PROGRAM INFORMATION TALK
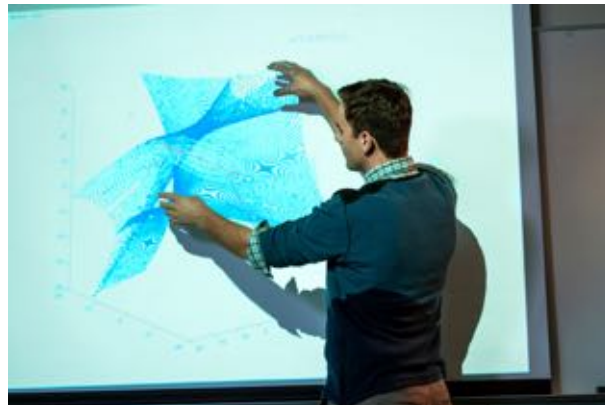
BIOMEDICAL   CIVIL   COMPUTER   ELECTRICAL   MECHANICAL   SOFTWARE

MARCH 8, 2022

CHAT! If you have a question, ask at slido.com!

1 Join at **slido.com** or scan this code
(with your smart phone camera)

2 Slide event code: **ECS**

AFTER THIS - TODAY!

PROGRAM INFORMATION FAIR IN THE ELW LOBBY until 5:30!

PROGRAM BOOTHS
& ACADEMIC ADVISING BOOTHS
… AND PIZZA!

GRAB YOUR PIZZA TICKET ON THE WAY OUT

ENGINEERING PROGRAM INFO: SPEAKERS

Dr. LillAnne Jackson, Host

Associate Dean, Undergraduate

Dr. Chris Dennison

Biomedical Engineering

Dr. Stephen Neville

Software Engineering

Dr. Heather Buckley

Civil Engineering

Dr. Brad Buckham

Mechanical Engineering

Dr. Amirali Baniasadi

Electrical Engineering

Dr. Mihai Sima

Computer Engineering

DECLARING:

https://servicecatalog.engr.uvic.ca/students/declare/

Before April 30:
- ✓ Declare (site above)
- ✓ Return, if needed

Declaration Requires:
- ✓ 2nd year standing
  (12.0 or more units)
- ✓ C+ Average
- ✓ No grades less than C
- ✓ Competitive Average
  (Where required by program)

PROGRAM

Biomedical Engineering:
- A broad and interdisciplinary field: medical/bio-sciences + engineering
- Focus: advancing human health and longevity

Interventional medical devices

Researchers and graduates from the program:
- Bioinstruments and medical devices
- Biomechanics: orthotics, prosthetics, orthopedics and protection equipment
- Biomaterials and tissue engineering
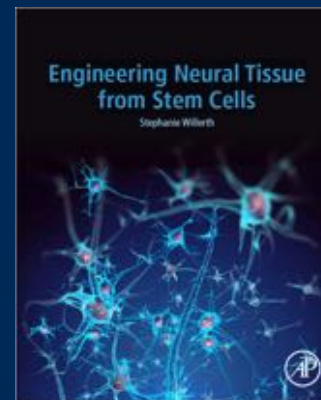- Medical imaging

Biomechanics

Medical imaging

Engineered tissues

Prosthetics – Victoria Hand Project

BIO-INSTRUMENTS

University of Victoria | Biomedical Engineering

Human performance and wearables

Technology to monitor human health, performance or improve health outcomes!

Instruments for patient monitoring

Instruments for surgical intervention

BIOMECHANICS

Repairing, or preventing damage as a result of ageing or accidental injury

Prosthetics

Restore joint/limb function

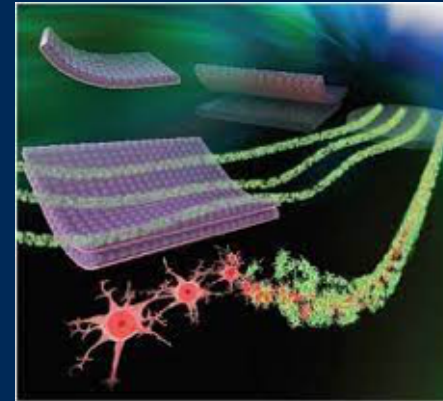

Human protection devices and armour

BIOMATERIALS

University of Victoria | Biomedical Engineering

Materials and replacement tissues for restoring function, drug testing, and tissue replacement

Neural tissue engineering

WILLERTH LABORATORY

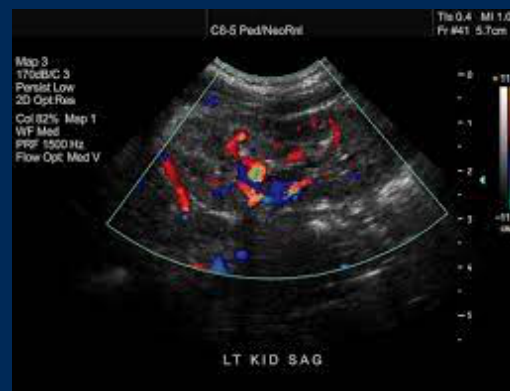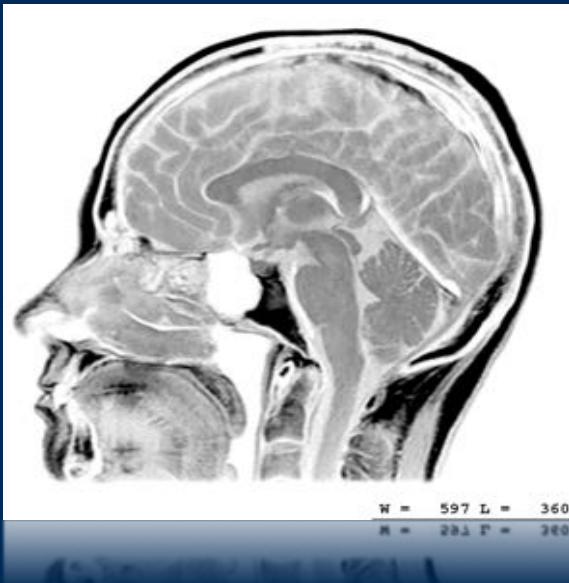Biocompatible synthetics

Replacement tissue

MEDICAL IMAGING

University of Victoria | Biomedical Engineering

Peer inside the body to understand form and function

Imaging function of CNS

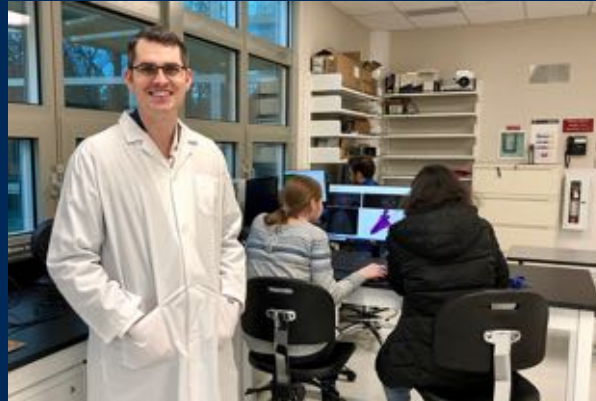Imagery analysis and novel techniques for MR and Ultrasound

TECHNICAL PROJECT & HONORS THESES

Impact biomechanics
Protection Devices

Orthopaedic
Technologies and
Biomechanics!

Electromagnetics
Instrumentation!

MRI Nerve Stimulation

Victoria
Hand Project

BIO X

WILLERTH
LABORATORY

MicroEngineering – LiME Lab!

Prosthetics!

Bioprinting!

BMED (HTTPS://ONLINEACADEMICCOMMUNITY.UVIC.CA/BMED/ABOUT-US/)

PROGRAM

- First accredited program in Western Canada
- Our graduates go on to a variety of opportunities, including medical school, graduate school, and industry
- Currently have ~160 students in the program

https://www.facebook.com/UVicBiomedicalEngineering/

https://twitter.com/biomedicaluvic

@uvicbme

? WHERE TO START, WHO TO ASK ?

Don't hesitate to reach out to me:

Dr. Chris Dennison – Program Director
Ms. Katharine Waring – Program Coordinator

bme.coord@uvic.ca

Civil Engineering

What is
Civil Engineering?

UVIC

Civil Engineering

The Tech that Builds Society

UVIC

Example Courses in Civil Engineering

Core Courses

Surveying and Geomatics Engineering

Sustainable Design of Steel, Timber, and Concrete Structures

Sustainable Water Resources

Environmental Engineering

Environmental Policy

Sustainability in Civil Engineering

Sustainable Transportation Systems

Geotechnical Engineering

Construction and Project Management

Buildings Science

Elective Courses

Earthquake Engineering Structures

Solid Waste, Air and Water Pollution

Green Building Design

Water & Sanitation for Low Resource Contexts

Infrastructure Engineering for Indigenous Communities

Drinking Water Contaminants

Resilient Smart Cities

Building and District Energy Simulation

UVIC

New Building

Hands-on Experience

Lots of jobs for Civil Engineers in BC

...

BC Labour Market 2019-2029 Estimates
2360 graduates, 4190 jobs available

Engineers Canada projects 328 Jobs per year
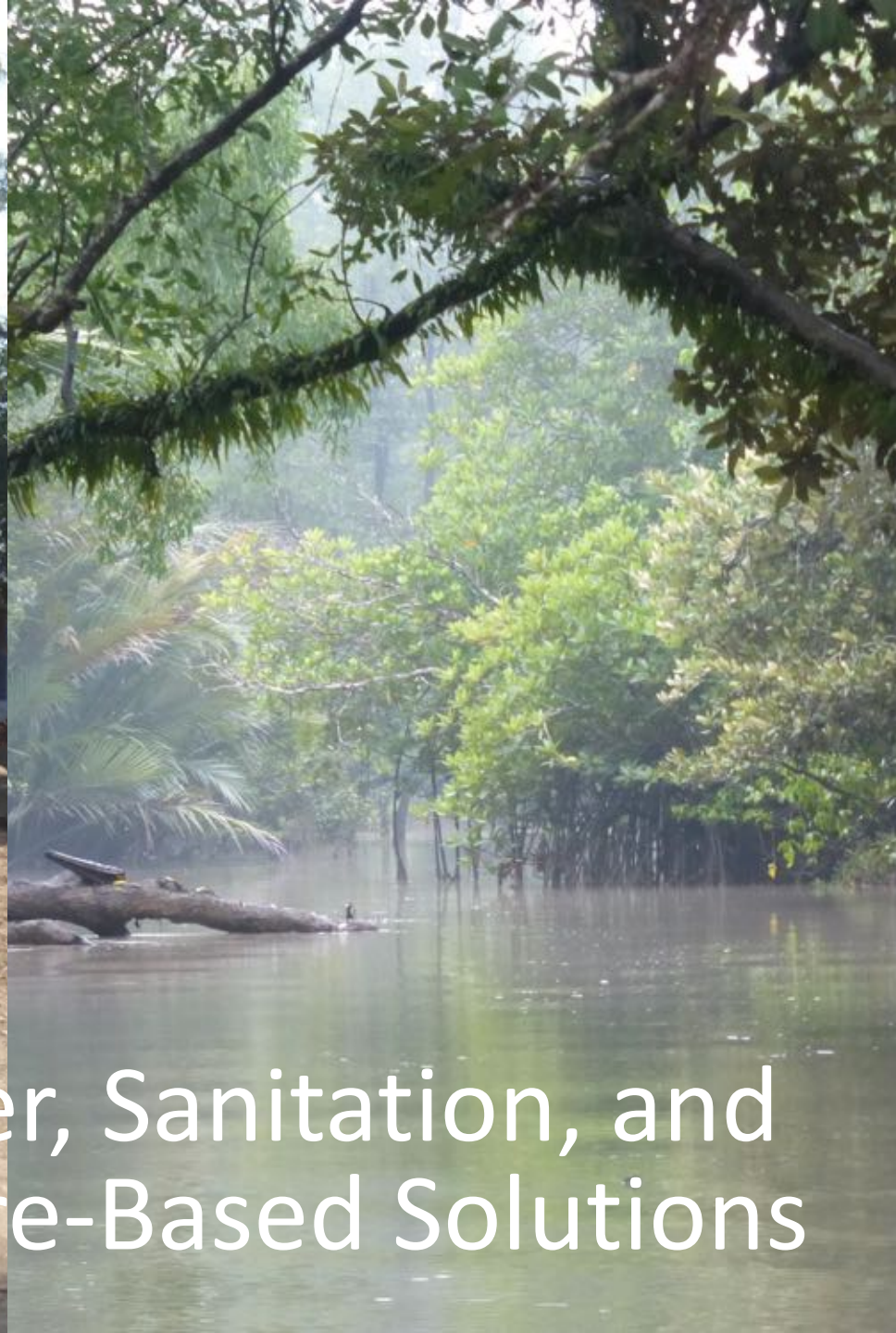
And our graduates
succeed in landing
these!

UVIC

Writing the code for Smart Cities

Water, Sanitation, and Nature-Based Solutions

Photo credits: Heather Buckley, 2015, Atif Rahman, 2017

Civil :
Engineering
for
& with People

UVIC

Photo Credit IACE

Amplifying Opportunities to Support Reconciliation

200 Million People Affected

Engaging with Global Challenges through Design projects and Problem-based Learning
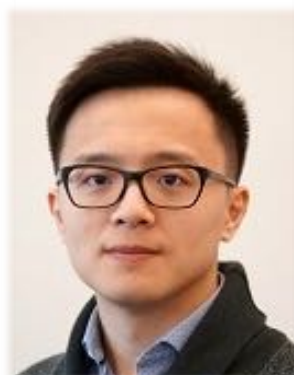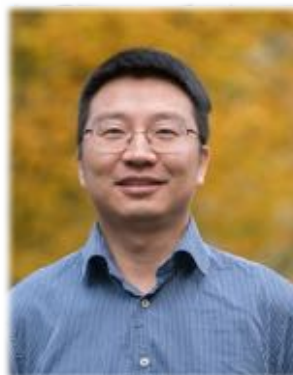
Questions for Potential Engineers:

1. Do you want to provide:
   healthy, safe, and comfortable lives for people?

2. Do you want to:
   minimize our impact on the environment?

3. Do you want to make a:
   positive impact on the world and humanity?

Electrical and Computer Engineers can give a positive answer to these questions.

University of Victoria

What can you do with your Electrical Engineering degree?
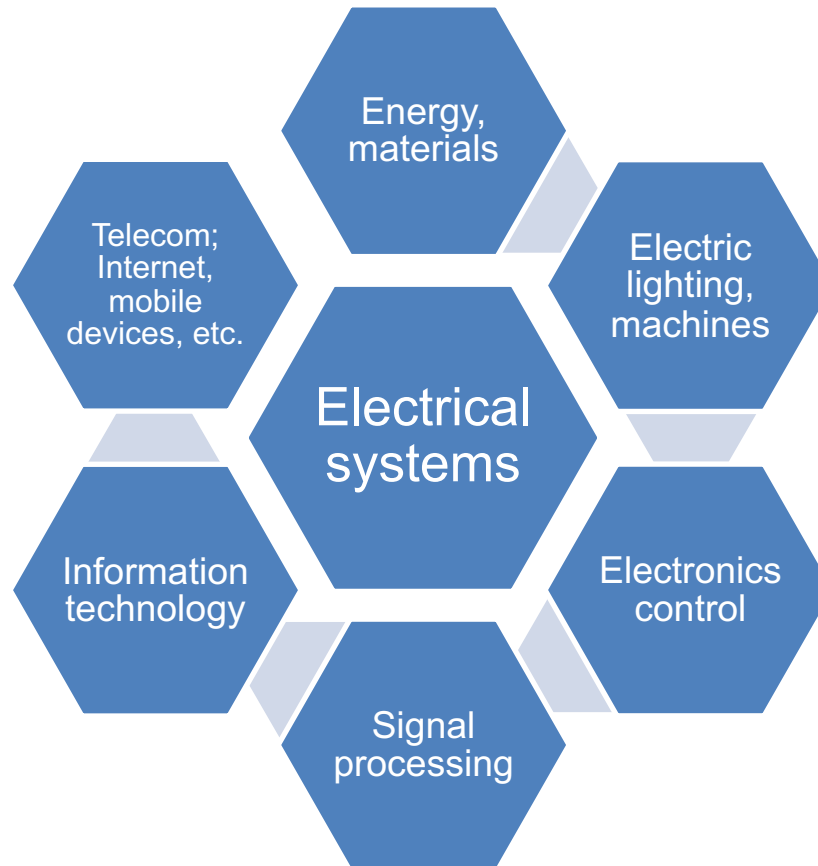
Impact: Make people healthier

We need:

- information about health and impacts of activities.
- new treatments.
- methods to overcome health limitations.

How Electrical Engineers are Impacting Health Care.

Medical robotics:

- Make surgery easier
  - Benefits: smaller incisions, quicker recovery, more precise tools
- Assist people with different abilities

Courses: Automatic Control, Real time programming, Pattern recognition, Materials Science, Human Computer Interface

Medical Imaging

- Diagnose disease
- Low impact imaging technology
- 3D imaging (AR and VR for medicine)

Courses: Digital signal processing, Electromagnetics, Image and video processing, Pattern recognition

University of Victoria

Other Impacts:

- Increase medical independence.
- Automatic drug delivery.

Courses: Networking, Embedded systems, Real-time systems

University of Victoria

Impact: reduce environmental footprint.

We need to:

- Do tasks with less energy, water, space…

- Get better information on energy and resources.

- Get better information on the gases, heat, and other products that they generate.

University of Victoria

Impact: Create better ways to generate/store energy.
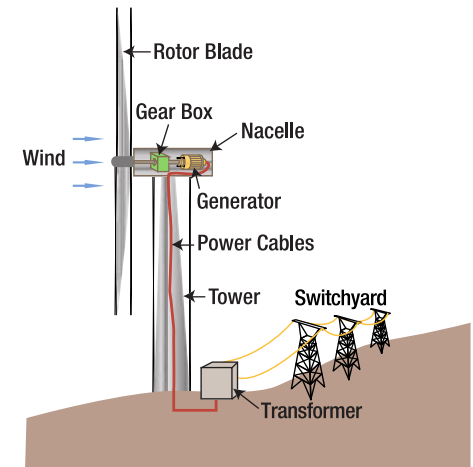
We need:

- Power from solar, wind, low impact hydro, …
- Renewal energy requires complex control schemes.
- Efficient batteries and power transmission.

Courses: Electrical machines, Devices, Materials, Power electronics, Control

University of Victoria

Electromagnetics and Photonics

- Single Molecule sensing
  - More accurate tests with smaller samples
  - Embedded medical sensors.
- Next Generation Electronics
- Quantum Computers
  - Creating new types of computing devices
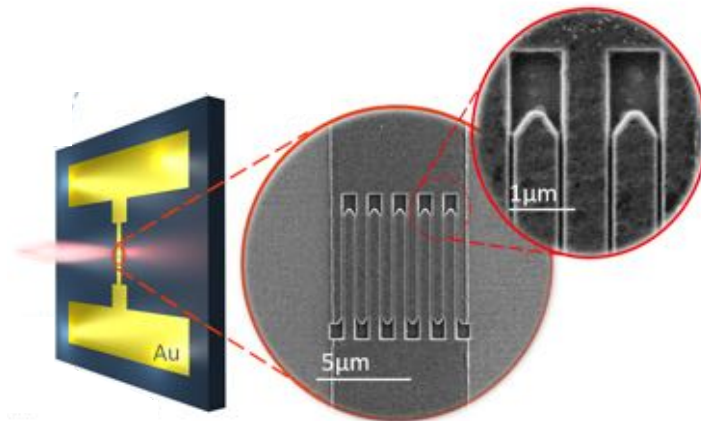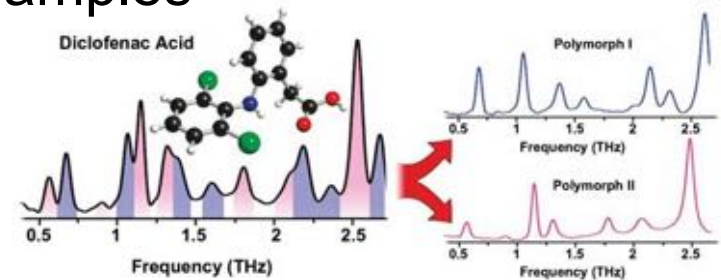
Digital Signal Processing
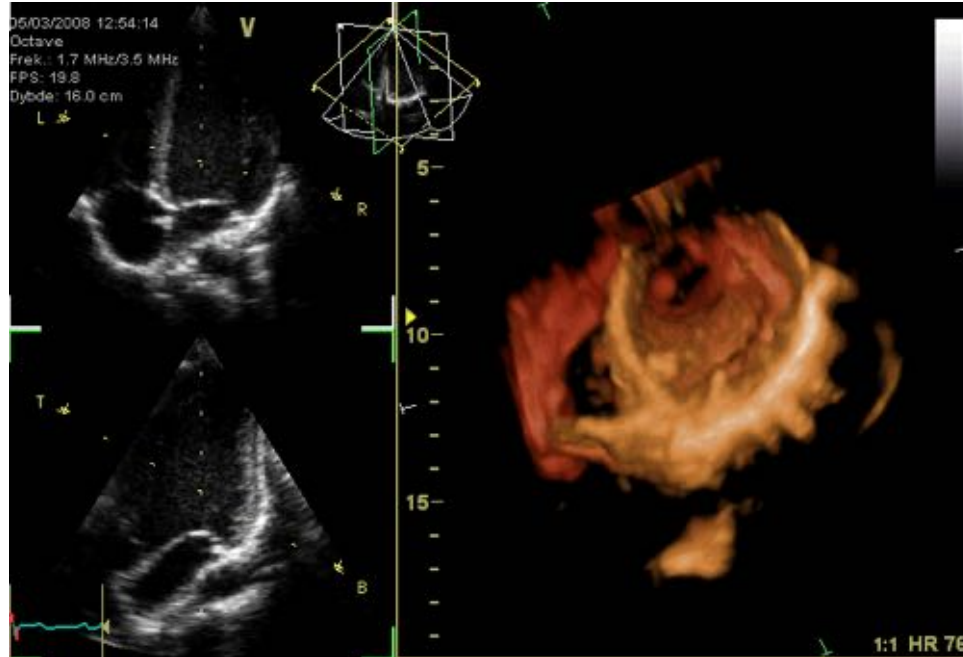
- Medical Imaging
- 3D modelling and printing
- Radio astronomy
- Audio processing

- "Apikal4D.gif" by Kjetil Lenes is licensed under CC BY-SA 3.0

University of Victoria

What can you do with your
Computer Engineering degree?

Portable information processing:

Image taken from: https://www.techinsights.com/blog/teardown/apple-iphone-13-pro-teardown

TechInsights

High performance computing:

University of Victoria

What else do Computer Engineers do?

AUDIO-VISUAL EQUIPMENT

MANUFACTURING EQUIPMENT

GAMING CONSOLES

MOTION SENSORS
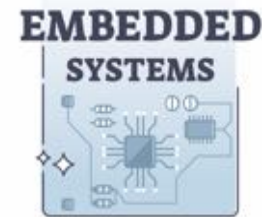
EMBEDDED SYSTEMS

DOMESTIC APPLIANCES

MEDICAL DEVICES

TELECOMMUNICATION EQUIPMENT

CARS AND VEHICLES
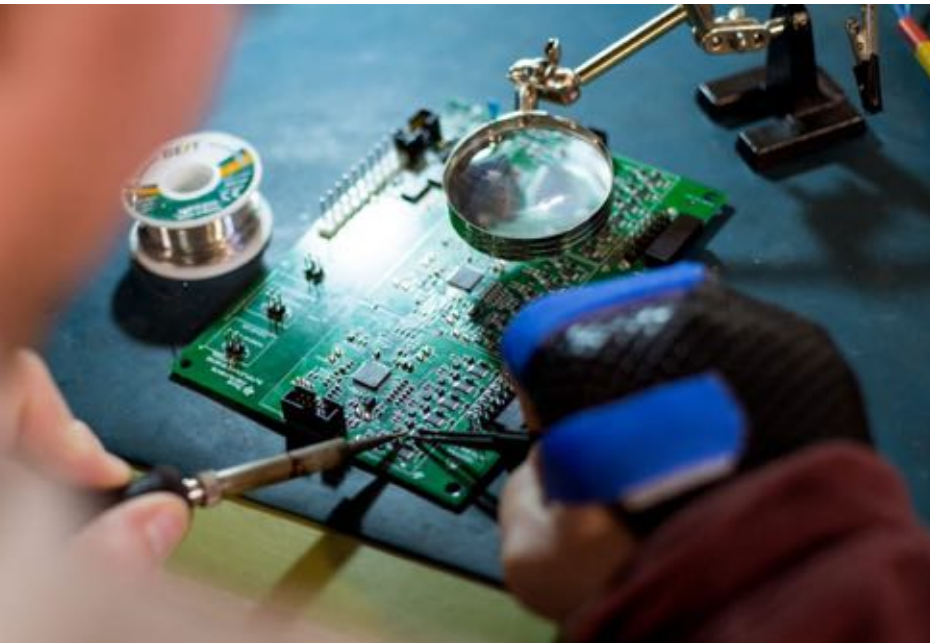
University of Victoria

Impact: Create efficient transportation options.
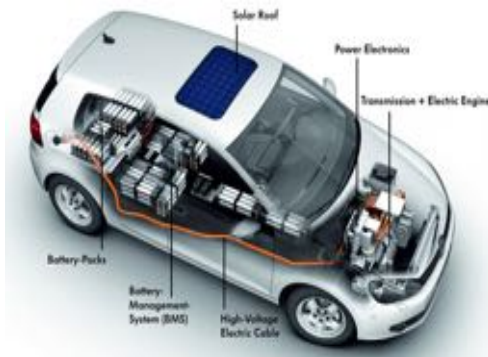
Enabled by Electrical and Computer Engineering:

- Self-driving cars

- High speed rail

- Electric and hybrid vehicles

- More efficient vehicular motors

- Navigation systems

Courses: Control, Power electronics, Drive systems, Real time control, Artificial intelligence, Robotics.

University of Victoria

Impact: Measure the environment.
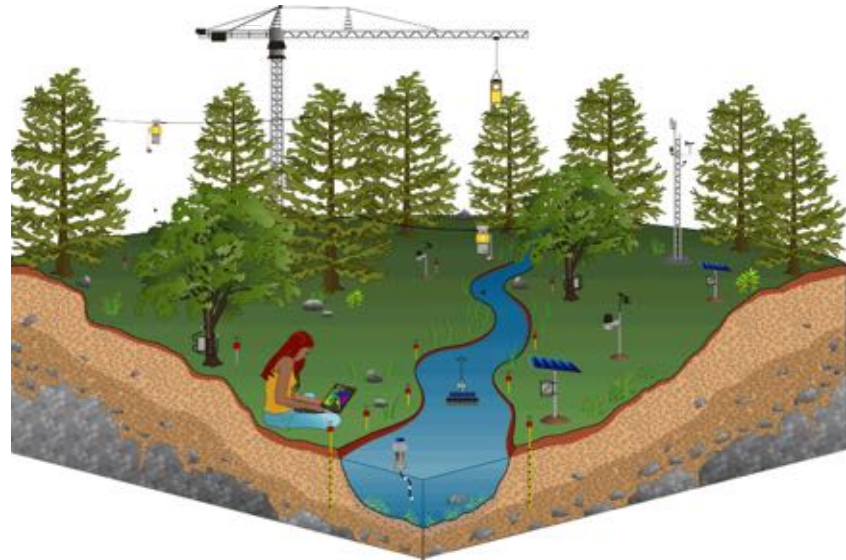
To measure our consumption and generation:

- Collect data from sensors in the environment.
- Sensors must be low cost and consume little power.
- Need to generate picture of effect from sparse data.

Courses: Electronics, Networking, Signal processing, and Communications.

University of Victoria

Impact: New ways to communicate

People now expect ubiquitous communications:

- Video and multimedia content.

- Private, secure, and safe.

- Not an avenue for surveillance.

- Used for financial transactions.

Courses: Communications, Networking, Information theory

University of Victoria

Impact: New ways of making data useful.

Getting actionable information from data:

- New computing paradigms.
- New machine learning methods: deep learning.
- Efficient physical implementation.
- Learn to exploit communications.

Courses: Digital electronics, Embedded systems, Pattern recognition, Artificial intelligence.

University of Victoria

ECE is defining and redefining technology.

Opportunities for Leadership:

Alumni in senior roles:

Catherine Roome, President, Lead Executive Officer
Technical Safety BC

Kirsten Peck, Senior Vice President
BC Hydro

Maher Fahmi, Vice-President Engineering
Microsemi

University
of Victoria

MECHANICAL ENGINEERING

me·chan·ics | mi-ˈka-niks

1: a branch of physical science that deals with energy and forces and their effect on bodies

2: the practical application of mechanics to the design, construction, or operation of machines or tools

3: mechanical or functional details or procedure

me·chan·ics | mi-ˈka-niks

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FORCES & THEIR EFFECTS ON BODIES…
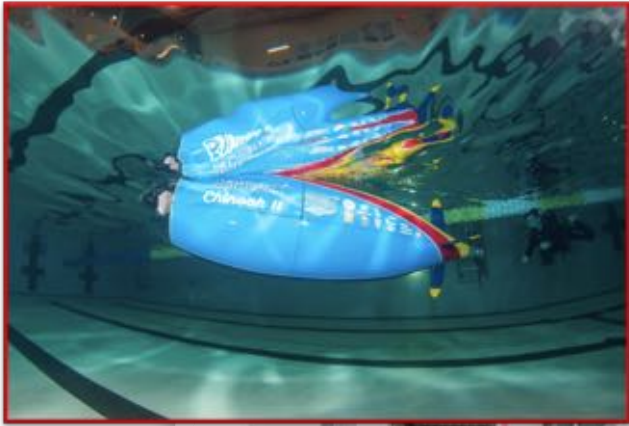
FORCES & THEIR EFFECTS ON BODIES…

FORCES & THEIR EFFECTS ON BODIES…
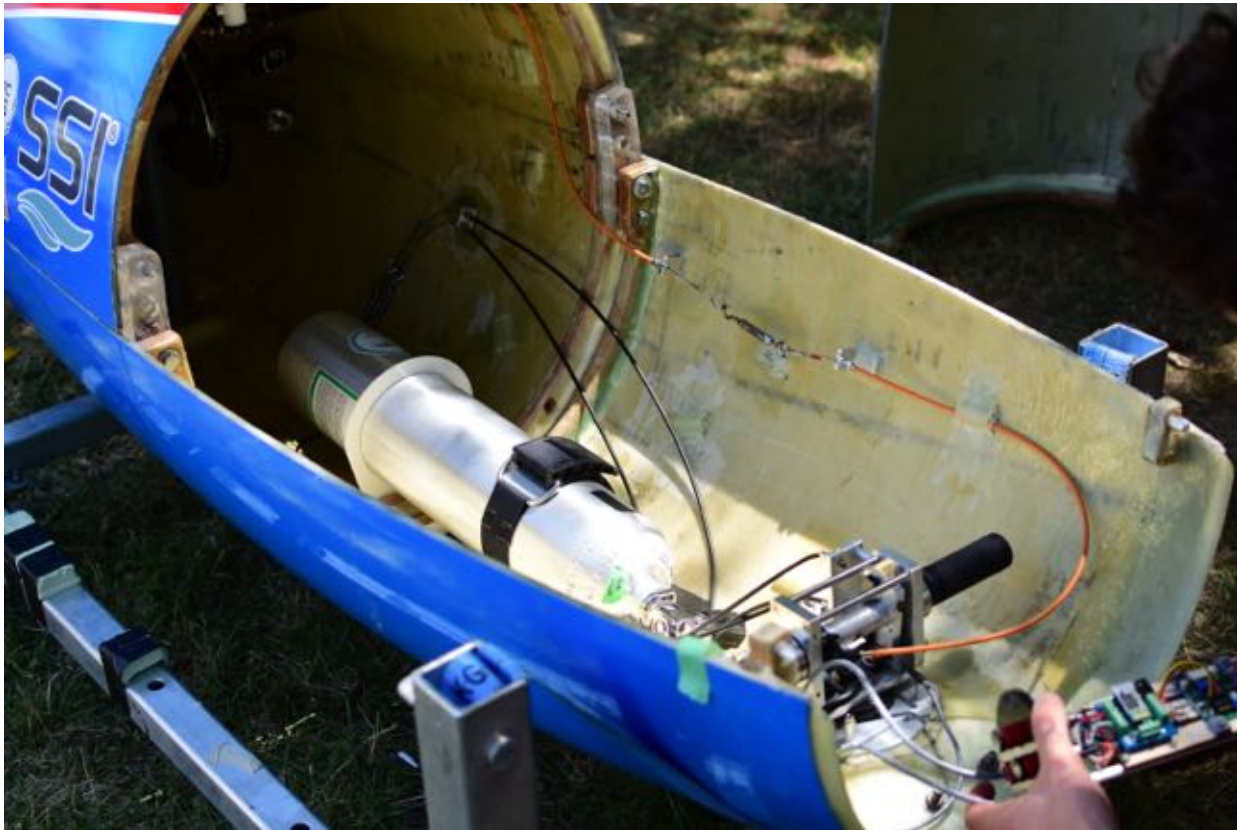
FORCES & THEIR EFFECTS ON BODIES...

MECHANICAL ENGINEERING AND 2030
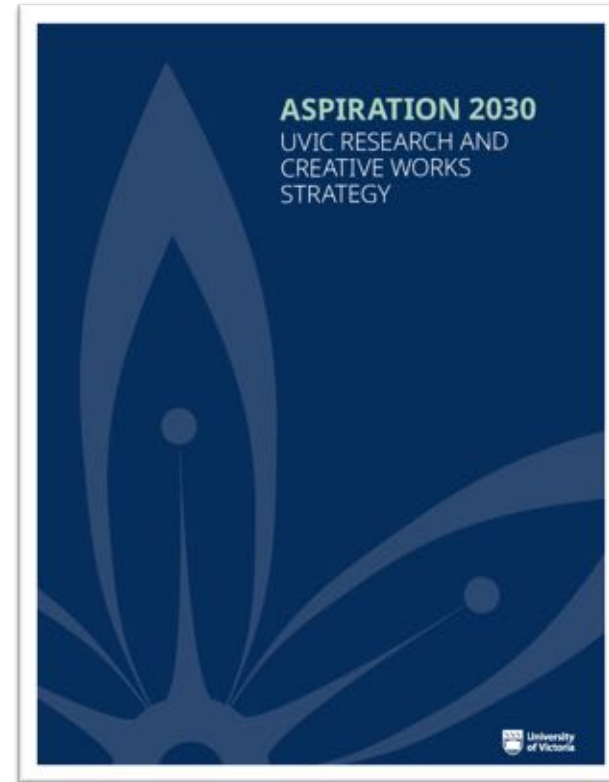
MECHANICAL ENGINEERING AND 2030

#6: CLEAN WATER & SANITATION (VALEO)

The water in this large stormwater pond (right) in a residential area in southeast Calgary is recycled with minimal treatment to help supply water in times of drought.

A numerical model was created to predict distribution of contamination in the pond and to identify the cleanest part of the pond to extract water with no treatment

An instrument specifically designed for measuring velocities in ponds of this size was designed, patented and used to verify predictions of pollutant dispersion.

#6: CLEAN WATER & SANITATION (VALEO)

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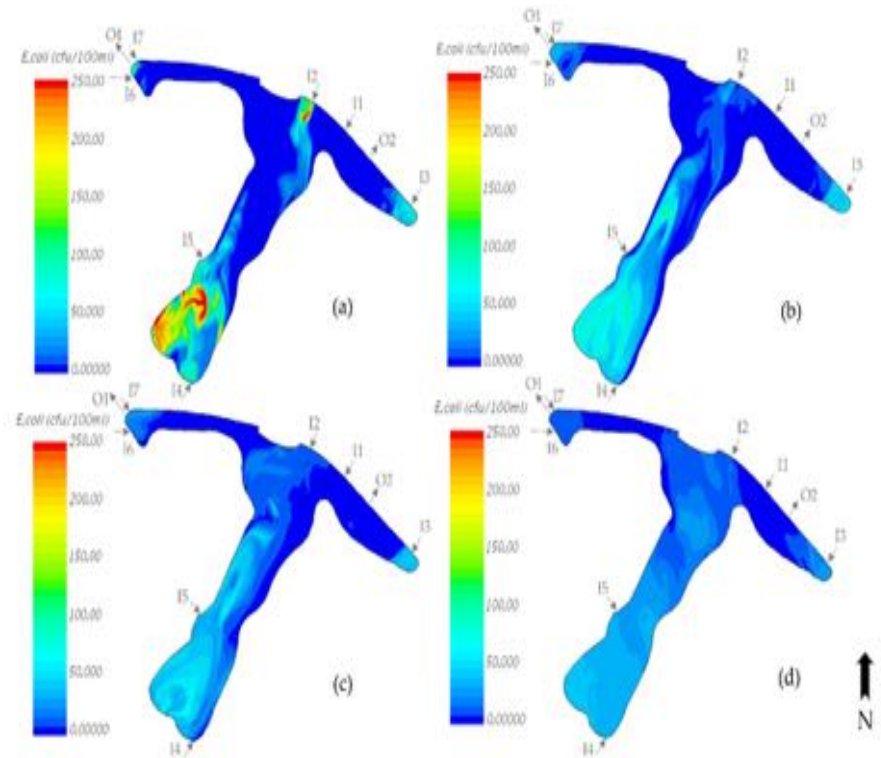
#7: AFFORDABLE & CLEAN ENERGY (BUCKHAM)

Mowachaht / Muchalaht
First Nation

The Mowachaht-Muchalat Nation is rebuilding the community of Yuquot – once the capital of the Nation (~1000 people in early 1900's).

The heart of the new Yuquot will be a hybrid energy system including wave supplied power
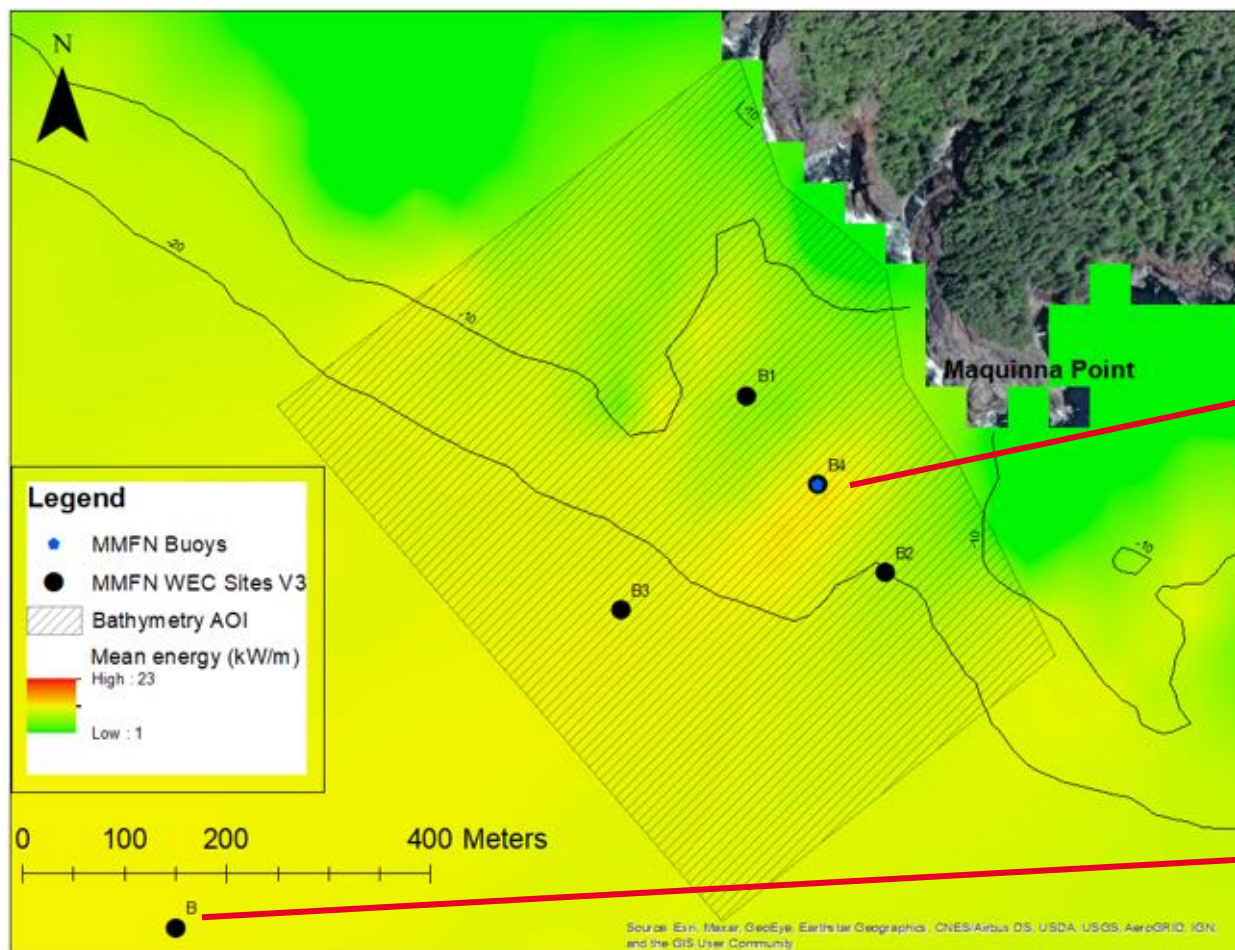
Energy conversion depends on the wave induced motions of the surface buoy creating rotation of the generator shaft on shore.

Elasticity of the cables imposes a cutoff on how far from shore the device can be installed

3ton$_f$ (Counterweight)

INGINE
Harness Nature Power Life

12ton$_f$ (Buoy)

PROTEUS DS

WEC   Sea Surface

Connecting Ropes   Weight

Water Depth

Sea Bed   Self-Alignment System

DSA ocean
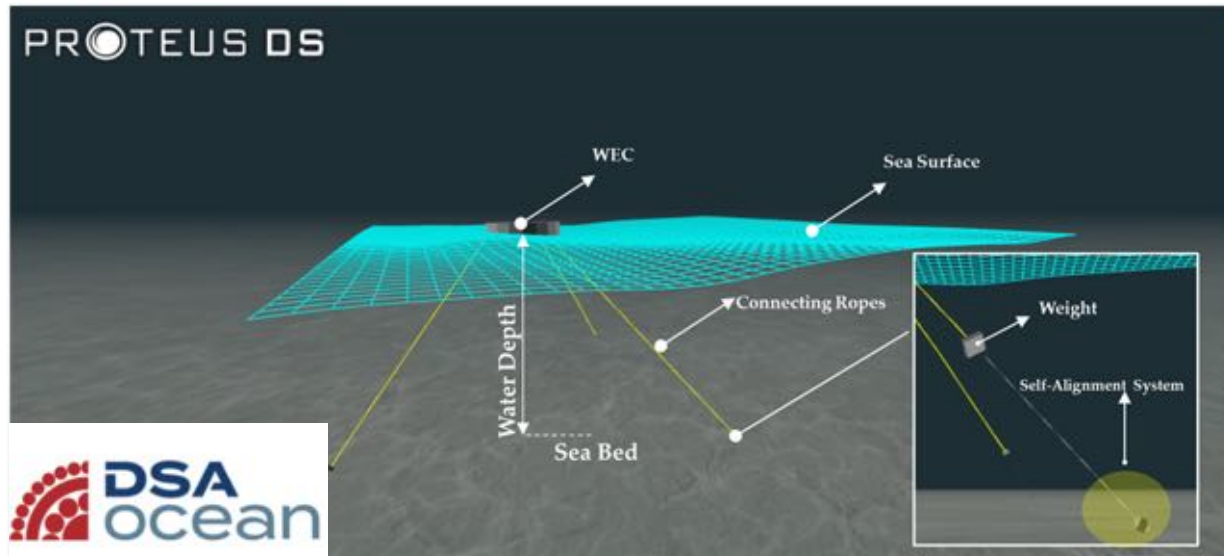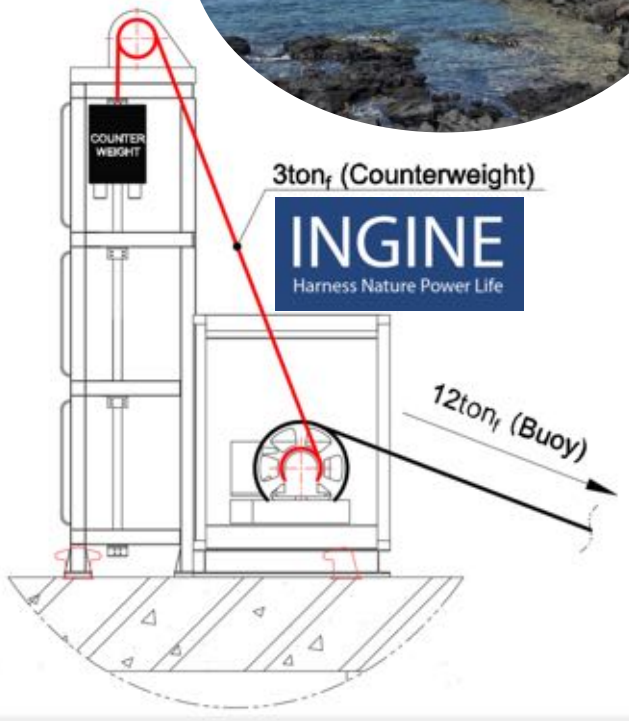
Schematic representation of WEC model set-up in PROTEUS DS

#15: LIFE ON LAND (SULEMAN)

Department of Mechanical Engineering

http://www.uvic.ca/engineering/mechanical/

Center for Aerospace Research

http://aero-cfar.uvic.ca/

TC approved Flight Test Range

http://aero-cfar.uvic.ca/

To steward remote (untouched) ecosystems, monitor species, manage forests, etc we need to be able to monitor large regions over long time periods from afar.

To steward remote (untouched) ecosystems, monitor species, manage forests, etc we need to be able to monitor large regions over long time periods from afar.
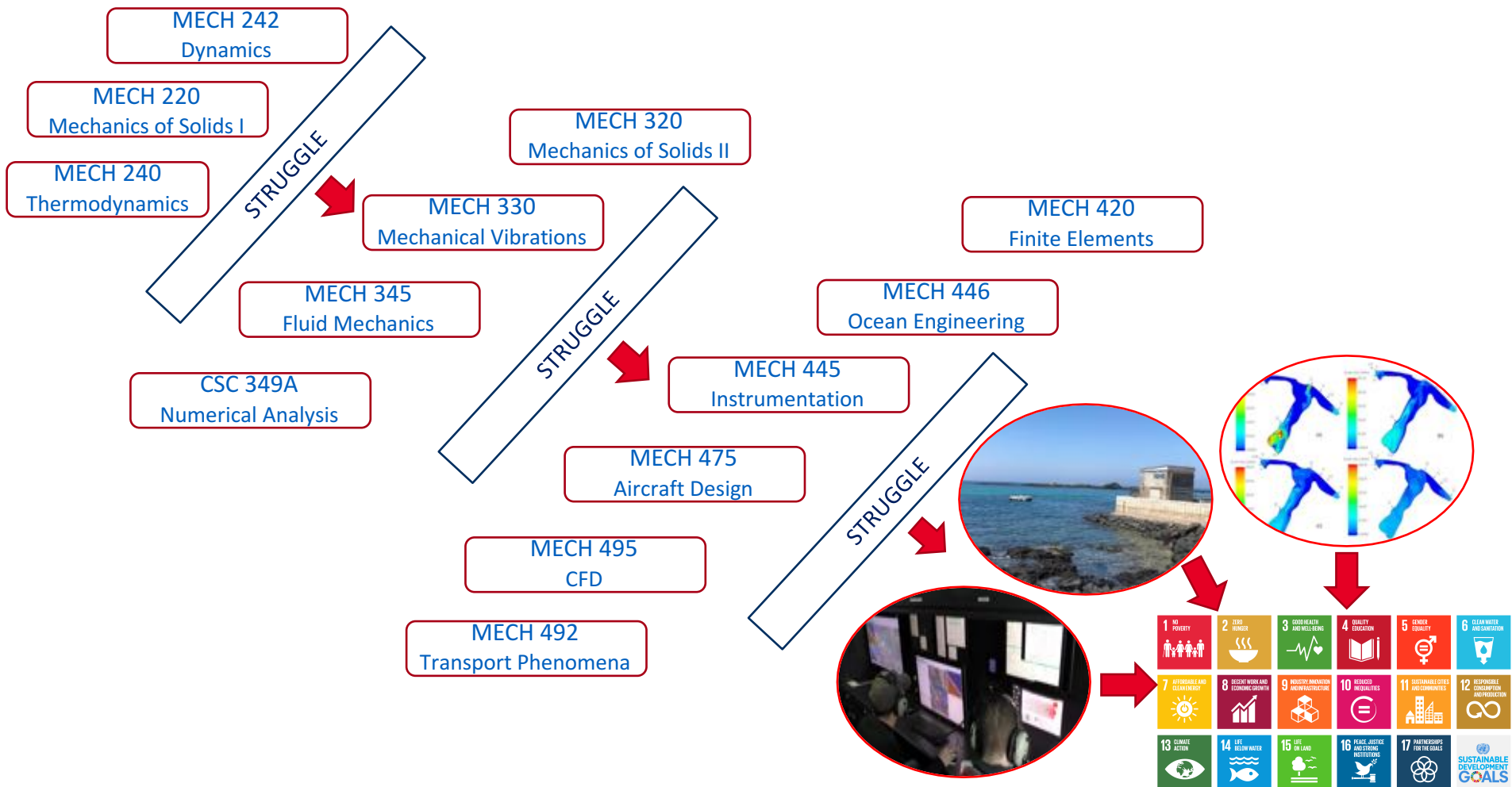
strug·gle | ˈstrə-gəl

1: to make strenuous or violent efforts in the face of difficulties or opposition

2: to proceed with difficulty or with great effort

strug·gle | ˈstrə-gəl

1: to make strenuous or violent efforts in the face of difficulties or opposition

2: to proceed with difficulty or with great effort

Software Engineering UVIC BSEng Program

Stephen W. Neville, PhD, PEng (BC)

Director, Software Engineering
Professor, Electrical & Computer Engineering
Co-manager, Entrepreneurship@UVic

uvic.ca/seng

Software Engineering

Engineering – a practical definition:

Designing and constructing systems that:
- Improve societies and peoples' lives,
- Operate correctly day-in day-out 24/7/365, and
- Behave predictably!

Engineers don't like surprises!

Software Engineering:

– Doing this for the large-scale, software-centric systems that modern societies critically rely on:

- Critical Infrastructure
- eCommerce and M-Commerce
- Social Media and Entertainment
- Banking and Finance
- eGovernment

- Business-to-Business Systems
- Transportation Systems
  - Autonomous Vehicles
- Cyber-physical Systems/Internet-of-things
- eHealth and Advanced Healthcare

Computing-centric Degrees

Large-scale

Software Engineering

"Building global scale systems and solutions is commonplace"

Computer Engineering

Computer Science

Embedded

Engineering
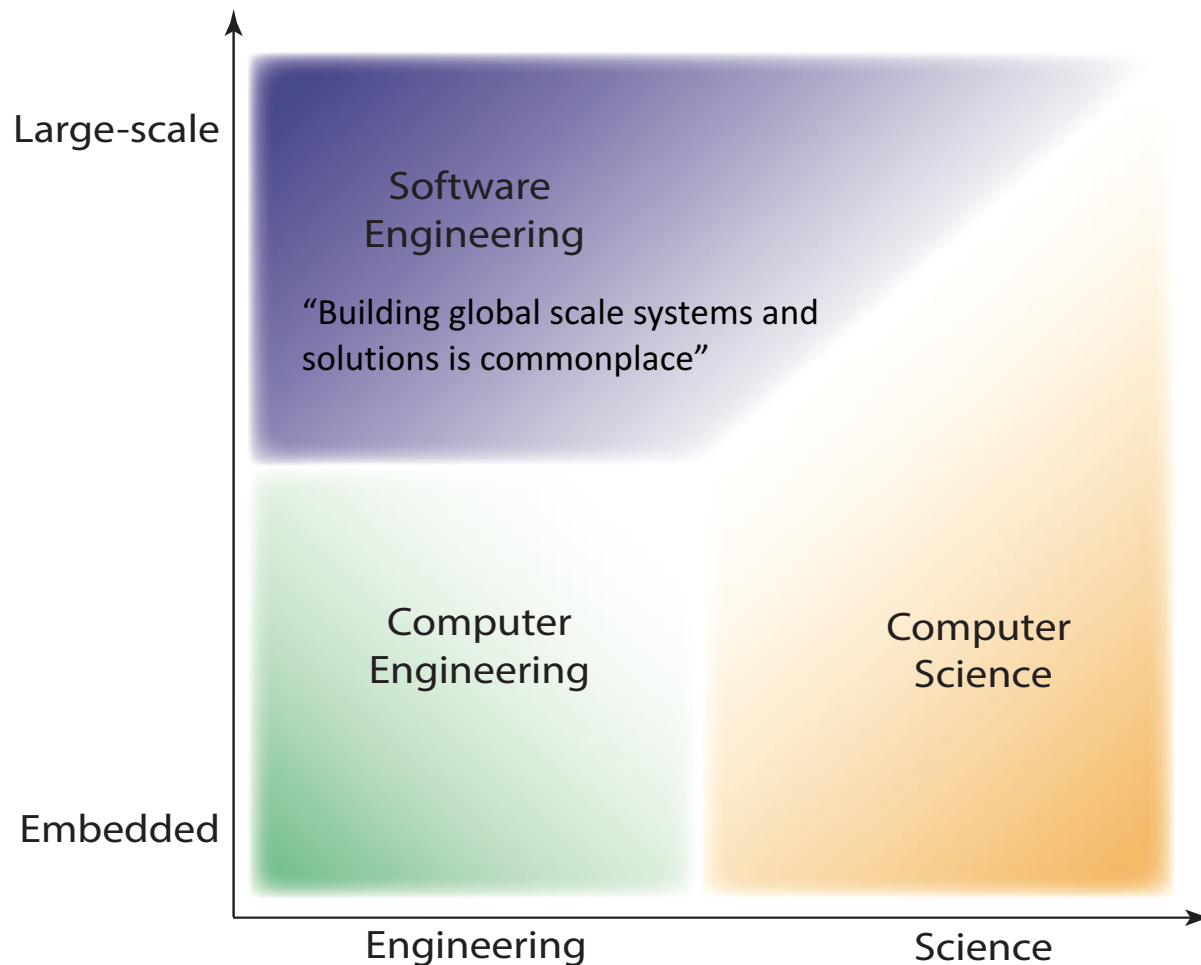
Science

Science:
   "Exploring what is possible"

Engineering:
   "Converting the possible into the day-to-day"

Engineering Degrees

As students, you're making substantial investments in:

- Time,

- Money,

- Effort, and

- Commitment.

Reasonable expectations upon degree completion:

- Good impactful opportunities to make impacts, and

- Good interesting careers with suitable renumeration.

Engineers create tomorrow's world!

Software Engineering

Where is technology going?

(over the next decade or so …)

Self-driving Cars:

– Software is responsible for the ”Self-driving”
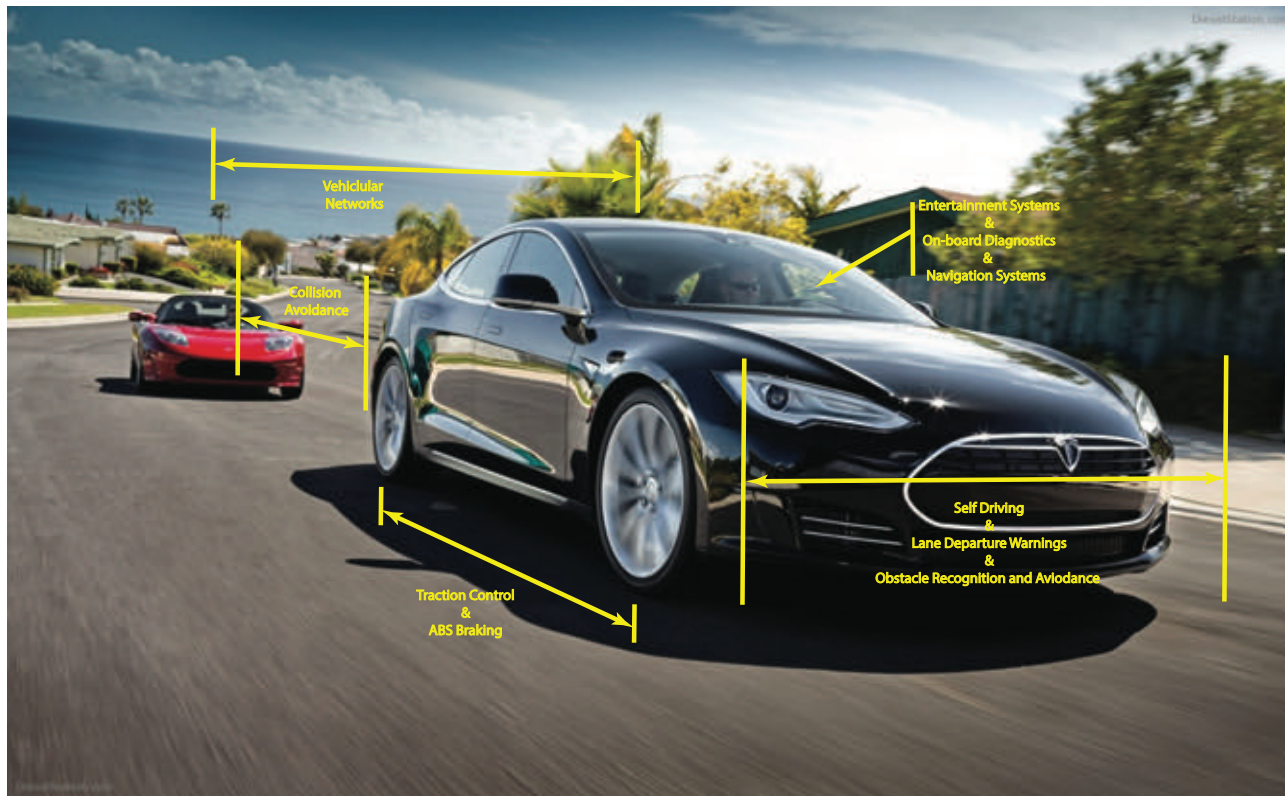
Cars Run on Code

100-200 mil. lines . ~100 processors . 70% effort in SW
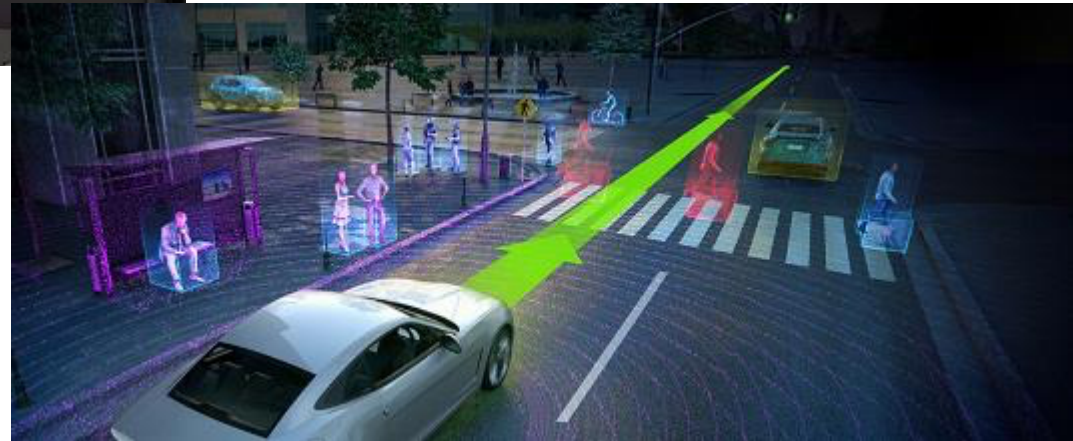
> 50% warranty costs due to SW

Over the Next Decade (or so …)

Smart Buildings:

– Software provides the "Smarts"
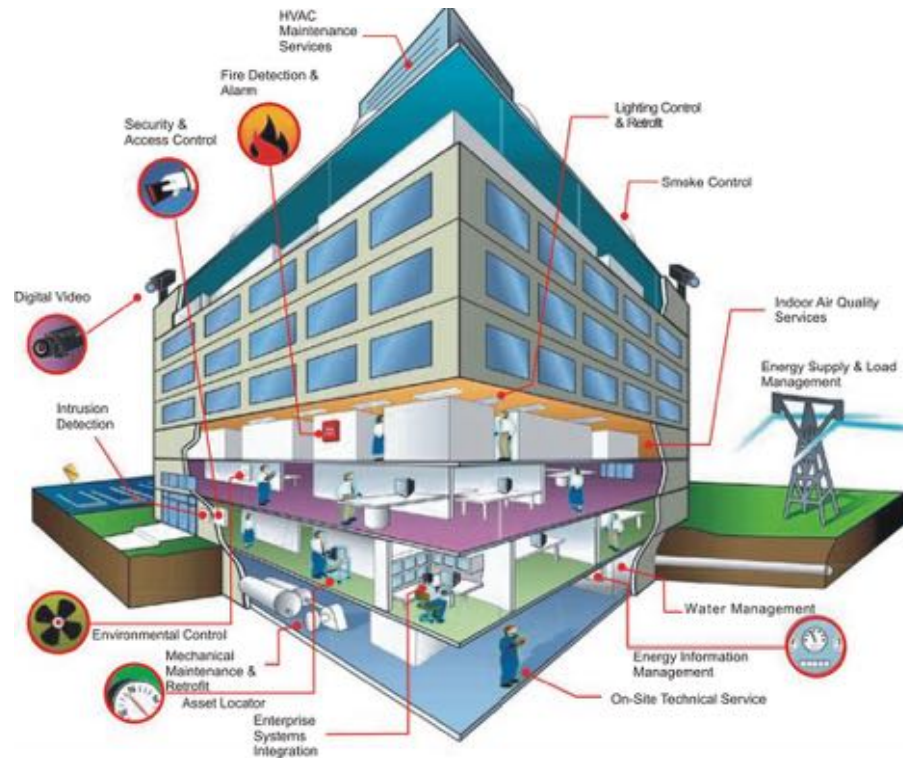
Over the Next Decade (or so …)

Smart Cities:

– Software provides the "Smarts"

Over the Next Decade (or so …)

Data-driven Agriculture:

Software converts measurements into correct actionable decisions.

Over the Next Decade (or so …)

Advanced Healthcare:

Software converts measurements into correct actionable decisions.

Software Engineering

All of the above requires software engineering as core components of these systems and systems-of-systems

Your Generation:

Is the one that's going to make the above happen!

Your challenges are going to be :

- Dealing with massive scale software-intensive systems
  - Today's Internet:
    - 1B-5B devices
  - Tomorrow's Internet:
    - 50B-100B+ devices

- Cyber-security and privacy concerns

  - Global adversaries / nation state adversaries

- Reliability/Performance/Maintainability/Cost Efficiency at massive scales

  - Core engineering issues

- Significant human and environmental health and safety concerns

  - You cannot simply re-boot a Smart City!

Example Careers:
(SENG is Canada's fastest growing Engineering discipline)

- Chief Technology Officer

- Cyber-security/privacy Analyst

- Designer (e.g., U/X), System Architect

- Data Analyst/Data Engineer/Data Scientist

- High-tech Entrepreneur

"All you need is a computer (and good software people) to create a company that can sell products and services globally"

Hunter MacDonald, CEO of Tutela Technologies Inc.

SENG Career Advantages:

- Creative and collaborative work
- Well paid (to exceptionally well paid …)
- High flexibility:
    - Where you work:
        - company, industry, country, etc.
    - How you work:
        - locations, schedules, remotely, etc.
- Rapidly accelerating global demand across all industries
- Small teams can (and do) make global impacts!

If you can imagine it, then you can build it, and people everywhere can use it!

Quick SENG Program Statistics

- Largest SENG program in Western Canada

- Only accredited SENG program in BC
  - 2023 is our 20th year of operation

- 2nd largest engineering program in the Faculty
  - Strong and active student body (320+ SENG students)
  - Growing at over 13% per year (since 2003)

  - 70% of co-ops are in Victoria's local globally competitive high-tech industry.

High-tech in Victoria:

Victoria's high-tech industry is software-centric:

- Vibrant and rapidly growing:
  - 900+ local companies
  - >4.3B+ in annual revenues
  - >18,000 employees
- Victoria companies compete very successfully globally
- Talent is the growth limiter
  - Very supportive of students

Economic Impact Study

With a total economic impact of $5.22 billion and 16,775 employees, our tech sector has seen a 30% growth since 2013!

$5.22 BILLON IN TOTAL ECONOMIC IMPACT

- In BC, high-tech is one of the largest and fastest growing industries:
  - >130,000 people employed, 6.6.% of GDP, $18.3B annually (2018)
  - Larger than the mining, oil and gas, and forestry sectors combined

VIATEC: https://www.viatec.ca/

The SENG Program Structure
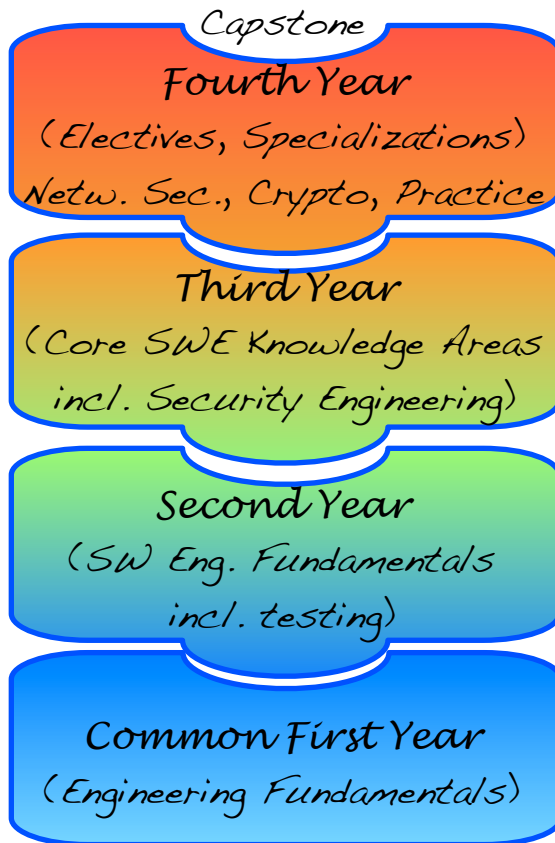
SENG Specializations:

- Data mining and analysis, artificial intelligence, and machine learning

- Cyber-physical and smart systems

- Cybersecurity and privacy

- Performance and scalability

- Interaction design and data visualization

- Visual computing (vision/graphics)

Accredited program: Canadian Engineering Accreditation Board

Capstone

Fourth Year
(Electives, Specializations)
Netw. Sec., Crypto, Practice

Third Year
(Core SWE Knowledge Areas
incl. Security Engineering)

Second Year
(SW Eng. Fundamentals
incl. testing)

Common First Year
(Engineering Fundamentals)

Accelerating Demand for SENG: Engineer's Canada 2019 Report

Engineering Discipline	2015	2016	2017	2018	2019	Abs. Growth	CAGR
Software	4,114	4,649	5,020	6,394	6,878	2,764	13.7%
Computer	4,838	5,473	6,097	6,451	7,389	2,551	11.2%
Year One/Two Common Year	7,905	8,067	7,849	9,476	9,341	1,436	4.3%
Biosystems	1,558	1,787	1,855	2,366	2,693	1,135	14.7%
Industrial or Manufacturing	2,648	2,787	2,798	3,370	3,271	623	5.4%
Environmental	1,462	1,501	1,668	1,247	1,965	503	7.7%
Mechanical	18,691	18,415	18,194	20,275	19,190	499	0.7%
Other	4,412	4,263	4,419	3,159	4,682	270	1.5%
Materials or Metallurgical	1,004	951	869	885	885	-119	-3.1%
Geological	779	746	654	609	603	-176	-6.2%
Chemical	6,323	6,341	5,949	6,451	6,099	-224	-0.9%
Civil	12,595	12,379	11,666	12,978	12,209	-386	-0.8%
Mining or Mineral	1,416	1,249	967	1,106	948	-468	-9.5%
Electrical	11,764	11,391	11,222	12,129	10,783	-981	-2.2%
Engineering Physics	2,865	3,303	3,245	2,346	1,335	-1,530	-17.4%
TOTAL	82,374	83,302	82,472	89,242	88,273	5,899	1.7%

LinkedIn Posted Jobs for "Engineering" (19/02/2022)

*6 open Canadian LinkedIn listed jobs per expected 2022 SENG graduate.*

LINKEDIN ENGINEERING POSTINGS - BC
FEBRUARY 19, 2022 - 6,000 TOTAL JOBS

- Other Engineering 19%
- Computer Engineering 32%
- Software Engineering 49%
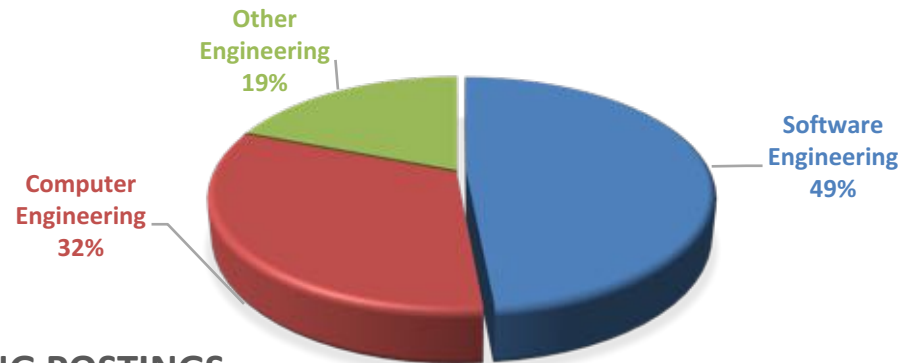
LINKEDIN ENGINEERING POSTINGS - CANADA
FEBRUARY 19 , 2022 - 32,000 TOTAL JOBS

- Other Engineering 15%
- Computer Engineering 32%
- Software Engineering 53%

LINKEDIN ENGINEERING POSTINGS - USA
FEBRUARY 19 , 2022 - 634,000 TOTAL JOBS

- Other Engineering 22%
- Computer Engineering 32%
- Software Engineering 46%
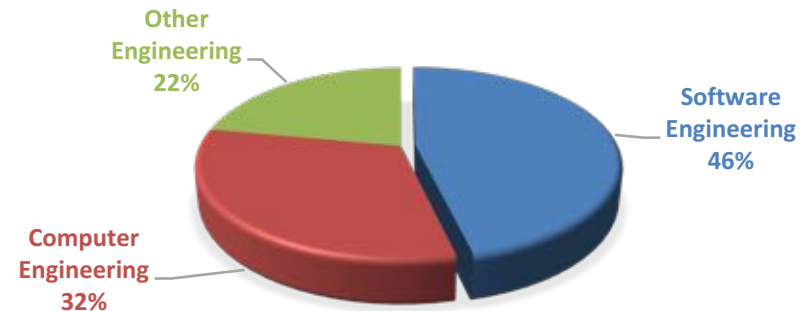
In Summary:

- Globally:
  - High growth, high demand, rapidly accelerating need

- Interesting, creative, and impactful careers:
  - The largest systems humanity has ever made
  - Highly collaborative (at global scales)

- High career and work flexibility:
  - Everyone uses the same software stacks (cloud, etc.), easy to move across industries and around the globe …
  - Remote work was commonplace pre-covid

- Providing the critical components to global solutions for global problems

- Strong and vibrant student body and highly supportive, globally competitive, software-centric local high-tech industry sector

Small teams making global impacts!

THANK YOU FOR JOINING US TODAY!

DON'T FORGET ABOUT THE PROGRAM INFORMATION FAIR today IN THE ELW LOBBY until 5:30!

THERE WILL BE PROGRAM AND ACADEMIC ADVISING BOOTHS AND … PIZZA!
GRAB YOUR PIZZA TICKET ON THE WAY OUT