SMITH ENGINEERING Queen's University — Mechanical and Materials Engineering

# Undergraduate Summer Research Award
# Proposed Projects

*APPLICATION DEADLINE: February 21, 2024 – 11:59 pm*

*Please review the posted summer research projects below. Reach out to the faculty members for more information. Projects are not limited to this list; You are welcome to discuss other projects with faculty members, these are a place to start.*

Dr. Amy Wu (amy.wu@queensu.ca)
Field: Mechatronics and Robotics
Project Title: Competing mechanical costs on the preferred foot-to-ground clearance

Humans prefer to walk with a non-zero foot-to-ground clearance during leg swing. While lifting the foot costs energy, hitting the ground during swing is also costly. The trade-off between the two coupled with the uncertainty of hitting the ground yields a non-zero clearance. It is unclear if the addition of mass at the foot would shift the preferred ground clearance. The goal of this research project is to investigate the energetics and mechanical consequences of added mass at the feet. This project is relevant to lower-limb assistive devices, which either have heavy actuators at the ankle or avoid actuating it. Therefore, in addition to adding mass, there will be a trial that includes immobilization of the ankle with a brace.

The student will perform a gait experiment by asking subjects to walk normally on a treadmill with added mass at the ankle and with the ankle brace. Gait energetics, kinematics, and kinetics will be measured and analyzed to determine energy expenditure and related changes in joint power and work. Pilot testing for this project was initiated by a previous undergraduate student but never completed due to the COVID-19 lab closures.

Dr. Amy Wu (amy.wu@queensu.ca)
Field: Mechatronics and Robotics
Project Title: Help me… or not. Human response to robots during joint collaborative tasks

People's responses to robots in personal and public spaces can range widely, from welcoming them to rapid rejection. Robot presence also has the potential to either support or disrupt the social dynamics within our communities. We seek to understand which factors or stressors will provoke the spectrum of affectionate to abusive behavior by humans on robots. This project probes human-robot relationships within dynamic social environments to understand the impact of robots on humans during cooperative tasks. The broad research objectives are to identify the (1) morphological robot features, like size and weight, (2) behavioral robot features, such as appropriate or inappropriate functionality, and (3) interaction of morphological and behavioral factors that elicit positive or negative social interactions and physiological reactions in humans in stressful or calm situations.

The student will design and carry out an experiment to address one (or a subset) of the three research objectives. They will learn to use a commercially available robot platform, such as a NAO robot, and will program the robot to perform a suitable collaborative task. The student will learn to use physiological sensors, and the use of motion capture to measure human movement. Time permitting, they will also learn data analysis techniques for analyzing physiological data.

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Dr. Brad Diak (brad.diak@queensu.ca), Dr. Diane Wowk (diane.wowk@rmc.ca),
Dr. Keith Pilkey (keith.pilkey@queensu.ca)
Field: Solid Mechanics, Heat Transfer and FEM
Project Title: Structural-thermal FEM modelling and experimental analysis of an in-service pipeline repair technology

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Dr. Brian Surgenor (brian.surgenor@queensu.ca)
Field: Mechatronics and Manufacturing

Project Title: Adaptive and non-adaptive navigation control

Autonomous driving has become an area of focus for many automotive companies. Research efforts are advancing in multiple areas needed to make autonomous driving a reality, including perception, mapping, planning and control.

This project sets out to continue work from the Summer of 2023 on the topic of exploring adaptive and non-adaptive navigation control systems with Quanser's QCar. The QCar is an open-architecture, scaled model vehicle equipped with a range of sensors including LiDAR and five cameras, together with a NVIDIA Jetson Tx2 computer.

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Dr. Claire Davies (claire.davies@queensu.ca)
Field: Biomechanics and Assistive Technology
Project Title: Participation requires communication: Developing accessible communication devices

High-tech communication devices have been designed to improve the lives of persons with disabilities. However, there is little evidence that these systems are effective for the intended population of users. There has been a move towards more sophisticated means of interpreting intent using these systems, but many engineers neglect to consult the client throughout the design of the device, leading to preconfigured signal processing systems that do not account for neurophysiological differences among populations. Issues with current systems include trade-offs among accuracy, speed, and degrees of freedom for task selection leading to fatigue when attempting to maintain attention and control. Minimizing these issues with hybrid systems that detect fatigue and switch modalities (between EEG, eye-tracking, and physiological signals) would be game-changing. There is a need for systems that learn and adapt to the user through simplified search and match task parameters (interfaces that are easily personalized), and dynamic dwell time algorithms. Our lab seeks to design systems that learn and adapt to the user.
This project will complement the work of a PhD student and involves the co-design of a device to identify emotions based on physiological signals and the design of an interface that conveys emotion from the user to communication partners. The protocol for data collection is established with data collected from 26 individuals with no disabilities and eight individuals with cerebral palsy, the analysis techniques are currently underway, and we are now moving towards ensuring that we can develop a device that is usable by our clients.
The tasks of the USRA will include the evaluation of eye-trackers that are reliable and efficient when detecting pupil features (size, movement etc) and choosing one that is relatively inexpensive, is compatible with either an iPad or other tablet, and can provide real-time feedback to the user of the device. Once the system has been identified and tested, an interface can be developed and co-designed with our clients. In

addition, the USRA will assist in the collection of data from eye-tracking results of persons with disabilities, perform extraction of features from the eye gaze signals including artifact removal, identification of pupil dilation, blink rate, fixation time, saccade duration etc. and validate the testing relative to a dataset of typically developed youth.

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Dr. Heidi-Lynn Ploeg (heidi.ploeg@queensu.ca)
Field: Biomechanics
Project Title: Bone Integrity for a lifetime through mechanical loading

Over half a billion people worldwide are affected by musculoskeletal disorders which dramatically diminish functional independence. The next generation of technologies for the assessment, intervention and treatment for skeletal integrity will be specific to the individual and designed to optimise their outcomes. The long term goal of the proposed research program is to provide a scientific basis for the maintenance of bone integrity over a person's lifetime by improving the understanding of bone mechanics and its adaptive response. The integration of emerging technologies, computer simulation, and tissue biology provide a unique approach to unlock the processes responsible for bone adaptation.
Skills learned will include biosafety lab skills, 3D printing, materials testing, finite element analysis, working in inclusive and multidisciplinary environment

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Dr. Il Yong Kim (kimiy@queensu.ca)
Field: Systems Design
Project Title: SMSD Summer Researcher in aerospace and automotive design and DfAM (design for additive manufacturing)

Successful candidates will work on one or multiple of the below projects during the summer, and there will be plenty of opportunities to get involved in work with industry as well as develop hands-on skills with physical testing.
Current SMSD Projects:

- Train a machine learning model to predict the net force acting on a body immersed in an external flow, using supervised learning. The training data for the model will be obtained by performing CFD simulations on a variety of arbitrary bodies. The summer student will assist in performing these simulations and post-processing the results for the training database.
- Perform physical testing of Carbon Fiber Reinforced Polymers (CFRP) and Fiber Reinforced Additive Manufacturing (FRAM)
- Learn and practice using industry-standard code storage and management software using SMSD's recommended practices. Propose and implement improvements to SMSD's recommended practices and provide instruction to SMSD members on how to best use the software storage and management software for in-house codes.

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Dr. Jackson Crane (jackson.crane@queensu.ca)
Field: Thermodynamics
Project Title: Detonation testing apparatus development

Up to 2 students can work on this project.
A new class of engines is poised to disrupt the aviation and rocket propulsion sectors, with theoretical efficiencies 40% higher than the state-of-the-art. These engines, called detonation engines, use shock waves to efficiently compress fuel. Despite intense international research efforts, development engines are not achieving the performance theoretically predicted, in part due to detonation instabilities. This project is to develop and qualify a new experimental testing apparatus designed to measure and control detonation instabilities. Students will work with high-speed diagnostics, optical techniques such as Schlieren visualization, and gas handling. This project is primarily experimental in nature.
Student duties:

- Install and qualify data acquisition and instrumentation
- Design parts for manufacture for apparatus
- Develop and implement test plans
- Develop codes in LabView and/or MATLAB to operate and trigger instrumentation and collect data
- Post-process data to make conclusions

Dr. Jackson Crane (jackson.crane@queensu.ca)
Field: Thermodynamics
Project Title: Detonation data reconstruction

This project is well-suited for 1 student.

A new class of engines is poised to disrupt the aviation and rocket propulsion sectors, with theoretical efficiencies 40% higher than the state-of-the-art. These engines, called detonation engines, use shock waves to efficiently compress fuel. Despite intense international research efforts, development engines are not achieving the performance theoretically predicted, in part due to detonation instabilities. We have access to some of the highest quality simulations ever produced to investigate detonation instabilities. One major challenge associated with these simulations, however, is the massive size of the datasets (many terabytes). This project is to understand how feasible it is to reconstruct datasets using subsets of the data using interpolation and machine learning techniques. This project is primarily computational in nature.

Student duties:

- Work with massive datasets
- Develop codes in Python and/or MATLAB to process and visualize data
- Use leading interpolation and machine learning techniques to reconstruct data, quantifying inaccuracies associated with reconstruction

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Dr. Levente Balogh (levente.balogh@queensu.ca)
Field: Computational Materials Science
Project Title: Design and write a software for the analysis of X-ray diffraction data of twinned Ti, Mg, Zr alloys

The student's task is to write software which implements the physics of X-ray scattering on metals which have hexagonal crystal structures and contain twin boundaries. Twinning is one of the main modes of plastic deformation of hexagonal metals/alloys, such as Ti, Zr, Mg, which are important structural materials in the automotive, aerospace and nuclear industries. The physics of X-ray scattering on twinned hexagonal materials is known, the task of the student will be to learn about the topic so that they can apply that knowledge for the coding-based project. The goal is to write a collection of scripts which will create parameter files describing the effect of twinning on the X-ray scattering patterns of any hexagonal metal of choice. The parameter files are a required input to the well-established Convolutional Multiple Whole Profile (CMWP) modeling software to combine the effect of twinning with other microstructural features present in metals (grain size, dislocation structures) on X-ray scattering. Given that the project is coding-based, it can be conducted remotely in case of exceptional circumstances.

The main task of the student will be to write the Python-based code of the software which will create the parameter files for CMWP. To work on the project the student will build on their knowledge of Python coding from 2nd year and will have the opportunity of significantly to deepen that knowledge through the course of this internship.
Expected quality of the training to be received: The student will learn about the theoretical basics of crystallography and X-ray diffraction (XRD) techniques. They will also have the opportunity to visit the X-ray laboratory and if possible, use the instrument to collect data. The student will be encouraged to discuss with Dr. Balogh's group, as a couple of HQPs are well-versed in coding. The student will be interacting with Dr. Balogh's group consisting of HQPs from different walks of life, which will enrich their internship experience.

Dr. Laurent Béland (Laurent.beland@queensu.ca)
Field: Computational Materials Science
Project Title: Atom-scale computer simulations of hydrogen-dislocation interaction in copper.

Copper produced by electrodeposition can contain large amounts of hydrogen. Curiously, hydrogen-containing copper seems to be more brittle than non-hydrogen-containing copper, but only at low strain rates. In the context of a project with the Nuclear Waste Management Organization of Canada, the student will study how hydrogren affects the movement of dislocations in copper. He/she/they will be working in tandem with a postdoctoral fellow.

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| Dr. Laurent Béland (Laurent.beland@queensu.ca)<br>Field: Computational Materials Science<br>Project Title: Optimizing CO2 to plastic conversion using atom-scale computer simulations<br><br>We are interested in transforming captured CO2 into plastics. In the context of a project involving Ontario-based start-ups and Dow Chemicals, the student will assist a postdoctoral fellow in understanding how CO2 can transform into ethylene molecules on top of a metallic catalyst. |
| Dr. Laurent Béland (Laurent.beland@queensu.ca)<br>Field: Computational Materials Science<br>Project Title: Study the interaction of radiation-induced defect clusters in zirconium<br><br>Zirconium is a widely used material used in the nuclear industry. The student would use molecular dynamics simulations (atom-scale computer simulations) to understand how radiation-induced defect clusters would behave in zirconium inside a nuclear reactor. |
| Dr. Laurent Béland (Laurent.beland@queensu.ca)<br>Field: Computational Materials Science<br>Project Title: Train a machine-learning interatomic potential for molten salt nuclear fuels.<br><br>Molten salt nuclear reactors are a next-generation reactor design, with inherent safety and performance benefits. The student would use machine-learning methods to obtain key molten salt fuel characteristics (viscosity, melting point, diffusion coefficients, etc.). |
| Dr. Laurent Béland (Laurent.beland@queensu.ca)<br>Field: Computational Materials Science<br>Project Title: Employing artificial neural networks to automate annotation of transmission electron micrographs<br><br>Annotating features in transmission electron micrographs is a tedious task. The student would automate this task using modern artificial neural network strategies. |
| Dr. Laurent Béland (Laurent.beland@queensu.ca)<br>Field: Computational Materials Science<br>Project Title: Development of accelerated atom-scale dynamics methods<br><br>Traditional atom-scale computer simulation methods, such as molecular dynamics, are typically limited to capturing timescales of tens of nanoseconds. In this project, the student would help improve an alternative method based on transition state theory, which allows to simulate materials over much longer timescales, of the order of seconds or hours. The student would focus on studying the aging of radiation-induced defects that would occur in structural materials to be employed to build small modular reactors. |

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Dr. Lidan You (you.lidan@queensu.ca)
Field: Biomechanics
Project Title: Vibration platform for biomechanical study

High frequency low magnitude vibration (30 Hz to 200 Hz at 0.1 to 0.3 g) has been shown to promote bone health and inhibit cancer bone metastasis. However, the mechanism underlying the cellular response to vibration is unclear. Design and fabricate a vibration platform for the investigation of the vibration's effect on cell function and metabolism.

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Dr. Lidan You (you.lidan@queensu.ca)
Field: Biomechanics
Project title: Cellular level study for understanding mechanical loading's impact on musculoskeletal disorders

Musculoskeletal disorders (MSD) represent a formidable challenge for healthcare systems worldwide. Canada has one of the highest prevalence rates of MSD, with approximately 2.3 million adults annually experiencing an MSD serious enough to limit their normal activities. Furthermore, chronic pain affects one in five Canadians, resulting in a staggering economic burden of up to $60 billion annually in healthcare expenses, lost wages, and taxes.

Despite substantial progress in treating these conditions, numerous critical issues persist, largely stemming from our limited understanding of the intricate cellular and molecular mechanisms at play. Diseases like cancer bone metastasis and arthritis continue to resist comprehensive cures, emphasizing the need for innovative approaches.

We are recruiting summer students to work on in vitro cellular level mechanobiology study in understanding how various mechanical loadings will affect bone cells behavior and how that will affect MSD progression and prevention.

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Dr. Mark Daymond (mark.daymond@queensu.ca)
Field: Nuclear Materials
Project Title: Design, Build and Test Elevated Temperature Sample Changer

The RMTL accelerator at Queen's is an internationally leading state-of-the-art facility allowing irradiation of materials using ions, to emulate the high irradiation conditions found in outer space or inside a nuclear reactor. We work with the nuclear industry and national labs in Canada, the US and Europe. There is a growing need for relatively short irradiations, meaning that we need to develop an experimental facility to enable 'sample changing' to allow multiple samples to be set up and then automatically switched into the irradiation location. As an additional challenge, we need to be able to control the temperature of the samples.

List of duties: The student will work with the existing RMTL team (technical staff, postdocs and graduate students) to determine design requirements, then develop a mechanical and control system to enable switching of samples into and out of the accelerator beam. Working with the RMTL technical staff they will build, and test the system first using our off-line testing station, and then if time allows on the accelerator itself. Comfort with design processes and CAD software is required. Experience of controlling actuators and temperature systems would be beneficial.

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Dr. Mark Daymond (mark.daymond@queensu.ca)
Field: Nuclear Materials
Project Title: Develop optimized cooling interface materials for accelerator irradiations

The RMTL accelerator at Queen's is an internationally leading state-of-the-art facility allowing irradiation of materials using ions, to emulate the high irradiation conditions found in outer space or inside a nuclear reactor. We work with the nuclear industry and national labs in Canada, the US and Europe. One of the key experimental requirements is to be able to maintain the sample at the correct temperature during irradiations. Heat load from the accelerator beam can be significant. While thermal pastes or liquid metals can be used to improve heat conduction across an interface between sample and mounting block, the optimum paste/metal depends on: the temperature range to be studied; the materials under investigation; the geometry of the sample.

List of duties: The student will work with the existing RMTL team (technical staff, postdocs and graduate students) to select several typical materials of interest to the nuclear industry, and carry out experiments to determine thermal conduction efficiency for different potential interface materials. This will include carrying out tests under thermal cycling conditions: thermal expansion/contraction can lead to degradation of heat transfer. Examination of the interfaces by microscopy will be carried out to ensure that detrimental chemical reactions (e.g. metal embrittlement) do not occur. The goal is to develop a set of recommended interface materials for different samples and conditions. An interest in hands on experiments is needed! While students will benefit from having taken materials courses in MECH, this is not required for the project.

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Dr. Mike Rainbow (michael.rainbow@queensu.ca)
Field: Biomechanics
Project Title: Exploring Shoulder Movement: A Fundamental Analysis of Function Across Sex and Genders

The human shoulder is amazing! It allows us to perform complex tasks over a wide range of torques and speeds. Its unique anatomy makes us the best throwers in the animal kingdom. The shoulder joint is highly complex. There is much to be learned about how it accomplishes its diverse functions. In our lab, we use a combination of medical imaging and motion capture to measure the shoulder joint complex during challenging activities precisely. We then apply various musculoskeletal and shape modelling approaches to reverse engineer the shoulder. This work impacts human health because it can allow us to understand why things go wrong, and it can potentially help clinicians design better treatments to restore healthy function. This work also has implications for Biological Anthropologists trying to reconstruct our history to determine what makes us human.

Technical skills that will be developed: Medical Imaging (dynamic X-ray, computed tomography, MRI), programming, 3D dynamics, Musculoskeletal modelling, learn to work in an interdisciplinary setting.
Check us out: https://skeletalobservationlaboratory.com/

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Dr. Mike Rainbow (michael.rainbow@queensu.ca)
Field: Biomechanics
Project Title: Unravelling Foot and Knee Biomechanics: An Undergraduate Investigation into Joint Morphology and Limb Function

Dr. Qingguo Li (ql3@queensu.ca)
Field: Biomechanics
Project Title: Wearable Sensor-based exo-sensory augmentation for improving posture for healthcare workers

In medical settings using X-Ray, such as cardiac catheterization suites, and orthopaedic operating rooms (ORs), healthcare staff (doctors, nurses, and X-ray technicians) are required to wear heavy lead apron protection equipment and assume stressful postures for long durations of time as part of their work routine, which leads to severe spinal loading and increased risk for musculoskeletal disorders. To mitigate the risk, rigid exoskeletons, robotic devices worn by the user, have been previously considered to redistribute the weight of lead aprons, but the extra weight and bulky structure of these exoskeletons restrict the range of motion and impede dexterity of the operator, hindering the adoption of the exoskeleton technology in clinical settings. Instead of exoskeleton solution, exo-sensory biofeedback based postural adjustment can be a viable option to reduce the musculoskeletal loading for surgeons without disturbing the primary surgery tasks. Currently, an air jet-based feedback system prototype has been developed in our lab, and further improvement and evaluation is necessary.

The summer research assistant will evaluate the performance of different biofeedback methods (tactile feedback, visual feedback, air-jet) based on wearable sensor measurements (inertial sensors) in posture correction. Another task is to miniaturize the air-jet based system and finalize the system for clinical testing in OR and cardiac catheterization suites. The student will work with graduate students and our clinical collaborators at the Sunnybrook Health Science Center in Toronto.

Dr. Qingguo Li (ql3@queensu.ca)
Field: Biomechanics
Project Title: Development of ergonomics analysis and measurement tools for women

The practice of yarn weaving, spun from cotton, contributes to an essential part of the Burkina Faso economy, but the physical demands of the work lead to pain and injuries for its practitioners. Dr. Sawadogo (professor at the Sports Science and Human Development Institute at Université Joseph Ki-Zerbo (UJKZ), Burkina Faso, had completed an ergonomic assessment of the motions as well as a survey that found the injury prevalence within the weaving community. A preliminary study on the benefits of a comprehensive exercise routine was completed and showed that exercise was able to reduce pain of the women weavers.

To further address these issues, the research collaboration between the Queen's University team and UJKZ was developed with support from The Canada Fund for Local Initiatives (CFLI). The primary contribution from the Queen's group was in the design of outdoor exercise equipment that targeted the most important muscles to allow for effective exercise to reduce pain and injury in the weavers. In total, three pieces of equipment were designed, tested, and installed on the campus of UJKZ. Over 30 women weavers have participated an exercise program with the equipment, and preliminary results show the benefit in strengthening the muscles and improving endurance.

To excel the collaboration to the next level, we'd like to recruit a summer research student to develop affordable motion analysis and ergonomics evaluation tools and methods to validate the effectiveness of the exercise equipment and training program. The duties include: 1. Evaluate simple video camera-based markerless motion capture and other machine learning techniques for measuring human movement. 2. Develop low-cost load measurement methods in studying human movement and activities. 3. Work with two visiting graduate students from Burkina Faso and develop documentation and training program.

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Dr. Roshni Rainbow (roshni.rainbow@queensu.ca)
Field: Regenerative Engineering
Project Title: Engineering skeletal muscle

It is increasingly recognized that muscle contractility is correlated to the secretion of various myokines or muscle-derived factors. Our lab is developing novel platforms for the in vitro study the skeletal muscle secretome during electrically stimulated contraction. The student will work under the direction of a graduate student to establish a tissue engineered skeletal muscle model that will be used to further validate these study platforms.

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Dr. Suraj Persaud (suraj.persaud@queensu.ca)
Field: Nuclear Materials
Project Title: Understanding Corrosion in Nuclear Power Systems

The Corrosion Research Group at Queen's University is seeking two undergraduate student candidates to perform research in the general area of corrosion in nuclear power systems. There are several projects available, and students will be given flexibility to select a project based on their interests. Currently, we have the following general projects: Evaluating the corrosion of nickel alloys and stainless steels relevant to CANDU plants in water-based environments, including possible use of 3D printed alloys; corrosion of Cu in sulfide-based environments relevant to nuclear waste storage materials; and corrosion in high temperature molten chloride salt environments relevant to small modular reactors (SMRs) including possibly irradiated materials. Industry sponsors include: Ontario Power Generation (OPG), Bruce Power, Canadian Nuclear Laboratories (CNL), and the Nuclear Waste Management Organization (NWMO). Some general tasks include:

- Performing corrosion experiments in a laboratory setting with a vibrant group of 15 current graduate students and postdoctoral fellows, and a senior research associate to provide ample support.
    - Receive training to use relevant novel equipment for experimental testing.
    - Perform a series of experiments to evaluate materials performance, including basic optical microscopy evaluation.
    - There could be an opportunity to participate in additional microscopic evaluation using electron microscopy methods.
- Collaborate closely with a senior lab member on their project who will act as an additional day-to-day mentor.

- Interact with industry sponsors at weekly corrosion group meetings and/or at technical advisory meetings, at least 1 of which is hosted during the summer term.

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Dr. Xian Wang (xian.wang@queensu.ca)
Field: Mechatronics and Robotics

Project Title: Develop of the Ferrofluid Microrobots for Tumor Mechanical Measurement
Robots at the micro/nanoscale, termed micro/nanorobots, have the advantages of accessing small and hard-to-read spaces within the human body. Our research group focuses on the development of microrobotic systems for understanding tumor mechanics and for developing novel tumor treatment approaches. In this project, a ferrofluid-based magnetic microrobot system will be developed to perform measurements inside healthy tissue and tumor tissue. The mechanical measurement results will help better understand the differences between healthy tissue and tumor tissue in terms of their mechanics. This research project will involve topics including robotic systems, computer vision, instrumentation, and basic mechanobiology.

The student will work with graduate students to design a system that can (1) generate a magnetic field required to control the force generated by ferrofluid; (2) cooperate with feedback control capability for performing the mechanical measurement, and (3) integrate a magnetic field model built in ANSYS into the magnetic field system for performing the mechanical measurement. The student will receive training in basic lab equipment and common engineering software. The student will learn technical skills in finite element simulation, magnetic field control, and basic mechanobiology. The student will work together with the graduate students and the supervisor to finish a conference paper for submission at the end of the research project. We are committed to creating an inclusive, welcoming, and collaborative environment for everyone. The priority of our lab is to realize the best potential and to foster career development for every member.

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Dr. Yong Jun Lai (lai@queensu.ca)
Field: MEMS, Design and Manufacturing
Project Title: Wearable sensors for glaucoma intraocular pressure monitoring

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Dr. Yong Jun Lai (lai@queensu.ca)
Field: MEMS, Design and Manufacturing
Project Title: Energy harvesting and wireless sensing network for machine condition monitoring

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Dr. Zhongwen Yao (yaoz@queensu.ca)
Field: Nuclear Materials
Project Title: Protective coating technology for innovative nuclear systems of Small Modular Reactors.