

GRADUATE STUDIES

ELECTRICAL ENGINEERING

The Department of Electrical Engineering (DGE) at Polytechnique Montréal offers a most stimulating environment for graduate studies in research. Its principal goal is to train highly qualified professionals. More than 600 students of all levels are currently enrolled, with close to a third studying at the graduate level. These graduate students, under the supervision of some 40 professors, participate in research projects in leading-edge fields, in partnership with dynamic local industrial partners.

RESEARCH AREAS

Automation and systems

Mechatronics and aerospace systems (robotics, drones, avionics), complex systems (electrical and telecommunications networks, manufacturing and biomedical systems), advanced control techniques (robust, nonlinear and optimal control, stochastic and distributed parameters systems). industrial informatics (Embedded and real-time systems, networking), emerging application areas: Smart Grid, cyber-physical systems, internet of things.

Biomedical

Brain Machine interface; Lab-on-chip diagnosis; sensor networks; electrical impedance tomography (real-time lung-perfusion monitoring); elastography (technology for imaging the elasticity of tissue for detection of certain types of tumour); automated muscle activity analysis (for identification of patients at risk for strokes); development of new methods for tomography image analysis, and development of new diagnostic and treatment methods (cardiac arrhythmia).

Electrical energy and power systems

Simulation, analysis and optimization of power systems (off-line and real-time), high performance numerical methods, power system software, modeling and analysis of wind farms, cables and transmission lines, and electric machines and drives, electromagnetic and electromechanical transients, transmission and distribution networks, smart grid concept and load management, computation techniques for electromagnetic fields, design of electrical equipment based on innovative materials, characterization and modeling of superconducting, ferromagnetic and composite materials, high power experiments on power devices (transformers, fault current limiters), simulation and optimization of aircraft power systems.

Microelectronics

Architecture of integrated circuits and systems; reconfigurable systems and rapid prototyping; embedded systems; systems on chips (SoCs); neural networks and adaptable machines; integrated-circuit modelling, simulation and synthesis; design methods for lowpower, high-speed circuits for wireless systems and data-conversion applications; design and production of optical interfaces; testing and verification; performance and fault modeling; biomedical circuits and systems.

Microwaves

Design and realization of passive and active microwave components and circuits, millimetre-wave and radiofrequency (RF) for telecommunication materials and wireless sensors: microwave circuits with MIC, MHMIC, MMIC and LTCC technologies, transmitters, receivers, amplifiers, antennas, metamaterials, characterization of materials (permittivity, permeability). Bragg's networks on fibre-optic, electromagnetic modelling, energetic applications in microwaves.

Telecommunications

Wired and wireless communication system, Internet, digital transmission, advanced OFDM modulation, multiple-access techniques, MIMO systems and space-time coding, error-correction techniques, iterative and turbo decoding, propagation and channel modelling, wireless systems; mobile wireless networks; network architecture, design and performance, energy efficiency in communication networks, green networking, applications of transforms for spectral analysis and digital signal processing, high-speed parallel processors for signal and image processing, radiolocation systems for internal and external environments.



INDUSTRY PARTNERS

Canadian Space Agency, Bell Helicopter, Bombardier, Bombardier Aerospace, Cartier énergie, Centre de recherche industrielle du Québec (CRIQ), CYME international, Clarovita, Teledyne DALSA, Électricité de France (EDF), EMS Technologies, EPRI, Ericsson, Hydro-Québec/IREQ, Mitec Telecom, Moloney Electric, OPALRT, PMC-Sierra, Pratt and Whitney Canada, Powersys, Repower Systems, Réseau de Transport d'Électricité (RTE), Rogers Wireless, Scanview, STM, Schneider Electric, Thales, Télémédic, Transformateurs Marcus, Victhom.

CENTRES, CHAIRS AND RESEARCH GROUPS

Centre for Advanced Research in Microwave and Space Electronics (POLY-GRAMES)

POLY-GRAMES target science and technologies necessary for circuit design, artificial materials, antennas, components and systems making use of microwave, millimeter wave and terahertz signals. Poly-Grames is one of the world's largest academic centers for radiofrequencies.

Centre for Radiofrequency Electronics Research (CREER)

This centre is affiliated with 13 institutions operating in various expanding sectors (radiofrequency technology to terahertz). The projects and scientific activities are organized around five main themes : theory, simulation and electromagnetic modeling, remote sensing and sensors, antennas, devices and radio frequency components and systems, natural and synthetic materials.

Canada Research Chair in Electromagnetic Metamaterials

This chair conducts research in various theoretical, computational and technological aspects of electromagnetic metamaterials and their radiofrequency (RF) applications. It develops a new generation of multi-scale metamaterials with unprecedented control of the bianisotropic and dispersive, classical and quantum, properties of artificial matter and applies these concepts in groundbreaking devices and systems, which will contribute to shaping the landscape of tomorrow's RF electronics.

Canada Research Chair in Quantitative Magnetic Resonance Imaging

The aim of this chair is to develop innovative methods, ranging from high-performance MRI coils to improve image quality, to image analysis algorithms using deep learning, to automate the analysis of the data (for example, automatic tumor detection). This work is done in close collaboration with clinicians.

Canada Research Chair in Vascular Optical Imaging

This research chair aims to develop new imaging techniques combining optics and other modalities with the goal of investigating the vascular network and its change with disease. Our work combines modeling of the vascular network with novel molecular probes to better understand how oxygen is delivered to the brain and how blood flow pulsatility modulates neurovascular function.

CRSNG/Huawei Future Wireless Chair (FuWiC)

This Future Wireless Chair strives to answer the core challenges and demands in much-discussed 5G and future wireless systems with focus on radiofrequency (RF) and millimeter-wave (mmW) technologies and architectures. Its program proposes, studies and demonstrates a set of innovative and scalable solutions through theoretical and experimental investigations.

Industrial Research Chair on Multi Time-Frame Simulation of Transients for Large-Scale Power Systems

The mission of the Chair is to contribute to the establishment of a new generation of numerical methods and mathematical models, for the hyper-performing and highly precise simulation of transients in large electric power transmission networks. This research aims at the development of more reliable and more efficient electrical energy networks.

Microelectronics Research Group (GR²M)

This group's research explores design and testing methods for high-performance very large scale integrated circuits as well as CAD tools development.

Microelectronics Strategic Alliance of Québec (ReSMiQ)

This centre promotes growth of industrial innovation and development of new avant-garde technologies in multiple fields of application: telecommunications, biomedicine, optical interfaces, CAD methodologies, as well as multimedia communications and transmission.

INFORMATION

Electrical Engineering Department

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polymtl.ca/ge (in French only)

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