Mathematics and Engineering

Discipline Night Session

JANUARY 21, 2026

Welcome!

Tonight's Agenda:

1. Program presentation by Professor Serdar Yüksel
   MTHE Program Chair

2. Alumni speaker: **Daniel David**

3. Remarks from student volunteers

4. Question/answer session

5. Refreshments and informal discussion
   with professors and upper-year students

Why Mathematics and Engineering (MTHE / Apple Math)?

- The **Mathematics and Engineering (MTHE)** program (also known as **Apple Math**) is a rigorous engineering program that provides a unique blend of **engineering** and **applied mathematics**.

- The **MTHE Program** graduated its first class in 1967. It was initiated in response to the understanding that there exists in the modern Engineering environment a need for practitioners having the tools and techniques of an Applied Mathematician along with the background and problem solving skills of an excellent Engineer.

- The **Mathematics and Engineering** program has been **accredited** by the Canadian Engineering Accreditation Board (CEAB) since 1974.

- The **Mathematics and Engineering** program is a unique program of its kind in North America because it is **offered by a mathematics department** and is an **accredited program**, thus merging mathematical rigor with engineering creativity and insight.

Why Mathematics and Engineering (Apple Math)?

DEFINITION OF ENGINEERING*: *The application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems.*

(*) American Heritage Dictionary of the English Language, Fifth Edition, 2016

- The **main goal** of Engineering is to harness physical and dynamical processes and phenomena for the benefit of people.

- **Modelling** these processes and phenomena can only be done using the language and concepts of Mathematics.

- **Understanding, analyzing, and designing** these processes and phenomena can only be done using the tools of Mathematics.

Program Structure

The Mathematics and Engineering program consists of **3 options**:

- **Applied Mechanics** (M6), preparing for applied and research careers in aerospace engineering, mechanical engineering, biomechanics, biomedical, computational fluid dynamics, control engineering...

- **Computing and Communications** (M9), preparing for applied and research careers in software engineering, data science, data analytics, signal processing, cryptography, networks, information and communications engineering, machine learning...

- **Systems and Robotics** (M11), preparing for applied and research careers in artificial intelligence, control engineering, systems engineering, operations research, financial mathematics, robotics, mechatronics, machine learning ...

Basic Description of Curriculum

In **years two and three** of their studies, our students take about half of their courses in the Department of Mathematics and Statistics as MTHE courses, and the other half in other Engineering Departments (depending on the option).

In **year four** of their studies, our students benefit from:

- **Advanced mathematics and engineering courses in the frontiers of knowledge** in their areas of specialization

- A **professional development** and **seminar course** in which students also reflect on societal impacts of the profession and interact with Apple Math alumni

- **Challenging engineering design projects** which prepare for industrial and academic research

Common MTHE Core Courses for all options

MTHE 212	Linear Algebra
MTHE 217	Algebraic Structures
MTHE 237	Differential Equations for Engineering Science
MTHE 280	Advanced Calculus
MTHE 281	Introduction To Real Analysis
MTHE 326	Functions of a Complex Variable
MTHE 328	Real Analysis
MTHE 335	Mathematics of Engineering Systems
MTHE 351	Probability I
APSC 200	Engineering Design & Practice II
APSC 293	Engineering Communications
MTHE 393	Engineering Design and Practice for Mathematics and Engineering
MTHE 493	Engineering Mathematics Project
MTHE 494	Professional Development and Responsible Engineering

Courses with significant content in **Engineering Science** and **Engineering Design**

M6 Applied Mechanics Additional Core Courses

MECH 221	Solid Mechanics I
MECH 210	Electronic Circuits and Motors for Mechatronics
MREN 230	Thermodynamics and Heat Transfer
MREN 241	Fluid Mechanics and Fluid Power
ENPH 225	Mechanics
MECH 321	Solid Mechanics II
MECH 328	Dynamics And Vibration
MECH 330	Applied Thermodynamics II
MECH 398	Mechanical Engineering Laboratory I
MECH 323	Machine Design I
MECH 341	Fluid Mechanics II
MECH 399	Mechanical Eng Lab II
MTHE 430	Control Theory
MTHE 433	Continuum Mechanics with Applications

Additionally,
4 Technical and 3
Complementary Studies Electives

M9 Computing and Communications Additional Core Courses

CMPE 212	Introduction to Computing Science II
ELEC 271	Digital Systems
ELEC 274	Computer Architecture
ELEC 278	Fundamentals Of Information Structures
ENPH 239	Eng. Electricity & Magnetism
CMPE 320	Fundamentals of Software Development
CMPE 332	Database Management Systems
CMPE 365	Algorithms I
ELEC 371	Microprocessor Interfacing and Embedded Systems
ENPH 334	Electronics For Applied Scientists
MTHE 353	Probability II
MTHE 455	Stochastic Processes & Applications
MTHE 474	Information Theory
MTHE 477	Data Compression and Source Coding: Theory and Algorithms

Additionally,

4 Technical and 3 Complementary Studies Electives

M11 Systems and Robotics Additional Core Courses

ELEC 221   Electric Circuits

ELEC 271   Digital Systems

ELEC 274   Computer Architecture

ELEC 278   Fundamentals of Information Structures

ENPH 225   Mechanics

ENPH 239   Eng. Electricity & Magnetism

ENPH 334   Electronics For Applied Scientists

MREN 348   Introduction to Robotics

ELEC 371   Microprocessor Interfacing and Embedded Systems

MTHE 337   Introduction to Operations Research

MTHE 353   Probability II

MTHE 430   Control Theory

MTHE 472   Optimization and Control of Stochastic Systems

MTHE 474   Information Theory

**Additionally,
4 Technical and 3 Complementary
Studies Electives**

Technical Electives (List I – MTHE-MATH Electives)

MTHE 406	Introduction to Coding Theory
MTHE 418	Number Theory & Cryptography
MTHE 430	Control Theory [core M6 and M11]
MTHE 433	Continuum Mechanics with Applications [core M6]
MTHE 434	Optimization Theory with Applications to Machine Learning
MTHE 436	Partial Differential Equations
MTHE 418	Number Theory & Cryptography
MTHE 455	Stochastic Processes & Applications [core M9]
MTHE 457	Statistical Learning
MTHE 472	Optimization & Control of Stochastic Systems [core M11]
MTHE 474	Information Theory [core M9 and M11]
MTHE 477	Data Compression and Source Coding: Theory & Algorithms [core M9]
MTHE 487	Stochastic Calculus with Applications to Mathematical Finance
MTHE 499	Undergraduate Research in Mathematics and Engineering

We continuously revise and update our offerings, requirements, and electives.

Technical Electives (List II – Non-MTHE Electives)

- MECH 346   Heat Transfer
- MECH 420   Vibrations
- MECH 424   Sustainable Product Design
- MECH 435   Internal Combustion Engines
- MECH 439   Turbomachinery
- MECH 441   Fluid Mechanics III
- MECH 444   Computational Fluid Dynamics
- MECH 448   Compressible Fluid Flow
- MECH 455   Computer Integrated Manufacturing
- MECH 480   Airplane Aerodynamics
- MECH 482   Noise Control
- MECH 492   Biological Fluid Dynamics
- MECH 494   Kinematics Of Human Motion
- MECH 495   Ergonomics And Design

- CMPE 434   Distributed Systems
- CMPE 454   Computer Graphics
- CMPE 457   Image Processing & Computer
- ELEC 374   Digital Systems Engineering
- ELEC 377   Operating Systems
- ELEC 422   Digital Signal Processing: Random Models and Applications
- ELEC 421   Digital Signal Processing: Filters and System Design
- ELEC 436   Electric Machines and Control
- ELEC 333   Electric Machines
- ELEC 470   Computer System Architecture
- ELEC 373   Computer Networks
- SOFT 437   Software Performance Analysis
- CMPE 351   Advanced Data Analytics
- MECH 496   Musculoskeletal Biomechanics

- MREN 410   Intelligent Machines and Autonomous Systems
- ELEC 431   Power Electronics
- ELEC 353   Electronics II
- MREN 348/ ELEC 448/MECH 448 Introduction To Robotics
- ELEC 454   Analog Electronics
- ELEC 457   Integrated Circuits and Sys. App
- ELEC 461   Digital Communications
- ELEC 464   Wireless Communications
- ELEC 483   Microwave and RF Circuits
- MECH 452   Mechatronics Engineering
- MINE 472   Mining Systems, Automation, and Robotics
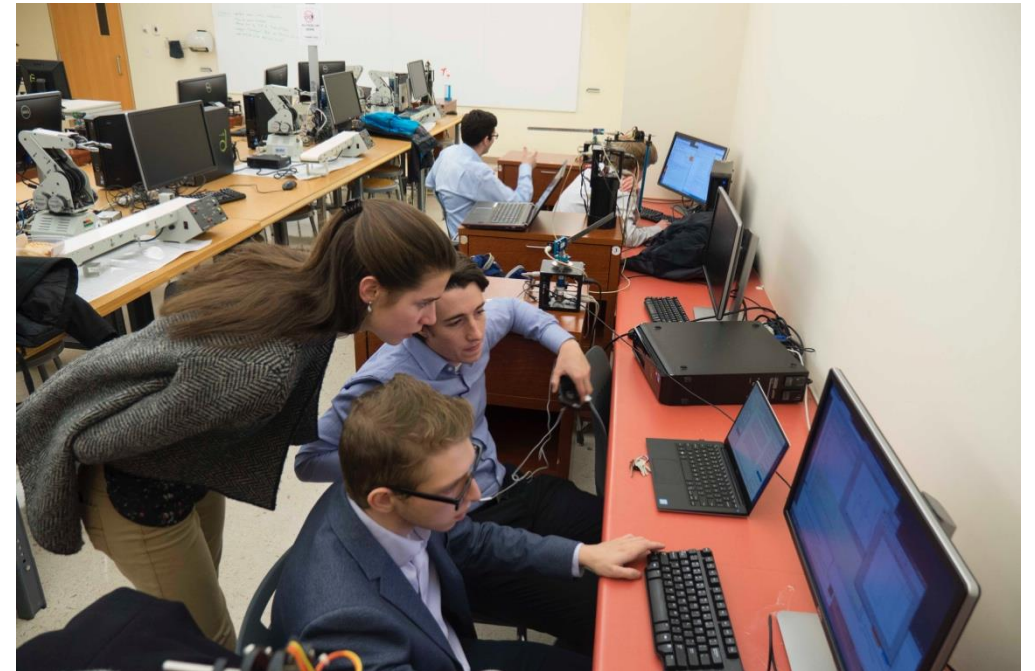- MECH 465   Computer Aided Design
- And many others by approvals

Recent 4th Year Engineering Design Projects

- **Control** of a group of robots

- **Data compression** via nonlinear transform coding using artificial neural networks

- **Energy Capture** from vortex-induced vibrations

- Optimal design of a **vibration energy harvester**

- **Information** bottleneck and **machine learning** algorithms

- **Restoring** degraded music recordings

- Automated **financial** trading via **reinforcement learning**

- Autonomous UAV **control** for underground mines

- **Reinforcement learning** for optimal traffic control

- Generative adversarial networks for **deep learning**

- **Learning** image priors for **image restoration**

- Opinion **dynamics** and **contagion** in social networks

- **Control** of an airfoil in planar flow

- Automated **face recognition**

- Joint source-channel **coding** for deep space **communications**

- **Coding** strategies for **communication** networks

- Design of region merging algorithms for **image segmentation**

- Optimal **control** of the **temperature** in a metal rod

- **Reinforcement learning** for optimal energy production

Mathematics and Engineering (Apple Math) Labs

Used to demonstrate both the power and the limitations of theoretical models
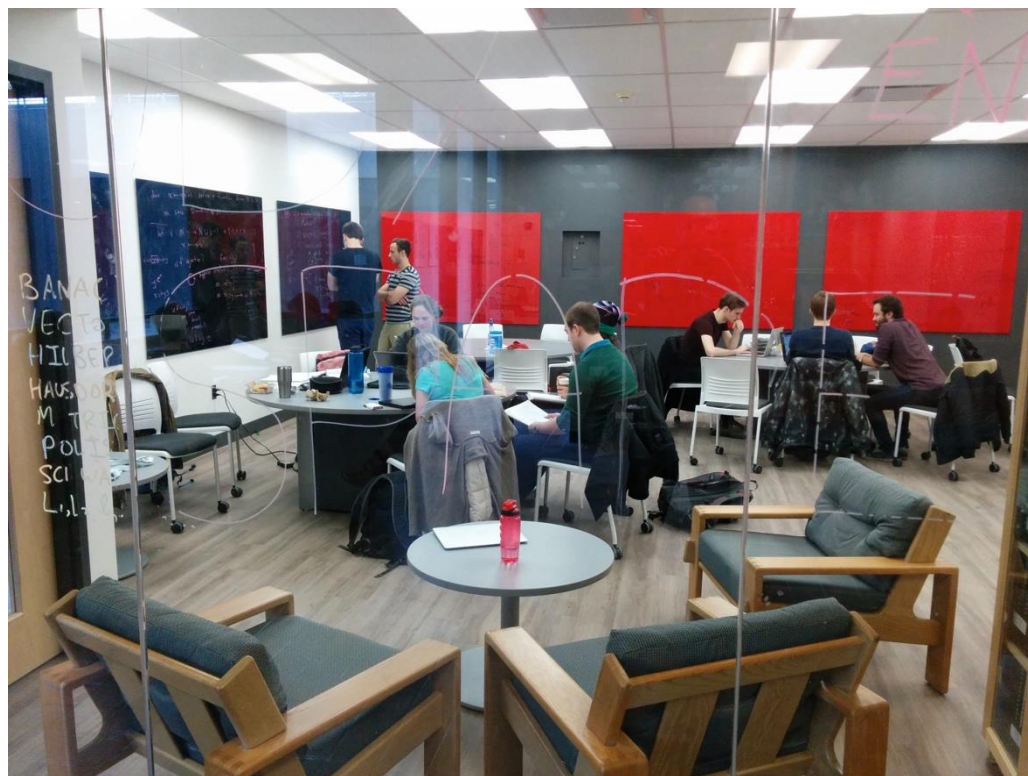

Housed in the Integrated Learning Centre

MTHE 430 (Control Theory) Lab

The Apple Orchard

A Study and Community Area for Mathematics and Engineering Students..

What do you gain by studying Advanced Mathematics alongside Engineering?

- MTHE curriculum allows for **technical depth** so that the **rigorous** nature of program gives our graduates a high quality training prior to entering the workforce or pursuing a research career.

- **Strong and versatile problem solving skills** also lead to careers outside of traditional engineering (finance, management consulting, data science etc.) where such skills are needed.

- The **mathematical maturity** leads to **flexibility, versatility,** and outstanding **problem-solving skills** for further career re-orientation (as areas popular today may not be so in the future, but mathematical foundations will stand the test of time).

Key Findings from the Canadian Engineering Accreditation Board, Accreditation Visit Reports

Queen's Apple Math program:

- Excellent communications and abundant enthusiasm among students, staff, and faculty

- Faculty very strong in research support

- Students of very high quality, and very engaged in their program.

- Students have a strong identification with cohort, undertake many technical and social activities

- **We received full accreditation for another 6 years in July 2025**

The Department of Mathematics and Statistics supports an excellent MTHE program

- The Department of Mathematics & Statistics (MATH) has 30+ excellent professors with world-class research in applied (including engineering) mathematics, pure mathematics, and statistics; and offers an outstanding teaching environment.

- Dedicated faculty members, with Professional Eng. license, oversee the MTHE program, teach courses involving Engineering Science and Design, and regularly and continuously revise and update the curriculum.

- The entire MATH department interacts with MTHE students in a variety of courses and activities (such as Math Club).

- Taking courses side by side with MATH students ensures that, under the guidance of P. Eng. licensed professors, MTHE students are suitably trained in both engineering and mathematics.

Our dedicated staff

Luisa Reyes
MTHE Program Assistant

Priya Rajan
MTHE Program Associate

Apple Math 50th Anniversary Celebration, 2017

Internships in Mathematics and Engineering

Pavle Ilic
Mathematics and Engineering
Quantitative Trading Developer, Scotia Bank

Sample employers who hired students from Mathematics and Engineering (2025)

- Celestica
- Hatch Ltd
- Novari Health
- InDro Robotics
- Scotia Bank
- Calian
- AMD (Advanced Micro Devices)

Example positions:

- Analyst Intern
- Data Engineering student
- Software Developer
- Virtual Reality Design Specialist
- Power Systems Engineer Intern

Selection of recent employers seeking Apple student interns (QUIP)

Company	Job Title	Start Date
General Motors of Canada	Data Science/Statistics - Software Defined Vehicle	2024 Jan
Intel	Physical Layout Design Intern	2024 May
Sanofi Pasteur	Data Logistics and Support	2024 Jan
MHI RJ Aviation Group	Business Intelligence Analyst	2024 May
Hatch Ltd	High Pressure Metallurgy - Mechanical & Piping Student	2024 May
Kinectrics Inc	Project Controls - Bruce Power Project Controls Specialist (Tiverton)	2024 May
Royal Bank of Canada (RBC)	Global Asset Management, Winter Data Specialists	2024 Jan
IBM Canada Ltd	QA/Automation Developer Intern	2024 May
Umicore	Engineering Internship	2024 May
Umicore	Analytical Lab Internship	2024 May
Umicore	Business Internship	2024 May
Geotab Inc	Data Platform Developer Intern	2024 Jan
AMD	Software Engineer Co-op	2024 May
LEA Consulting Ltd.	Electrical Designer (Traffic Signal and Street Lighting)	2024 May
Toronto Hydro	Student - Meter Data Management	2024 Jan
Geotab Inc	Embedded Systems Developer Intern	2024 Jan
Ontario Teachers' Pension Plan	Intern - Analytics Engineer	2024 May
Ontario Power Generation	Engineering Internship Opportunities - Durham & Toronto	2024 May

Selection of employers of recent Apple Math graduates

- **Google**
- **Amazon**
- **Microsoft**
- **OpenAI**
- **Capital One**
- **Facebook / Meta**
- **Airbnb**
- **MDA Space Missions**
- **Tiktok**
- **Instragram**
- **Rogers**
- **Nokia**

- **Toyota Motor Manufacturing, Canada**
- **Bombardier**
- **Hatch**
- **SNC Lavalin Nuclear**
- **Bain & Company**
- **IBM**
- **D-Wave quantum systems**
- **Oliver Wyman**
- **McKinsey**
- **Accenture**
- **Motorola**
- **SickKids Hospital**

Selection of institutions where Apple Math Alumni have recently pursued Graduate Studies

- **Princeton University**

- **Stanford University**

- **Harvard University**

- **Yale University**

- **ETH-Zurich**

- **University of Washington**

- **Georgia Institute of Technology**

- **Oxford University**

- **California Institute of Technology**

- **MIT**

- **University of Michigan**

- **Columbia University**

- **Imperial College, London**

- **Cornell University**

- **University of Edinburgh**

- **Canadian Univs.: Alberta, Queen's, McGill, Toronto, Waterloo**

In 2024, ~25 alumni were enrolled into many top graduate programs such as Oxford (x2), ETH-Zurich, EPFL, CMU, Boston U., U. Toronto (x2), U. Waterloo (x2), Queen's (x5), McGill (x2), UBC (x2)...; to study engineering / computer science / data science / mathematics / neuroscience ...

MTHE Alumni at Queen's and Academia

At Queen's

- M. Green, Professor, **Civil Eng.** and Former Provost at Queen's

- K. Deluzio, Professor, **Mech. Eng.** and Dean (Smith Engineering and Applied Science)

- J. Cartledge, Professor, **ECE**

- K. Rudie, Professor, **ECE**

- J. McLellan, Professor, **Chem. Eng.**

Beyond Queen's: Many MTHE alumni contribute to the Canadian and international research community as professors (in electrical, mechanical, computer, aerospace, biomedical etc. engineering, and as applied mathematics, pure mathematics, computer science, health sciences, medicine etc.) at, e.g., UBC, U. Toronto , U. Waterloo, McMaster U., U. Ottawa, Dalhousie U., Carleton U., U. Laval etc., and Harvard, Columbia, U. California, U. Minnesota, U. Wisconsin, SUNY, CUNY, U. New Hamphsire, U. Miami, U. Hong Kong, etc.

- Note the **diversity of research areas**!

Student Volunteers Tonight & Apple Math Student Activities

Apple Math Discipline Club is very active, organizes several social events, also closely working with faculty (via formal & informal meetings).

Student volunteers present this evening to answer questions on:

- [Apple Math Discipline Club] **President Abby Harlow (3rd Year MTHE Student)**

- [2nd Year] **Grace Bunker, Rosie Wang**

- [3rd Year] **Matei Nitu**

- [4th year] **Lindsay Atkinson, Katherine Justason, Emma McNabney, Viren Tated, Brooke Thomson**

- [Graduate Studies Career Questions] **Spencer Hill, Michael Rhodes-Bliss**

- [Internship Questions] **Pavle Ilic**

- [Extracurricular Activities] **Abby Harlow**

They are happy to answer questions tonight or later.

Meet our Alumnus

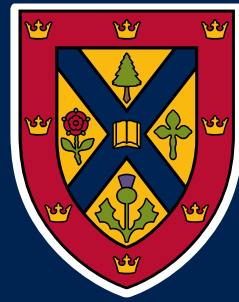**Daniel David** (Apple '24) Graduate Student in Applied Mathematics at Columbia University, New York, USA)