

# ENGINEERING PROGRAMS



INFORMATION TALKS  
TUESDAY February 13, 2024

Dr. LillAnne Jackson, Associate Dean

Biomedical ★ Software ★ Civil ★ Computer ★ Electrical ★ Mechanical

*We acknowledge and respect the Lekwungen peoples on whose traditional territory the university stands and the Songhees, Esquimalt and WSÁNEĆ peoples whose historical relationships with the land continue to this day.*

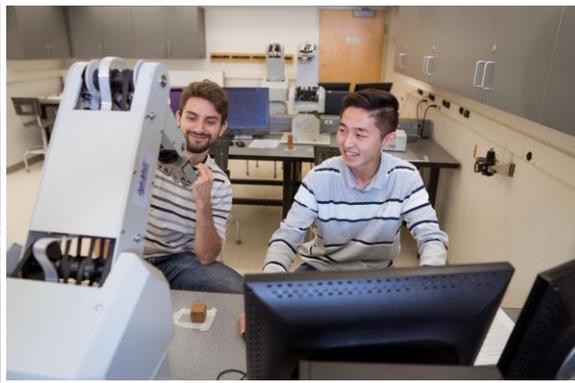


# Program Declaration

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

- You declare: Between now & April 30
- Declaration Requires:
  - at least 12 (relevant) units
  - C+ GPA with No relevant grade less than C
- After spring grades arrive (in May/June)
  - Declared into programs
  - Email confirms your program

# So, which program is for you??





## Presenters:

### **Biomedical Engineering**

Dr. Karol Valente & Dr. Chris Dennison

### **Software Engineering**

Dr. Stephen Neville

### **Civil Engineering**

Dr. Caetano Dorea

### **Computer Engineering**

Dr. Mihai Sima

### **Electrical Engineering**

Dr. Sana Shuja

### **Mechanical Engineering**

Dr. Bosco Yu

# Biomedical Engineering @ UVic

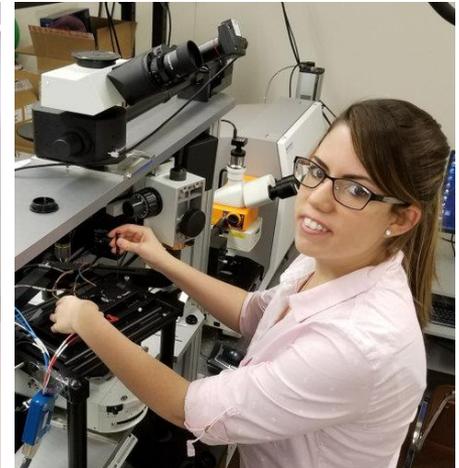
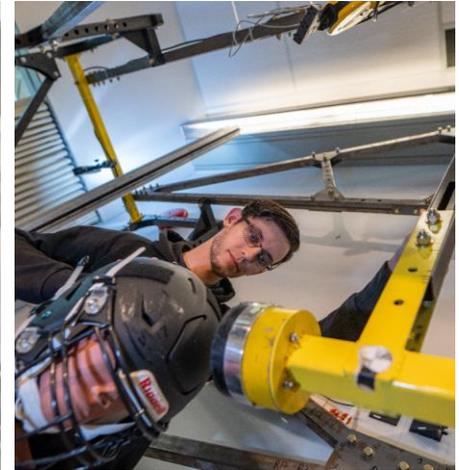
Dr. Chris Dennison  
BME Program Director

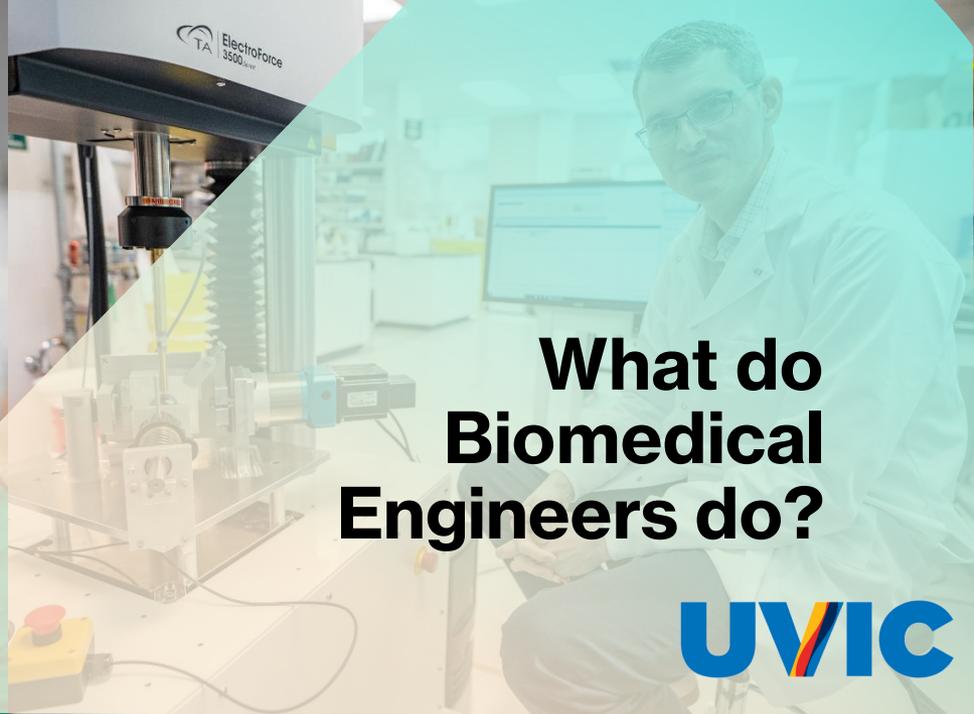
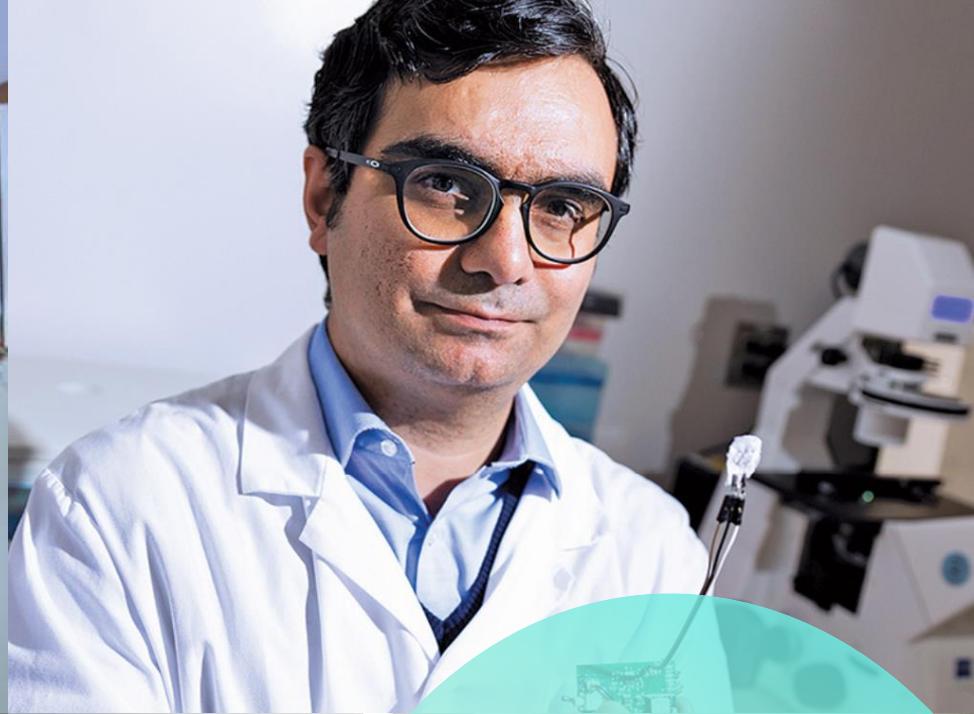
Dr. Karolina Valente  
Assistant Teaching Professor

# What is Biomedical Engineering?

Applying engineering principles to problems in medicine and biology.

Developing new tools and approaches to improve human health and well-being.

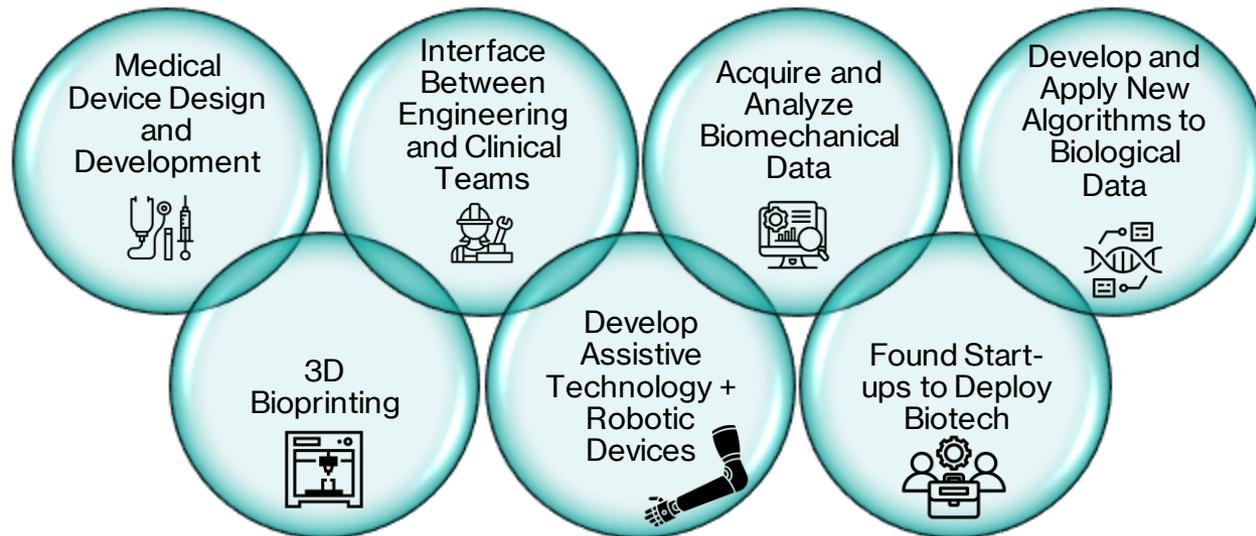




**What do  
Biomedical  
Engineers do?**

**UVIC**

# What do Biomedical Engineers do?





*“My network of people has proven to be the most useful to me in terms of getting jobs, learning new skills and staying connected with what's happening in the healthcare/biomedical industry.”*

# Where do BME grads go?

**You'll find UVic BME grads in:**

- *Medical device start-ups*
- *Biotech companies*
- *Graduate school (MAsc, PhD)*
- *Medical school*
- *Established BME companies*
- *Medical imaging companies*
- *Not-for-profits*
- *Venture capital*
- *Biomedical research...*



*“I discovered my deepest interests and passion within the field of Biomedical Engineering. Through networking, targeted coursework, and involvement in BME extracurriculars, I honed my expertise and positioned myself for postgraduate opportunities aligned with my passions. This deliberate approach ultimately led to a fulfilling career in a field I love.”*

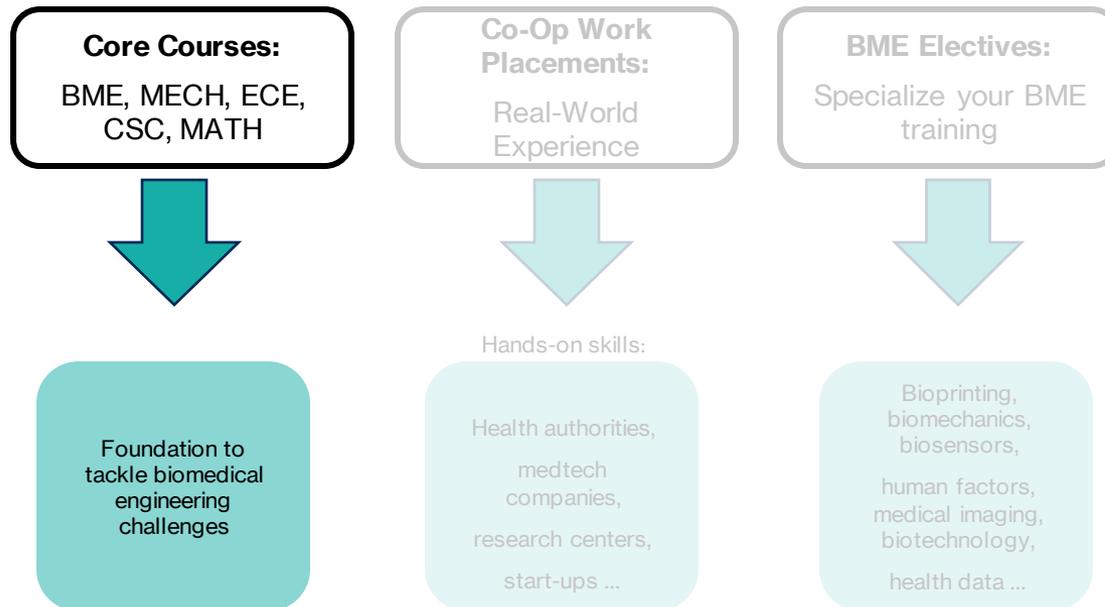
# Where do BME grads go?



VoxCell BioInnovation



# BME Program





# Biomedical Engineering Design Team



# Why choose BME...?

... like-minded people  
passionate about  
improving human lives

... grand challenges that  
could improve human  
health and well-being

... opportunities for  
creating medical  
devices or to develop  
biotechnology

... interdisciplinary  
engineering foundation  
to enable you to tackle  
any problem

... benefit humanity

... rapidly-evolving,  
rapidly growing,  
engineering disciplines  
at the leading edge of  
innovation

**... join Biomedical Engineering!**

# Reach out:

BME Director:

**Dr. Chris Dennison**

[bmedirector@uvic.ca](mailto:bmedirector@uvic.ca)

Current Faculty:

**Dr. Karolina Valente**

[kvalente@uvic.ca](mailto:kvalente@uvic.ca)

BME Program Coordinator:

**Ms. Katharine Waring**

[bme.coord@uvic.ca](mailto:bme.coord@uvic.ca)



# UVic Software Engineering

*Founded in 2003*

*2024 is our 21<sup>st</sup> Year of Operation*

*Stephen W. Neville, PhD, PEng (BC)  
Director, Software Engineering  
Professor, ECE Dept., Co-Manager Entrepreneurship@UVic*



# Software Engineering



## Highlights:

- 2<sup>nd</sup> largest UVic engineering program
  - 325+ declared students (as of Fall 2023)
- BC's principal CEAB-accredited SENG program.
  - Nationally accredited SENG is not offered at UBC or SFU ...

## BC Gov't. Growth Mandate:

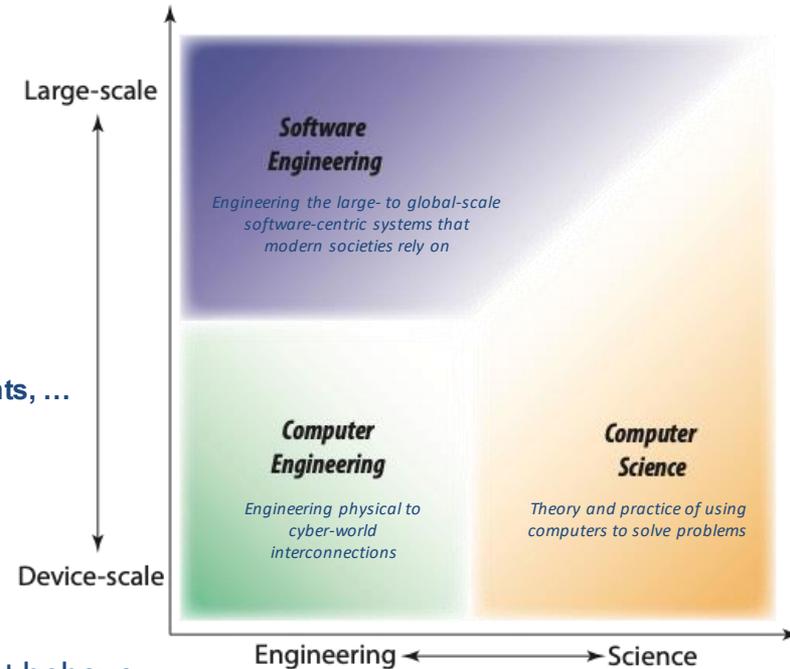
- SENG is mandated to double in size over next 5 years
- Secured funding for:
  - Adding 300 SENG-specific seats
  - New 200-server \$3.85M SENG Teaching Cluster
  - New SENG faculty, new courses, on-going program improvements, ...

## Sciences:

“Exploring what is Possible”

## Engineering Disciplines:

“Converting the Possible into the day-to-day & building systems that behave predictably in the real-world.”



# Top-10 Global Industries

All modern industries critically rely on software-centric systems!



## Software Engineers:

- Building global-scale systems are commonplace.
  - These are the largest, most complex, & challenging systems humanity has ever created
- Unique to SENG:
  - Substantial direct/immediate societal impacts.
  - High career portability (Industry agnostic):
    - Everyone uses the same soft. dev. frameworks & cloud-deployment regimes

Industry (Top-10)	Annual Market Value (as of 2021)
1. Financial Services	\$22.5T
2. Construction	\$12.5T
3. Commercial Real Estate	\$9.6T
4. E-commerce	\$9.1T
5. Life and Health Insurance	\$8.5T
6. Information Technology	\$5.0T
7. Food Industry	\$5.0T
8. Oil & Gas Exploration & Production	\$4.6T
9. Automobile Manufacturing	\$3.0T
10. Telecommunications	\$1.7T
<b>Total:</b>	<b>\$81.5T</b>

Note: Healthcare is the world's 11<sup>th</sup> largest global industry.

# Specific Example Industries:

Software is everywhere and in everything!



**SENG skills are needed Everywhere!**

**Critical Infrastructure**  
- Telecom, water, power, ...



**Advanced Healthcare & Digital Health**



**Precision Agriculture**



**Social Media & Entertainment**



**eCommerce & M-commerce**



**Intelligent, Smart, & Autonomous Systems**



**Banking & Financial Tech (FinTech)**



**Software Engineering**

# SENG Technical Domains:



# Market Analyses (for Careers):

*Engineering degrees take significant time, effort, and money –  
You're making core investments in yourselves and your careers ....*



## Supply side data:

- Engineers Canada Enrollment Reports

Source: <https://engineerscanada.ca/reports/canadian-engineers-for-tomorrow-2020>

### **Top-3 Fastest Growing Engr. Disciplines (2016-2020)**

- BME (13.5% CAGR) – being driven by advanced healthcare/digital health.
- SENG(12.3% CAGR) – being driven by global pan-industry demand (*SENG is industry agonistic*)
- CENG (10.6% CAGR) – being driven by cyber-physical systems (CPS) and internet-of-things (IoT) growth.

## Demand side data: (Multiple data sources)

Source: <https://occupations.esdc.gc.ca/sppc-cops/occupationssummarydetail.jsp?tid=82>

- Gov't. of Canada Job Projections:

SENG: “**SHORTAGE**: This occupational group is expected to face labour shortage conditions over the period of 2022-2031 at the national level.”

# Demand Side (cont.)

As engineers evidence-based data driven career decisions is something you have the skills/knowledge to do ...



- BC Gov't: WorkBC Labour Market Outlook:**

Source: [https://www.workbc.ca/sites/default/files/2023-11/MPSEFS\\_11803\\_BC\\_Jobs\\_LMO](https://www.workbc.ca/sites/default/files/2023-11/MPSEFS_11803_BC_Jobs_LMO)

Work BC 10-year estimates	Added SENG Job Openings	Year-over-year Increase (%)
2022-2032	9,980	-
2023-2033	12,300	2,320 (23%)

- WorkBC explicitly separates out SENG from the other computing-centric disciplines, e.g., CS majors, CENG, etc.

Ontario & Quebec train CEAB SENGs at **4.5x** the rate of all of Western Canada per 100k population!

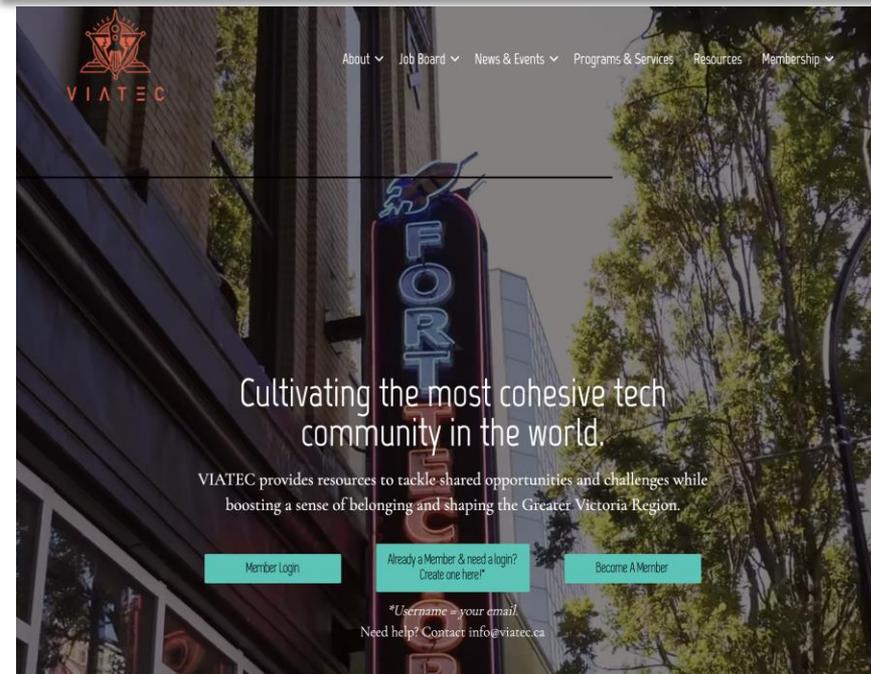
- Non-estimated job data – LinkedIn job searches:** (or similar sites)

- Companies only post jobs after they have committed to fund the position(s).

LinkedIn allows generation of your own direct and current "order of magnitude" job stats:

LinkedIn Search Term:	Region: "Canada"	Region: "British Columbia"
"Software Engineer"	12,000	1,000
vs "Engineer"	17,000	2,000
"Software Engineering"	32,000	2,000
vs "Engineering"	60,000	7,000

# Regional/Local Statistics: Victoria Innovation, Advanced Technology & Entrepreneurship Council (VIATEC)



Victoria has a very strong, globally-competitive, software-centric high-tech sector (and an exceptional base of globally-experienced industry advisors).

### In 2018:

- 900+ companies, 18k+ employees, \$4.3B+ annual revenues
  - Mainly young earlier-stage companies and some mid-sized.

### By 2030:

- On pace for \$10B in revenues – suggests around 42k+ local employees
  - Translates to about 1,500+ SENG-specific jobs added
- Industry demand is driving the BC's government's commitment to UVic SENG growth.

- 70%+ of SENG co-ops are within the Victoria tech sector:
  - In SENG, skills gained locally easily translate globally!

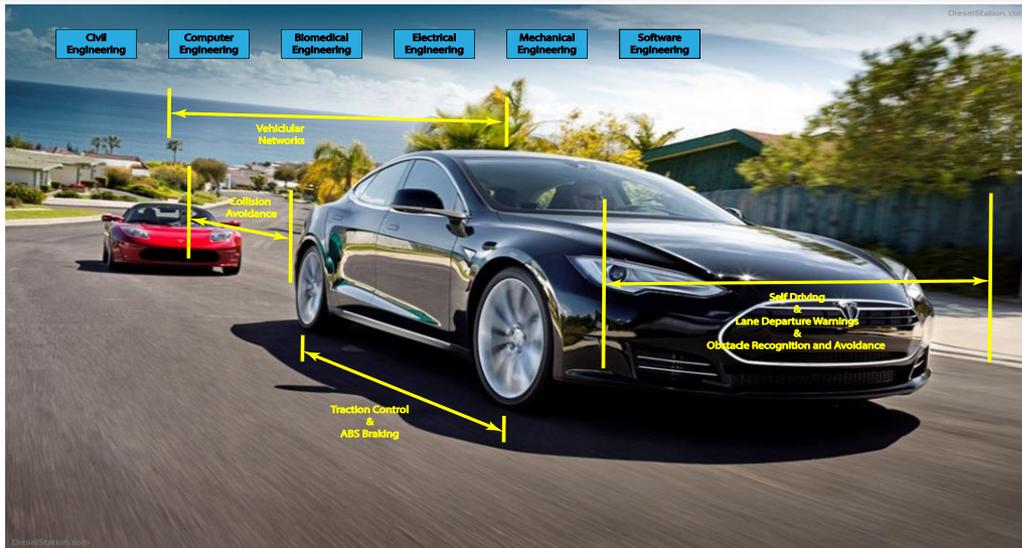
*VIATEC holds many events where students are welcome! <https://www.viatec.ca/>*

# Modern Problems & Technologies are Highly Multi-disciplinary & Collaborative



- **Software Engineering:**
  - *Applications, backend systems, security & privacy, connections into cloud and web services (social media, games, email, texting, video conferencing, lost item tracking, etc.)*
- **But also:**
- ***Mechanical Engineering:***
  - Case, water proofing, water ejection, touch sensitive glass, buttons, dial, circuit board physical characteristics
- ***Electrical Engineering:***
  - Power, wireless communications (WiFi, Cellular), Error correction codes, transistors, circuit board electrical characteristics, etc.
- ***Computer Engineering:***
  - Computer memory, cpu and chip design, power efficiency, device drivers, etc,
- ***Biomedical Engineering:***
  - EEG, Heart rate, Pulse Oximeter, Mobility tracking, Sleep tracking, Menstrual tracking, etc.
- ***Civil Engineering:***
  - Interconnecting with Smart cities, smart buildings, emergency response (earthquake, fire, etc.)

# Modern Problems & Technologies are Highly Multi-disciplinary & Collaborative



## Modern Vehicles (and Tomorrow's Self-driving Vehicles):

>500M lines of Code

100+ processors

*Even before considering self-driving cars, vehicular networks, EVs, etc.*

## NPR Story (Sept. 30, 2022):

Automakers' once-in-a-century transformation

Source: <https://one.npr.org/?sharedMediaId=1126083799:1126083800>

“Software engineers are hugely important in EVs”

*Keeping an eye on growing markets & emerging high demand skills is just pragmatic career engineering!*

# Do you already need to be a good/great coder to do SENG?



- **No! You're bright and we are here to teach you!**

*"Software is not the hard part of Software Engineering" – 2023 SENG 499 student*

- You are also not currently not good/great at many other engineering areas:
  - Antennas & waveguides, Power grids (EEng)
  - FPGAs & power efficient circuits (CEng)
  - Fluid dynamics or robotics (Mech)
  - Structures & concrete (Civil)
  - Bioprinting & tissue engineering (BME)Or,
  - Cloud & edge computing, SaaS containerization, software system scalability, cyber-security (SEng)

*Tomorrow's societies will not be less dependent on large-scale software-centric systems and the need to properly Engineer them!*

# Software Engineering is:



Highly Creative & Impactful



Collaborative (at global-scales)



High Societal Impact



High Career Flexibility  
& Mobility



High & Accelerating Global Demand



Challenging & Interesting  
Careers

# Uniquely High Leverage:

*Small teams can (and do) make global impacts!*



In SENG, if you can think of it, you can create it ...



And change the world!



SENG Web Site:

[www.seng.uvic.ca](http://www.seng.uvic.ca)

SENG email contact:

[sengdir@uvic.ca](mailto:sengdir@uvic.ca)

# UVIC Department of Civil Engineering

February 2024

# UVIC



University  
of Victoria



**Civil Engineering**  
The Tech that Builds Society

Deep Green Civil  
**Engineering**

**Civil:  
Engineering**  
for  
& with **People**

**Civil Engineering**  
Heads-Hands-Hearts

# **Civil Engineering**

The **Tech** that **Builds** **Society**

# Vision

- **We build the big stuff**
- **Deliver the infrastructure & service that supports every aspect of society**
- **World-class, innovative research and technology**

Deep **Green Civil**  
**Engineering**

## Vision

We aim to be the **greenest civil engineering** department in Canada addressing the **most pressing global environmental and sustainability challenges** through **engineering design**, science and practical solutions.

We focus on **green civil engineering solutions for Canada and beyond.**

Our **undergraduate** program teaches **fundamental competencies** supplemented with **cutting-edge ideas** from environmental science, building science and industrial ecology.

**Civil:**  
**Engineering**  
for  
& with **People**

# Vision

- Civil Engineering serves **people** and **society**
- Civil Engineers work is **collaborative** and **trans-disciplinary**
- Continuously improve in **professional ethical behavior**, with emphasis on **safety, health, and welfare of the public**, including the protection of the environment and **EDI+R**

# **Civil Engineering**

## Heads-Hands-Hearts

# Learning, Teaching, and Knowledge Generation

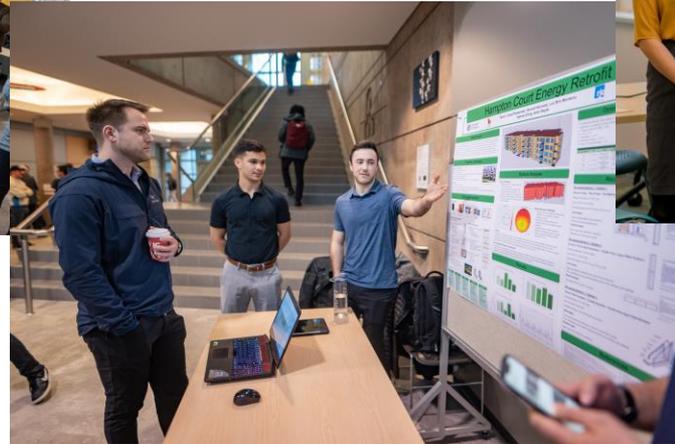
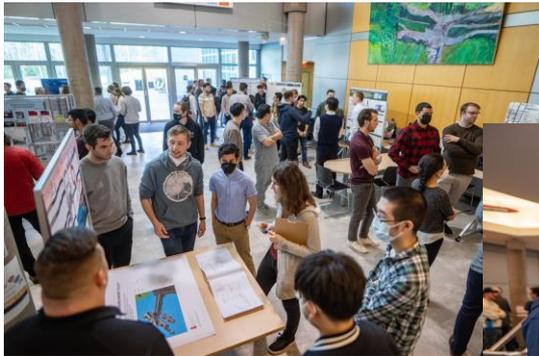
- **Heads:** Knowledge
- **Hands:** Skills
- **Hearts:** Mindset



- How to engineer?
- Why we engineer the way we do?
- How to learn, to teach, to generate new knowledge?

# Teaching: innovative methods

## ○ Problem Based Learning (project based):



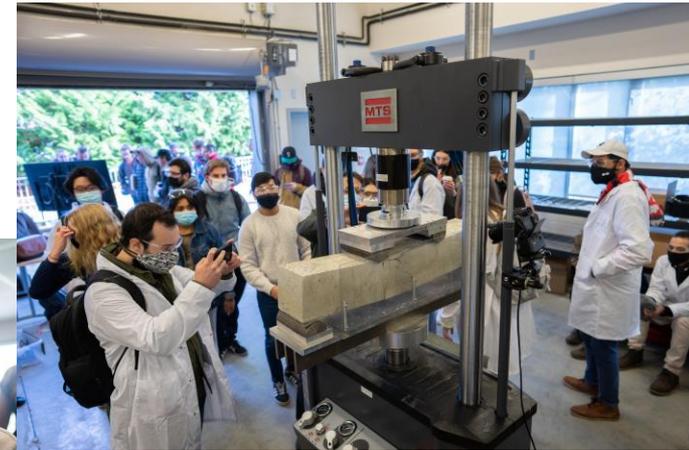
## Teaching: innovative methods

- Committed to hands-on experience:



## Teaching: innovative methods

- Labs with new and cutting-edge equipment and instrumentation:



# Teaching: innovative methods

## ○ Experiential learning: Field school!



## Teaching: innovative methods

- A dedicated technical staff to deliver high quality labs:



## Student Teams... get involved!



# New Buildings

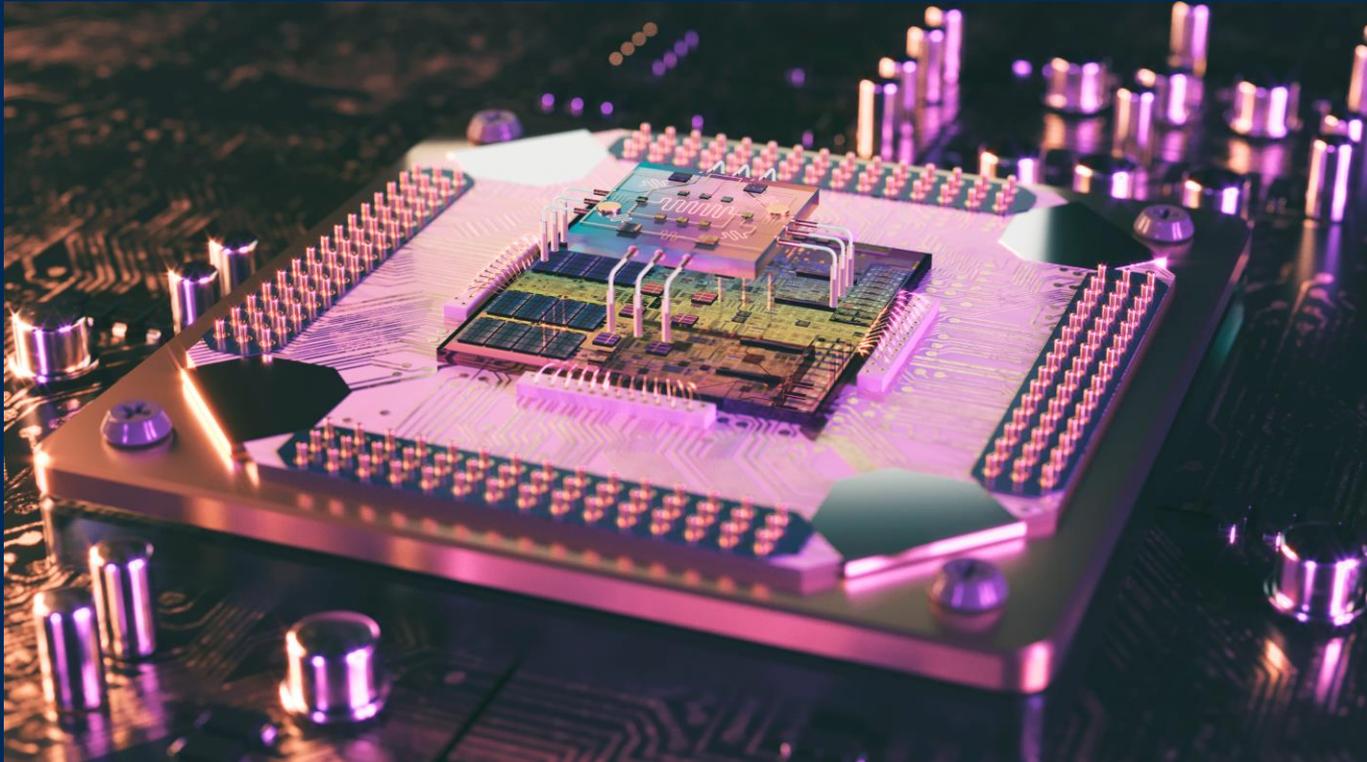


# Faculty





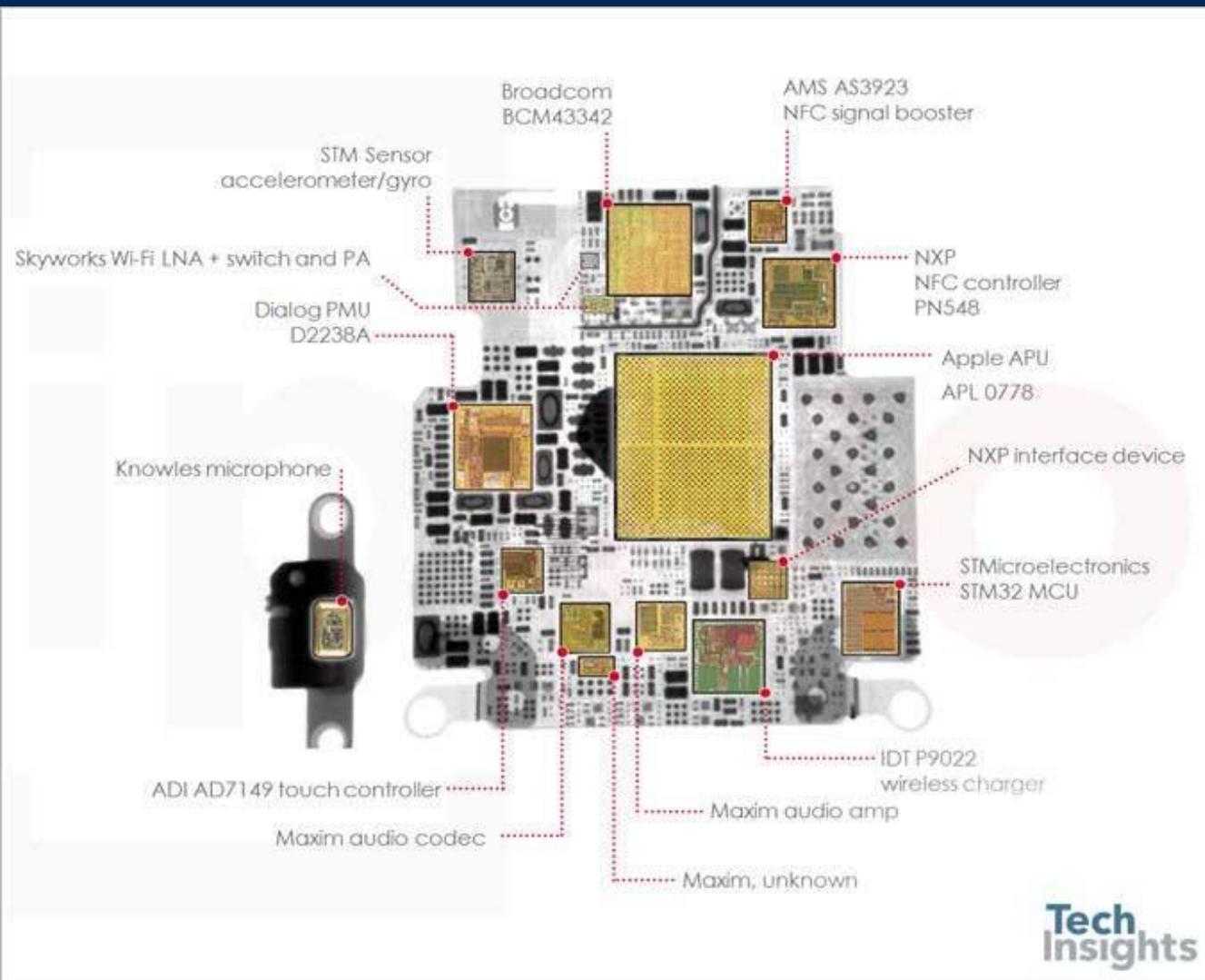
# COMPUTER ENGINEERING



# What is Computer Engineering?

- **CYBER** world (Computer Science, Software Engineering)
    - Software algorithms, software architecture, AI, Internet, cybersecurity, databases, operating systems, etc...
  - **PHYSICAL** world (Electrical Engineering)
    - Sensors, circuits, signal processing, wireless communication, control systems, power, electromagnetics, quantum, etc...
  - **Computer Engineering** translates **CYBER** into **PHYSICAL** and vice versa (must speak **both** languages)
    - Digital hardware, embedded code, computer architecture, portable devices, communication networks, etc...
- 

# Computer Engineering on a small scale



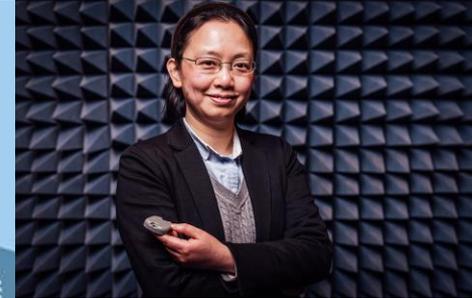
*A look inside:  
**Apple WATCH***

# Computer Engineering on a large scale

Prof. Lin Cai, IEEE Fellow

## V2X: INTELLIGENT TRANSPORTATION

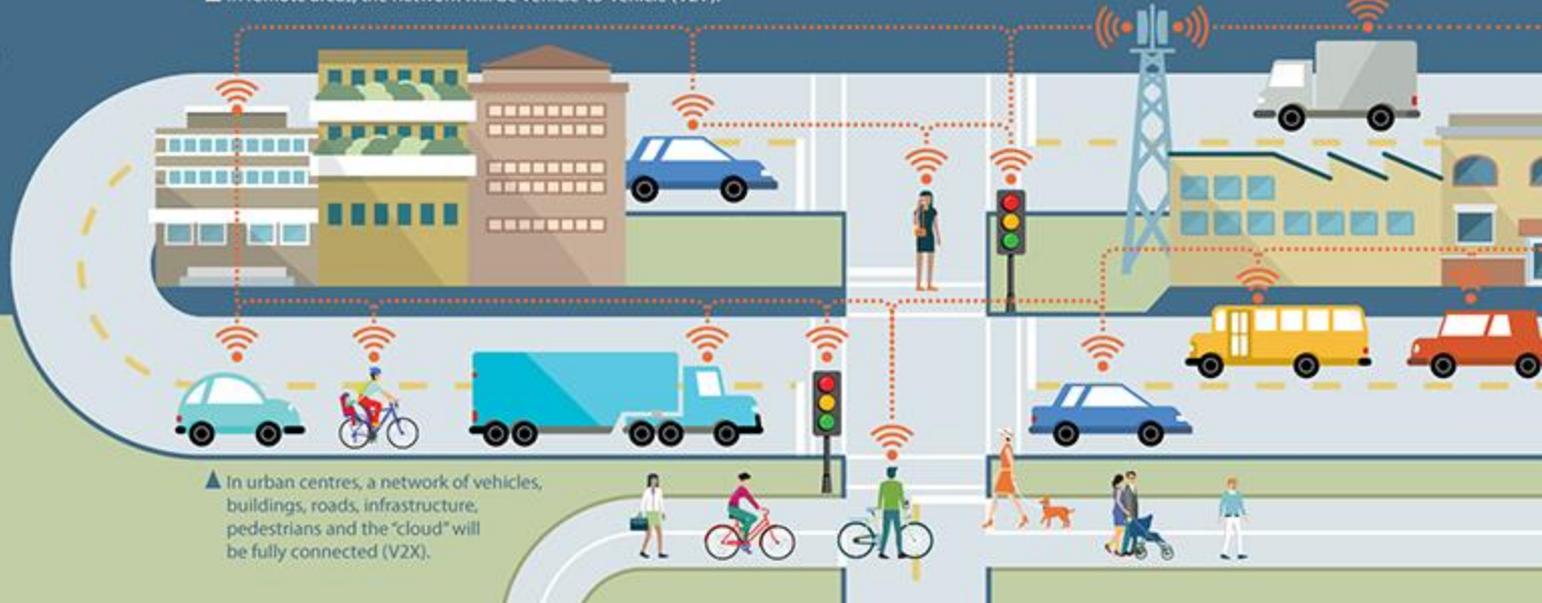
University of Victoria engineer Lin Cai is designing a safe and reliable V2X—vehicle-to-everything—wireless networking solution.



▲ In remote areas, the network will be vehicle-to-vehicle (V2V).

Whether remote or urban, the roads of the future are self-driving.

- ▶ Fewer accidents
- ▶ Less congestion
- ▶ Better fuel efficiency
- ▶ Less air pollution



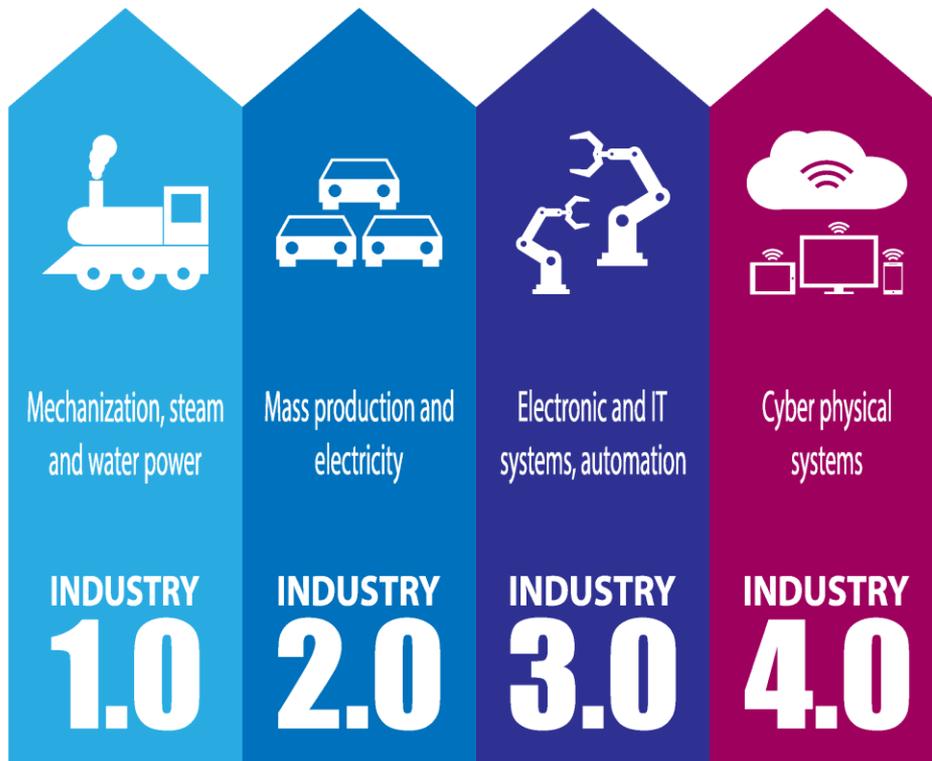
▲ In urban centres, a network of vehicles, buildings, roads, infrastructure, pedestrians and the "cloud" will be fully connected (V2X).



University of Victoria

Transportation of the future: **vehicle-to-everything (V2X) networks**

# New era: Cyber-Physical Systems (CPS)



- What is a **CPS**?

*“An **integration** of computation with physical processes whose behavior is defined by **both cyber and physical parts**”*

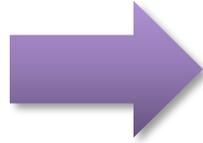
- **CPS** examples:

- “Smart” anything (power grid, buildings, appliances, etc.)
- Medical robotics
- Autonomous vehicles
- *Internet of Things (IoT)*

# Why choose Computer Engineering?

- Anything **cyber-physical** involves **Computer Engineering**
- *“I want to develop **innovative** solutions to **challenging** problems”*
  - Energy-efficient **design**: digital **hardware** + embedded **software**
  - Robust **integration**: embedded **system** + communication **network**
- *“I want my work to have a positive and **significant** impact”*
  - Green computing
  - Mobile healthcare
  - Ambient intelligence
  - And much, much more...

# Embedded Systems



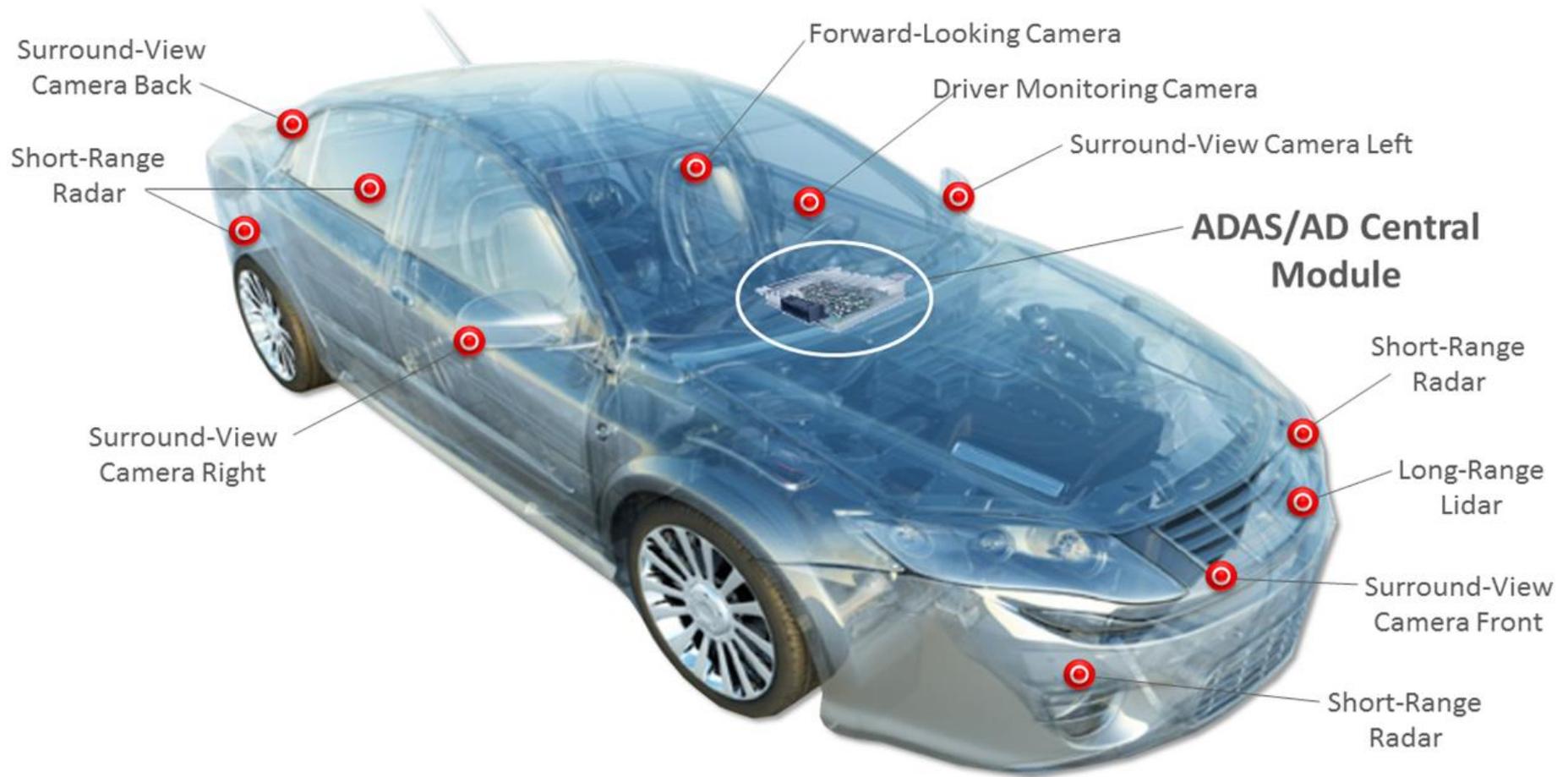
GE Healthcare

Vscan with Dual Probe

Pocket-sized Ultrasound

Unlike general-purpose computers, *embedded systems* are engineered to meet specific application needs.

# Embedded Systems



# We hope to see you next year!

CYBER

**Computer Engineering**  
*hardware + software + system + network*

PHYSICAL

Examples of recent **Computer Engineering Co-OP** placements:

**Schneider**  
Electric

( Victoria, BC )

**intel**

( Burnaby, BC )



**nVIDIA**

( Toronto, ON )

**amazon**

( Toronto, ON )

**AVIGILON**<sup>TM</sup>  
a Motorola Solutions Company

( Vancouver, BC )

**ERICSSON** 

( Ottawa, ON )



**AXYS**  
TECHNOLOGIES INC.

( Sydney, BC )

**GENERAL DYNAMICS**  
Mission Systems-Canada

( Calgary, AB )

**TESLA**  
( Palo Alto, CA )

# UVIC

## ELECTRICAL ENGINEERING



University  
of Victoria

# OBJECTIVES

- Why Electrical Engineering (EEng)?
- Why EEng @ UVic?

# ELECTRICAL ENGINEERING



Clean power generation & integration

# ELECTRICAL ENGINEERING



Transportation electrification

# ELECTRICAL ENGINEERING



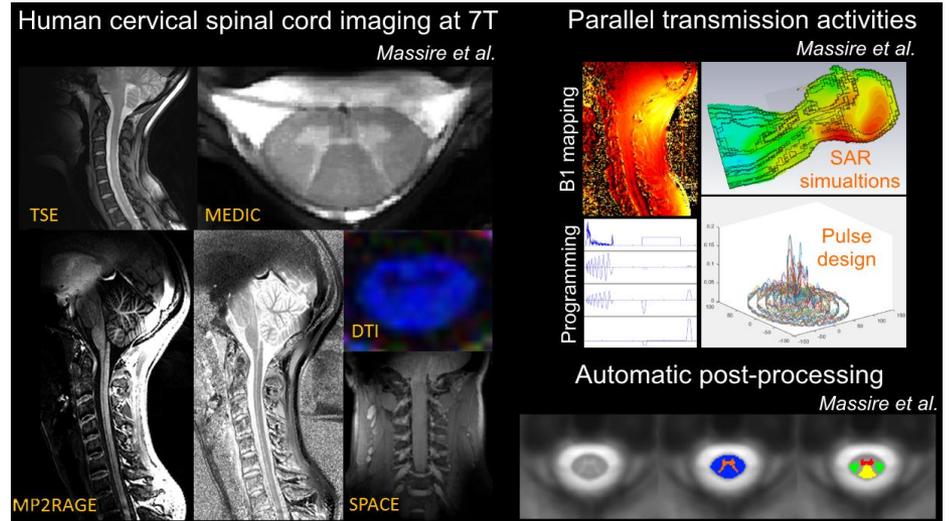
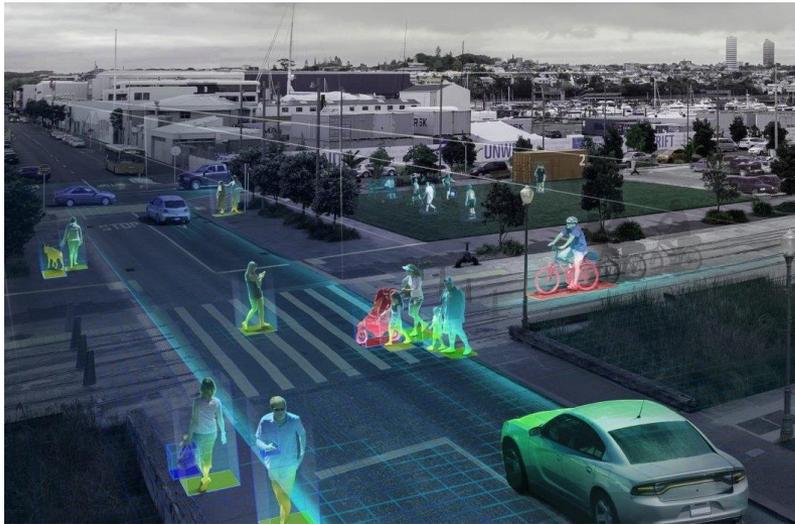
Modern communication & automation

# ELECTRICAL ENGINEERING



Autonomous robots & systems

# ELECTRICAL ENGINEERING



## Computer Vision & Image Processing

# EENG @ UVIC



Hands-on learning: design courses, coop & clubs

# EENG @ UVIC



Innovation at UVic



Coast Capital Savings Funding Luncheon

Research enriched, Community engaged learning

# EENG @ UVIC



Life Is On



# GOOD CAREER PROSPECTS

Engineering Discipline	Expected Job Openings in BC (2022-2032)	Job Growth Rate (Annual)
Computer	1760	+2.8%
Electrical and Electronics	2530	+1.5%
Mechanical	2300	+1.4%
Civil	4670	+1.6%
Software	9980	+3.5%

Solid on-going demand for Electrical and Computer Engineers

Figures taken from Work BC website, <https://www.workbc.ca/plan-career/explore-careers>, Accessed February 2024.

# SUMMARY

- Co-op opportunities
- Engineering clubs
- Project Based learning
- Research opportunities
- Entrepreneurship
- Green & Renewable energy
- Transportation Electrification
- Modern Communication
- Autonomous Robots
- Computational Intelligence

# MECHANICAL ENGINEERING @ UVIC



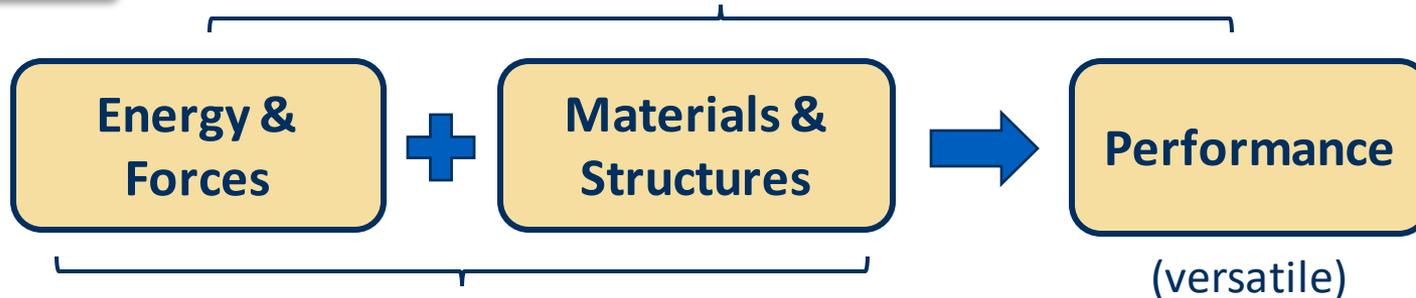
Program information: Feb 13<sup>rd</sup>, 2024  
Dr. Bosco Yu (Assistant Professor)

# What is mechanical engineering?



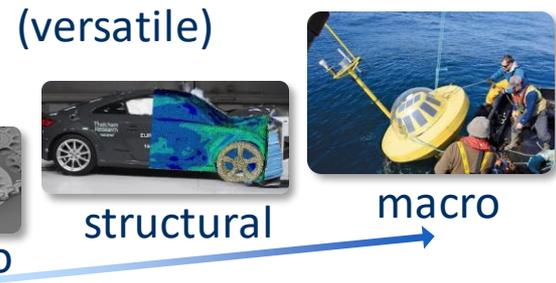
## Engineering Design

(creative, hands-on, tangible impact)

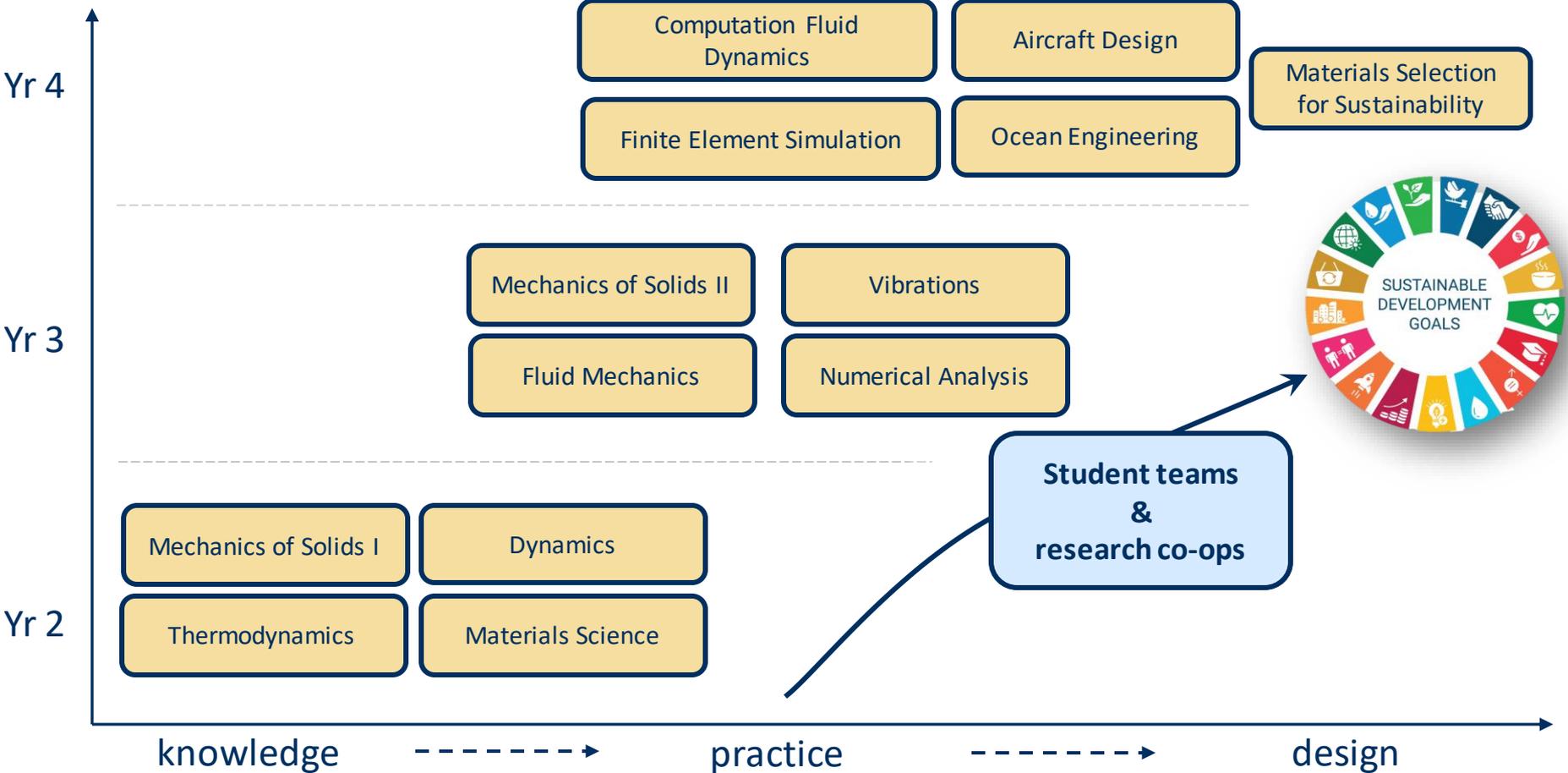


## Physics: Mechanics

(motion, deformation, dynamics)



# Program Structure:



# We are essential in many UVic student teams: Deeper! Faster! Higher! Farther!



Higher! (Rocketry)



Higher! (Aero)



Farther! (Satellite)



*launched in Nov 2022!*

Deeper! (Submarines)



Faster! (Formula cars)



# Your professors are also designers!

## Research Opportunities in Sustainable Development



Dr. Valeo



Dr. Buckham



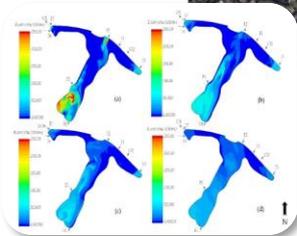
Dr. Dong



Dr. Suleman



Dr. Crawford



Using Google Earth to locate clean water



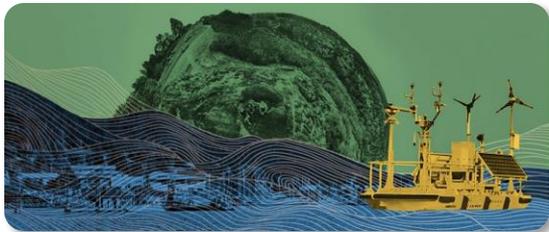
Wave electricity generators & Hybrid electric ships



Using electric planes to monitor ecosystems

# Research Centers @ MECH. Tailor your own path!

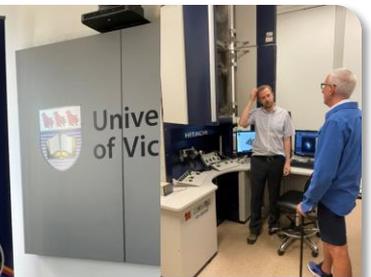
## Climate Action



## Aerospace/Transportation



## Manufacturing & Discovering New Materials

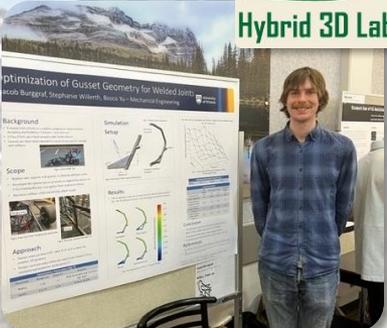


# Some alumni success stories from MECH UVic

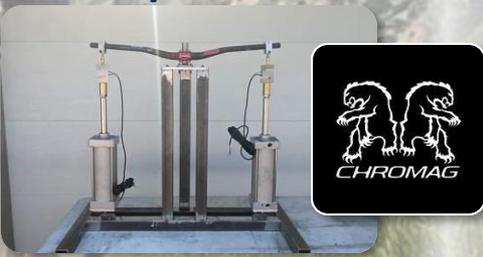
**Jacob Burggraf, EIT (B.Eng 2024)**

**Club**

**Co-op**



**Capstone**



**Emma Rautio-Roe, EIT (B.Eng 2024)**

**Elective: Materials Selection for Sustainability Development**



**Materials Selection for Telescope Design**



**Supervisor:**



**Jeff Crane, P. Eng (UVic B.Eng 2011)**



**Mercedes Baylis, P. Eng**

(2003)

(B.Eng 2005)  
(MAsc 2013)



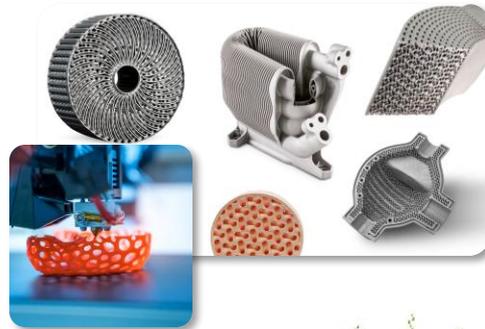
(Director of Fleet Management at BC Ferries)

# So, is MECH a good choice for you? Well... do you like:

**Being hands-on?**



**Being creative?**



**Working with people?**



**Have a versatile professional degree  
& making a tangible impact?**



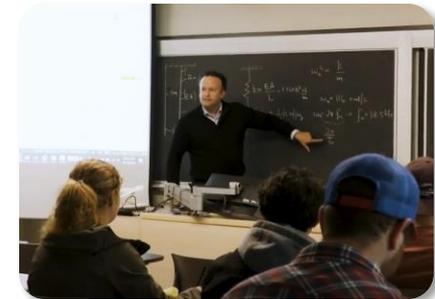
**If your answer is “YES”,  
then UVic MECH is for you!**

# Have any questions? Our doors are always open!

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# Summary

*With such an interdisciplinary faculty,  
there are no wrong choices!*

*Each department has great things to  
offer.*

Questions?

Don't forget about the Program Information Fair today in the ELW Lobby until 5:00 PM!



There will be Program and Academic Advising Booths and Pizza!  
Grab your Pizza ticket on the way out