the parts produced. Safran Group and the LM<sup>2</sup> at Polytechnique Montreal have been collaborating since 2015. The first collaborative project was followed by a 5-year (2018-2023) project through an Industrial Research Chair entitled "Fabrication additive des composites à matrice organique (FACMO)".

### DYZE DESIGN

Dyze Design is a Montreal-based SME active in the design and fabrication of various 3D printer components (e.g., hotends, extruders, nozzles), upgrades and accessories. Their high-flow printing heads such as Pulsar™ and Typhoon™ are becoming more and more popular for rapid printing of large structures ([www.dyzedesign.com](http://www.dyzedesign.com)).

## ORS INC.

ORS Inc. develops advanced 3D visualization and analysis software for today's most demanding 2D/3D/4D imaging studies, including data from correlative and hyperspectral imaging systems, X-ray, SEM, confocal microscopy, and other advanced applications. Potential customers that use ORS's software are based in the US, Canada, Europe and Asia, which includes all manufacturers of composites. The company's main products, the software Dragonfly and Dragonfly Cloud, provide innovators from leading universities or industries, an advanced machine learning and neural networks-based segmentation engine ([www.theobjects.com/dragonfly/index.html](http://www.theobjects.com/dragonfly/index.html)).

## ABOUT POLYTECHNIQUE MONTREAL

Polytechnique Montréal is an internationally renowned engineering university. Located in the heart of Montréal on Mount Royal, it is renowned for the high quality of the training offered at all levels, and for its multidisciplinary and multisectoral research. Approaching its 150th anniversary, it now welcomes more than 10,000 students and relies on the expertise of nearly 1,600 staff members with diverse skills, including more than 300 professors.

Polytechnique is known for its innovative approach and its active role in technological, economic, and social development. Having received the Parity Certification from Women in Governance, it offers excellent working conditions, focusing on work-life balance and the well-being of its community.

The bilingual (French, English) city of Montreal is often considered one of the best cities to live for students. It is a diverse and multicultural city and a vibrant cultural hub with a thriving arts, culinary and music scene, as well as a wide array of entertainment options. It hosts numerous festivals throughout the year, such as the Montreal International Jazz Festival and Just for Laughs comedy festival. The city offers a high quality of life. Its extensive network of parks, bike paths, and green spaces make it an attractive place to live.



*Polytechnique Montréal*



*Saint-Lawrence River*



*The Village*



*Festivalgoers*