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Education

University of British Columbia

Vancouver, Canada

B.A.Sc. ENGINEERING PHYSICS & MINOR IN COMMERCE

Sep 2013 - May 2018

- A physics and applied mathematics program enriched by design fundamentals in electrical, software, and mechanical engineering.
- One of 25 entering engineering students admitted to Pre-Med Alternative Path.

Eidgenössische Technische Hochschule Zürich (ETHZ)

Zürich, Switzerland

INTERNATIONAL EXCHANGE – DEPARTMENT OF MECHANICAL AND PROCESS ENGINEERING

Sep 2016 - Dec 2016

- Studied graduate level courses as undergraduate technical electives.
- Highlighted courses: Quantitative Flow Visualization, Plasmonics, and Radiation Heat Transfer.

St. Michaels University School

Victoria, Canada

HIGH SCHOOL DIPLOMA

Sep 2009 - Jun 2013

Research & Work Experience

Embrace Orthopaedics

Vancouver, Canada

ENGINEERING PHYSICIST

Oct 2018 – Present

My work spans researching, designing, and implementing new tools and collaborations to enable the development and testing of our current knee bracing product.

- Implemented image pattern matching and 3D spatial-temporal mesh reconstruction as well as other advanced computer vision techniques in MATLAB to support the mechanical development of a proprietary orthopaedic brace.
- Reduced camera calibration error x8 by implementing a simulated annealing optimizer on intrinsic and extrinsic camera parameters.
- Developed a graphical user interface in MATLAB to easily visualize and analyze 3D mesh data.
- Supervised engineering interns and collaborated in designing and developing an automated test jig to determine and confirm the mechanical efficacy of the brace.
- Developed and conducted pilot studies together with physiotherapists under the guidelines of Research Ethics Board of Canada.

Dynamic Optics

Port Coquitlam, Canada

PROJECT COORDINATOR & MECHANICAL ENGINEER

Jun 2018 – Oct 2018

I managed mechanical designs, optimized the optical and fluid subsystems, and coordinated among key industry stakeholders for the HyDRA optical mirror polisher project.

- Designed an automated slurry recovery system for a proprietary hydrodynamic robotic mirror polishing system (HyDRA).
- Developed preliminary designs for an optical metrology system using both commercial and experimental interferometry systems.
- Supervised mechanical engineering co-op students on the design of HyDRA force plates and safety systems surrounding a KUKA robot.
- Coordinated project timelines, budgets, and development for employees of Dynamic Optics and held monthly board meetings to update all stakeholders.

Nanoplasmonics Laboratory, University of Victoria

Victoria, Canada

RESEARCH INTERN WITH DR. REUVEN GORDON

May 2017 – Aug 2017

I was awarded an NSERC Research Award to perform analysis, literature review, and manuscript writing. My contributions resulted in two peer-reviewed publications (journal and conference paper).

- Studied the use of double-nanohole (DNH) apertures in an optical tweezing experiment to analyze protein composition of heterogeneous egg white solutions [2,4].
- Developed autocorrelation and standard deviation analyses on Brownian motion signals of trapping events to characterize and identify proteins based on molecular mass (MATLAB).
- Assisted in the design of focus ion beam fabricated DNHs and measured the degradation of DNHs using a scanning electron microscope.

Human Interaction Robotics Laboratory (RREACH), University of British Columbia

Vancouver, Canada

MECHATRONICS ENGINEERING INTERN WITH DR. MACHIEL VAN DER LOOS

May 2016 – Aug 2016

I was awarded an Undergraduate Student Research Award Fellowship for conducting clinical studies and developing the SleepSmart V2 prototype. My work and manuscript successfully aided biomedical engineering graduate students to develop the full device.

- Developed a version two prototype of a biomedical device, SleepSmartV2 – a mattress topper for detecting body temperature, movement, and posture over time of a sleeping person.
- Interfaced digital sensors with a PIC18F4550 microcontroller by implementing SPI and UART communication protocols to process real-time temperature and accelerometer data for SleepSmart V2 (LabVIEW, MATLAB).
- Conducted human research trials with SleepSmartV1 under the guidelines of the Research Ethics Board of Canada.

Max Planck Institute for the Structure and Dynamics of Matter

Hamburg, Germany

OPTICS RESEARCHER & PROGRAMMER INTERN WITH DR. WESLEY ROBERTSON

Jan 2015 – Apr 2015

I developed software and hardware for optical instrumentation experiments and aided in conducting experiments. My contribution resulted in a peer-reviewed journal publication.

- Studied the use of an auto-alignment imaging system with experiments using picosecond laser ablation to wetted wells in a nanofabricated structure [3].
- Developed programming routines and optimized parameters for the imaging based auto-alignment system for high-throughput sampling and achieved a sampling frequency of 16 Hz and an alignment accuracy of $3.7\mu\text{m}$ (LabVIEW, MATLAB).

Research Publications

JOURNAL PUBLICATIONS

1. Y. Lu, C. L. Pieterse, D. Eggert, **C. J. X. Ip**, F. Busse, S. Keskin, W. D. Robertson, and R. J. D. Miller. “Direct Laser Sampling of Aqueous Solutions from Lab-on-a-Chip Devices for Mass Spectrometry.” (In preparation, available on request.)
My contributions: aided in performing experiments and development of instrumentation.
2. N. Hachohen, **C. J. X. Ip**, and R. Gordon. “Analysis of Egg White Protein Composition with Double Nanohole Optical Tweezers”. *ACS Omega*. 2018, 3, 5, 5266-5272. doi.org/10.1021/acsomega.8b00651.
My contributions: aided in performing analysis and manuscript writing.
3. W. D. Robertson, L. R. Porto, **C. J. X. Ip**, M. K. T. Nantel, F. Tellkamp, Y. Lu, and R. J. D. Miller. “Note: A simple image processing based fiducial auto-alignment method for sample registration.” *Rev. Sci. Instrum.* 2015, 86. 086105. doi.org/10.1063/1.4929408.
My contributions: aided in performing experiments, development of instrumentation, and manuscript writing.

CONFERENCE PROCEEDINGS

4. N. Hachohen, **C. J. X. Ip**, G. K. Laxminarayana, T. S. DeWolfe, and R. Gordon. “Nanohole optical tweezers in heterogeneous mixture analysis”. *Proc. SPIE 10347, Optical Trapping and Optical Micromanipulation XIV 103470F*, 2017. doi.org/10.1117/12.2273358.
My contributions: aided in performing analysis and manuscript writing.

Technical Projects

Snake Game - A* Implementation

Victoria, Canada

COMPETITION TO DEVELOP A SNAKE PLAYER FOR BATTLESNAKE IO

Spring 2019

- Implemented the A* (A-Star) algorithm in Python to automate path-finding for our snake to compete in the Battlesnake competition.
- See Project:  [git.io/fjznh](https://github.com/fjznh)

Optics Experiments

Vancouver, Canada

SERIES OF EXPERIMENTS CONDUCTED FOR PHYSICS 408 AT UBC

Spring 2018

- Performed and analyzed results on three separate experiments: characterization of the HeNe Laser spectrum and mode-control, understanding Fourier optics, and building a Michelson Interferometer.
- Applied classical electromagnetic theory to calculate predicted experimental outcomes and compared them to experimental results.

Experimental Physics

Vancouver, Canada

SERIES OF EXPERIMENTS CONDUCTED FOR ENGINEERING PHYSICS 352 AT UBC

Fall 2017

- Presented a poster on pulsed nuclear magnetic resonance (NMR) experiments and became familiar with basic RF pulse sequences (using π -pulses and $\pi/2$ -pulses) and its effect on the magnetization of nuclei. Explored the unique characteristics of free induction decay signals and spin echoes of various samples.
- Wrote a scientific paper on the characterization and analysis of material acoustic impedance using acoustic experiments and measuring acoustic pressure ratios.
- Presented on the experimental outcomes of using gamma ray spectroscopy to identify unknown elements and the process of using spectroscopic analysis techniques.

Electrical Impedance Tomography

Vancouver, Canada

PROJECT FOR APPLIED MATHEMATICS IN APPROXIMATION AND VARIABLE METHODS, MATH 406 AT UBC

Fall 2017

- Studied Green's function methods for finite element and boundary element formulations.
- Implemented the solution to an inverse problem to image anomalies e.g. a "tumor", given measurements of field quantities.
- See Project: git.io/vxP3h

Affordable Network Sensors for Alpine Environments

Vancouver, Canada

CAPSTONE PROJECT, TEAM OF TWO: SOFTWARE AND ELECTRICAL LEAD

Fall 2017

- Designed and prototyped a low-powered and cost-effective humidity and temperature sensor for backcountry Alpine environments.
- Programmed C and C++ on a Cortex M0, Nordic Semiconductor nRF51822 microchip, and implemented I2C communication protocol to communicate with digital sensors.
- Developed a solar-powered battery recharging circuit for the sensor system.

Senior Design Engineering Robot Competitions

Western Canada

AUTONOMOUS ROBOT DESIGNS, TEAM OF FOUR

Fall 2015 - Fall 2017

- Developed autonomous robots for each competition with VEX over an 8 hour span before presenting to a panel of technical judges from industry.
- Placed first at UBC Senior Design competition and was invited to represent UBC at the 2016 Western Engineering Robot Competition in Kelowna, BC.
- See Competitions: <https://git.io/vx6Rb>

Thermal Time-Of-Flight Flow Meter

Vancouver, Canada

CAPSTONE PROJECT, TEAM OF THREE

Sep 2016 - Apr 2017

- Developed an electro-mechanical device to detect flow velocity within a PVC pipe using a thermal time-of-flight principle for use in a helium recovery system.
- Prototyped with thermocouples and nichrome wire and acquired signals through Arduino which were processed in MATLAB.
- Improved the signal-to-noise ratio of microvolt signals by implementing low-pass filters in hardware and autocorrelation analysis in software.

Simulating Radiative Heat Transfer

Zurich, Switzerland

PROJECT FOR RADIATION HEAT TRANSFER COURSE AT ETH

October 2016

- Implemented Monte-Carlo Methods in MATLAB to find the configuration factor and net energy radiation from two different surfaces at differing emissivities and temperatures.
- Compared the Monte-Carlo simulation to the analytical solution calculated using the "Radiosity" method.

Formula Electric / E-Racing, University of British Columbia

Vancouver, Canada

ENGINEERING STUDENT TEAM: ELECTRICAL TEAM MEMBER

Sep 2014 - Aug 2016

- Developed circuitry for the Tractive System Active Light and designed a 3D printed waterproof casing for the car.
- PCB layout, mechanical braking systems, component specification, waterproofing, and CAD.
- See Website: <http://www.ubcformulaelectric.com/>

Autonomous Robot for Object Retrieval

Vancouver, Canada

PROJECT FOR ENPH 253, TEAM OF FOUR

Summer 2015

- Designed, prototyped, and developed a fully autonomous robot using in-house modified Arduino microcontroller and electro-mechanical components such as servo and DC motors, IR sensors, sheet and bulk metals and 3D printed components.
- Designed and implemented the software for PID control and machine states (Arduino IDE) and interfaced with sensors and actuators.
- See Project: <https://goo.gl/7Vdaqm>

Orbit, University of British Columbia

Vancouver, Canada

ENGINEERING STUDENT TEAM: STRUCTURAL SUB-TEAM MEMBER

Sep 2013 - Apr 2014

- Designed a vacuum flange for testing the satellite in sub-atmospheric conditions (SolidWorks).
- Vacuum systems, mechanical prototyping, and waterjet cutting.
- See Website: <https://www.ubcorbit.com/>

Honors & Awards

COMPETITIONS

- | | | |
|------|--|-------------------|
| 2017 | 2nd Place , The University of British Columbia, Senior Design Competition | Vancouver, Canada |
| 2015 | 1st Place , The University of British Columbia, Senior Design Competition | Vancouver, Canada |

AWARDS

- | | | |
|------|--|-------------------|
| 2018 | Dean's Honour List | Vancouver, Canada |
| 2017 | NSERC Undergraduate Student Research Award | Victoria, Canada |
| 2016 | Engineers in Scrubs Undergraduate Student Research Award Fellowship | Vancouver, Canada |
| 2016 | Applied Science Coordinated International Exchange Award | Vancouver, Canada |
| 2013 | District Dogwood Authority Award Scholarship | Victoria, Canada |
| 2013 | Carol Lobb Award for Athletics, Good Academic Standing, and Contribution to School Community | Victoria, Canada |
| 2013 | Atheletic Director's Merit Award | Victoria, Canada |

Professional Development

CONFERENCES & COURSES

- | | | |
|----------|--|-------------------|
| May 2019 | Stanford d.School: Research as Design Pop-Out Course. | Stanford, USA |
| Mar 2019 | BC Tech Summit. <i>Company Representative & Attendee.</i> | Vancouver, Canada |
| May 2016 | Innovation in Health and Research Technologies Symposium. <i>Student Attendee.</i> | Vancouver, Canada |

CERTIFICATION

- | | | |
|------|---|-------------------|
| 2017 | Laser Safety Training | Victoria, Canada |
| 2017 | Workplace Hazardous Materials Information System (WHIMIS) Training | Victoria, Canada |
| 2016 | Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Course on Research Ethics | Vancouver, Canada |

Leadership Experience

STEM Mentoring Cafe

Vancouver, Canada

VOLUNTEER MENTOR

Fall 2019

- Participated in mentoring events as part of Open Science Network for high school students to discuss with STEM professionals and learn about various fields.

Shad Program Mentor

Vancouver, Canada

VOLUNTEER MENTOR

July 2019

- Mentored as a Team Project Mentor for a group of high school students involved in the Shad Program, a month-long STEAM and entrepreneurship program for students to develop a solution to real-world problems in food security, water management and waste.

Volunteer Judge for Robotics Events

Vancouver/Victoria, Canada

VEX & FIRST ROBOTICS JUDGE

Spring 2018 - Spring 2019

- Volunteered as a judge for high-school level student robotics teams for VEX and FIRST Robotics competitions and events.

VP Graduate Representative

Vancouver, Canada

ENGINEERING PHYSICS STUDENT ASSOCIATION

Sept 2017 - April 2018

- Organized the graduate class of Engineering Physics to meet graduation requirements.
- Prepared funding documentation and organized a professional development trip for the graduate class of Engineering Physics to San Francisco to network with Graduate Schools and industries.

Engineering Physics Student Mentorship Program

Vancouver, Canada

VOLUNTEER MENTOR

Sept 2017 - April 2018

- Coordinated weekly activities and events for my mentorship group were are current Engineering Physics 2nd years.

VP Events Executive

Vancouver, Canada

ENGINEERING PHYSICS STUDENT ASSOCIATION

Sept 2015 - May 2017

- Organized successful social events for students, faculty, and alumni.
- Acquired over \$15,000 in funding and other sponsorships from university organizations and private companies for annual events and obtained licensing for Engineering Physics related events.

Outdoor Leader

Victoria, Canada

ST. MICHAEL'S OUTDOOR LEADERSHIP PROGRAM

Sept 2011 - June 2013

- Guided a five-day sea kayaking trip around the Gulf Islands for a group of grade 10 students.
- Developed skills, including wilderness first aid, to plan, organize, and lead outdoor trips.

Badminton Coach

Victoria, Canada

PACIFICSROT REGIONAL BADMINTON CENTRE

Summers of 2009 - 2013

- Coached youths aged 7-16 for various badminton programs.
- Developed responsibility, judgement, and decision making skills to ensure an engaging and safe environment.