Adam Schonewille

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Education

University of Toronto — *Toronto, Canada*

MASc, in Mechanical and Industrial Engineering, *with Emphasis on Robotics and Mechatronics* — *Sept. 2018 - Mar. 2022*

University of British Columbia — *Vancouver, Canada*

BASc, in Engineering Physics, *with Specialization in Mechanical Engineering* — *Sept. 2013 - May 2018*

Aldergrove Community Secondary School — *Aldergrove, Canada*

BC Certificate of Graduation (Dogwood Diploma), *Valedictorian, Governor General's Award* — *Sept. 2008 - June 2013*

Research & Work Experience

University of Toronto – Department of Mechanical and Industrial Engineering — *Toronto, Canada*

Graduate Research Position / Technical Communications Teaching Assistant — *Sept. 2018 – Mar. 2022*

About: Under the supervision of Dr. Eric Diller, I developed a clinical magnetic actuation system responsible for wirelessly controlling robotic microsurgical tools targeting minimally-invasive neurosurgery. Technical information about the project can be found in the Technical Projects section.

- **Prototype I:** Designed and built a mechatronic system prototype consisting of four rotating permanent magnets positioned around a brain phantom for controlling a microrobot inside the brain in a mock neurosurgery trial.
- **Experimental Design:** Carried out several successful tumor resections using a cooked pea to simulate the pineal region tumor. Several different microrobot designs were tested and compared to one another to help guide the design process of the neurosurgical tools by finding design flaws as well as advantages in practice.
- **Electromagnetic Simulations:** Investigated the effect that electromagnet geometry has on the efficiency of magnetic field generation by simulating configurations in Ansys and COMSOL. Used findings to implement a 40 DOF optimization routine in MATLAB for determining the best system configuration using a novel control scheme.
- **Prototype II:** Designed and built the optimal system configuration based on simulations. The resulting system provides surgeons with more access to the patient during operation than any existing system available and serves as a surgical platform for future works in the Microrobotics Lab. More information can be found in the Technical Projects section.
- **Supervisor Role:** Acted as supervisor to a summer co-op student for the 3 month work term. Oversaw mechanical designs and experiments to aid in guiding their research project. Also supervised an 8 month thesis undergraduate student working to automate the calibration process of one of our magnetic actuation systems.
- **Marking and Constructive Criticism:** Provided guidance in technical communications to a class of 20 graduate researcher students.

Dronelogics Systems Ltd. / Candrone — *Burnaby, Canada*

Robotics Engineer/Drone Technician — *June 2018 – Aug. 2018*

About: Worked in a fast-paced, small start-up environment with < 10 employees. Built upon two car-mounted robotic arms which controlled a camera gimbal for filming car chase style shots in movies and commercials.

- **Robotic Arms:** Fixed several controllability issues in software and improved the robustness of the electrical design of two different robotic arm prototypes: a 1 DOF arm and a 2 DOF arm.
- **Electrical Circuit Design:** Designed and built circuits for DC high voltage and current power switching, RFID wireless communication, brushed and brushless DC motor speed control, signal wiring, and micro-controller processing (Arduino).
- **Software Development:** Developed the software in C/Arduino to control the pan and tilt motions of the robotic arms, including implementing safety features and fail-safes. Improved the overall responsiveness of the controller.
- **Commercial Production and Manufacturing:** Collaborated to develop controller prototypes (electrical components, packaging and enclosures) as well as plans for future mass production of designed controllers.
- **Documentation:** Kept a detailed documentation of engineering work and system functionality to streamline the project hand-off.
- **Troubleshooting and Repairs:** Aided in the diagnosis and repair of several commercially available drones for multiple clients.

University of British Columbia – Faculty of Applied Science

Vancouver, Canada

Robotics Teaching Assistant

May 2018 – Aug. 2018

About: The ENPH 253 summer course is a condensed 4 month course where students design, fabricate, and test prototype autonomous robots culminating in a competition against their peers in a competition at a end. Students design and build their own motor controller circuits, filters, IR detection circuits, power distribution circuits, as well as constructing everything from the robots chassis to wheels and appendages. Students have access to tools such as a water jet cutter, laser cutter, 3D printers, drill press, mills, lathe, and power tools to build their robots.

- **Troubleshooting:** Helped students debug their circuits when they broke or worked unexpectedly. Provided guidance in electrical changes and improvements. Analyzed student's code to help fix electrical problems. Showed students the microcontroller electrical schematics to show them how to solve their problems.
- **Mechatronics projects:** Miscellaneous projects the instructor outsourced to me. These included making IR beacons, a RFID tag door opener, and the electronics of the competition surface.
- **Teaching and Advising:** Commented on students mechanical designs and provided insight. Helped students brainstorm solutions to their mechanical design problems. Provided suggestions to electrical circuit design to reduce noise and enhance performance.

NORAM Engineering and Constructors Ltd. – Electrochemical Group

Vancouver, Canada

Mechanical Engineer Co-op

May 2017 – Aug. 2017

About: NORAM is a Vancouver-based company that develops, engineers, and commercializes technologies and equipment packages for the chemical, pulp and paper, minerals processing, and electrochemical sectors. They also work with early-stage technology companies providing engineering design and fabrication support, as well as giving advice in technology commercialization.

- **Mechanical Design:** Worked within the Electrochemical group as a mechanical engineer co-op. Gained practical experience in mechanical design, SolidWorks modeling, prototyping, piping, structural mechanics, fluid dynamics and heat transfer.
- **Commercial Production:** Helped to design and build the infrastructure necessary for assembly production of commercial cells to build a commercial plant. Contributed substantial work to multi-million dollar projects.
- **Documentation:** Wrote reports to send to clients, documented prototype progress and kept a detailed logbook of research and development experiments.

Laser Zentrum Hannover e.V. – Laser Micromachining Group

Hannover, Germany

Additive Manufacturing Research Position with Dr. Kotaro Obata & Arndt Hohnholz

May 2016 – Dec. 2016

About: Laser Zentrum Hannover is a research institute supported by the Lower Saxony Ministry for Economics, Labour and Transport, and is devoted to the selfless promotion of applied research in the field of laser technology and optics.

- **Independent Research:** Conducted various experiments in additive manufacturing with new materials. Gained experience with PDMS and micro-fluidics as well as micro-stereolithography with unique polymers and acrylates.
- **Academic Publications:** Wrote and edited papers based on findings. Co-author on two manuscripts.
- **Safety Training:** Trained for Laser Safety as working environment included optics and hazardous lasers. Trained and worked with toxic and combustible chemicals.

University of British Columbia – Department of Chemistry and Physics

Vancouver, Canada

Technical Undergraduate Research Assistant for Dr. Takamasa Momose

Jan. 2015 - Apr. 2015

About: Worked in Dr. Takamasa Momose's lab conducting research on the physics and chemistry of extremely cold molecules and atoms. The lab contains various operational apparatuses including Zeeman and Stark decelerators, counter rotating nozzles, and a parahydrogen matrix system for making cold and ultracold molecules.

- **Machining Experience:** Utilized lathes, milling machines, drill press, power tools, hand tools, a waterjet cutter and laser cutter to quickly create working prototypes for use in the lab.
- **Data Acquisition and Analysis:** Worked with several graduate students simultaneously, helping run multiple experiments. Performed data acquisition and analysis through MATLAB simulations.
- **Research Assistant:** Presented several times to colleagues as part of scheduled weekly meetings. Received acknowledgement for my work in the lab in both a PhD thesis and published paper.

Technical Projects

Maximizing Workspace Accessibility in Magnetic Actuation of Tethered Microsurgical Tools using Non-uniform Magnetic Fields

Toronto, Canada

Master's Thesis Research Project

Sept. 2018 - Mar. 2022

- **Mechanical Design:** Structural design of a system weighing > 1000 lbs, coolant system design to avoid electrical overheating, plumbing and piping assembly of coolant, and machining of components on the lathe and milling machine based on CAD drawings.
- **Electrical Design:** Power electronics circuit design, analog I/O signals, signal amplification and filtering circuit design.
- **Software Integration:** Programmed a GUI in Qt and C/C++ to interface with a DAQ board via PCIe to control servo drivers via reference voltages. Added joystick functionality for the user to intuitively control the surgical tool with a game controller (Xbox360 or PS3). Implemented optimization algorithms for accelerating calculations to achieve real-time control of complex magnetic interactions.

Obstacle Avoidance Software for Industrial Robotic Arms – Capstone II *Vancouver, Canada*

Solo: Software Lead *Sept. 2017 - Jan. 2018*

- Developed a MATLAB simulation of an industrial robot to find the shortest collision-free path between two points.
- Created a pipeline in MATLAB and Simulink to convert from a CAD assembly file of a robot arm into a dynamic MATLAB model. The model was then used to plan a trajectory that avoids obstacles and prevent collisions.
- Programmed the model to simulate its motion and produce the joint variables of the robot needed to follow the path that is produced.

Thermal Time-of-Flight Flow Meter – Capstone I *Vancouver, Canada*

Team of Three: Technical Manager, Mechanical Lead *Sept. 2016 – Apr. 2017*

- Developed an electro-mechanical device to detect fluid velocity within a pipe using a thermal time-of-flight principle for the integration in a helium recovery system.
- Utilized thermocouples as temperature sensors and nichrome wire as heaters and acquired signals through Arduino and processed in MATLAB.
- Implemented noise-reduction techniques for micro-voltage signals in both hardware and software.
- Gained experience in circuit analysis, debugging, noise reduction techniques, mechanical design, and prototyping.

Autonomous Robot for Object Retrieval – ENPH Annual Robotics Competition *Vancouver, Canada*

Team of Four: Mechanical Lead and Electrical Integration, http://engfuzz.wixsite.com/engfuzz *May 2015 - Aug. 2015*

- Designed, prototyped, and developed a fully autonomous robot using an in-house modified Arduino microcontrollers and electrical and mechanical components such as servo and DC motors, IR sensors, sheet and bulk metal and 3D printed components.
- Gained experience in PID control, circuit building, C programming, 3D printing, SolidWorks modeling, laser cutting, and water-jet cutting.

Formula Electric / E-Racing – University of British Columbia *Vancouver, Canada*

Engineering Student Team Member, http://www.ubcformulaelectric.com/ *Sept. 2015 - May 2016*

- Utilized lathes and milling machines to machine and fabricate various chassis components including suspension mounts, adapters, and shaft couplings.
- Gained experience in fibreglass patching and molding.

3D Printer Hobby Project – Self Sponsored *Vancouver, Canada*

Engineering Student *Sept. 2015 - May 2018*

- Designed and built an FDM 3D printer in my spare time. Made CAD models of my designs in SolidWorks.
- Machined parts and assembled the prototype using the lathe, mill, drill press and waterjet cutter available to me.
- Implemented PID control theory on an Arduino for regulating nozzle temperature at 200 °C .

Research Publications

Journal Publications

A. Lim, **A. Schonewille**, C. Forbrigger, T. Looi, J. Drake, and E. Diller, "Design and Comparison of Magnetically-Actuated Dexterous Forceps Instruments for Neuroendoscopy." *IEEE Transactions on Biomedical Engineering*, vol. 68, no. 5, pp. 4415-4425, 2021.

K. Obata, **A. Schonewille**, S. Slobin, A. Hohnholz, C. Unger, J. Koch, O. Suttmann, and L. Overmeyer, "Hybrid 2D patterning using UV laser direct writing and aerosol jet printing of UV curable polydimethylsiloxane." *Applied Physics Letters*, vol. 111, no. 12, pp. 121903, 2017.

K. Obata, S. Slobin, **A. Schonewille**, A. Hohnholz, C. Unger, J. Koch, O. Suttmann, and L. Overmeyer, "UV laser direct writing of 2D/3D structures using photo-curable polydimethylsiloxane (PDMS)." *Applied Physics A*, vol 123, no. 7, pp. 1-5. 2017.

Conference Proceedings

C. Forbrigger, **A. Schonewille**, and E. Diller, "A Miniature Magnetic Robot with Tailored Magnetic Torsion Springs," *IEEE International Conference on Robotics and Automation*, 2021.

Patents Filed

C. Forbrigger, **A. Schonewille**, and E. Diller, "Magnetic Torsion Spring for a Magnetically Actuated Mechanism and Method for Designing the Spring," 2021.

Honors & Awards

Competitions

2017	**2nd Place**, UBC Senior Engineering Design Competition	*Vancouver, Canada*
2015	**1st Place**, UBC Senior Engineering Design Competition	*Vancouver, Canada*

Awards

2020	**$2000 –** William Dunbar Memorial Scholarship in Mechanical Engineering	*Toronto, Canada*
2018-2020	**$5000 per term –** MIE Endowed Fellowship Scholarship	*Toronto, Canada*
2017	**$4500 –** Natural Sciences and Engineering Research Council of Canada (NSERC) Experience Award (Previously called: Industrial Undergraduate Student Research Awards – IUSRA)	*Vancouver, Canada*
2016	**$1000 –** Go Global Self-Directed Research Award	*Vancouver, Canada*
2016	**$1000 –** Science Co-op International Placement Award	*Vancouver, Canada*
2014	Chancellor's Scholar Award	*Vancouver, Canada*
2014	Dean's Honour List	*Vancouver, Canada*
2013	Governor General's Award	*Vancouver, Canada*
2013	High School Valedictorian	*Vancouver, Canada*

Professional Development

Workshops

March 2017	Robot-assisted laparoscopic surgery with the da Vinci Surgical System workshop. *Student attendee.*	*Vancouver, Canada*

Conferences

June 2021	IEEE International Conference on Robotics and Automation (Remote Attendance)	*Xi'an, China*

Certification

Mar. 2019	16 hr Student Machine shop course at George Brown College (Provided by the MIE Dept. at UofT)	*Toronto, Canada*
Sept. 2018	Workplace Hazardous Materials Information System (WHIMIS) Training	*Toronto, Canada*
Sept. 2018	Laser Safety Training	*Toronto, Canada*
May 2017	Workplace Hazardous Materials Information System (WHIMIS) Training	*Vancouver, Canada*
May 2016	Laser Safety Training	*Hannover, Germany*
Feb. 2015	40 hr Student Machine shop course (Provided by the PHAS Dept. at UBC)	*Vancouver, Canada*
Jan. 2014	British Columbia Class 5 Driver's License	*Vancouver, Canada*