

Charles Holtforster

Charles.holtforster@gmail.com

choltfo.github.io

Candidate for B.A.Sc., **Mechatronics Engineering**, University of Waterloo

Summary of Qualifications

Electronics design: Broad experience in PCB design (EAGLE, DipTrace), circuit design (LTSpice), and high-power circuits.

Electronics prototyping: Comfortable with lab tools – power supplies, oscilloscopes, signal generators. Can solder 0603.

Mechanical CAD: Adept in AutoCAD, SolidWorks and Inventor.

Rapid prototyping: Practised with laser cutting & 3D-printing.

Robotics: Hands-on experience with LiDAR, SLAM, point-cloud manipulation, localization, and path planning.

Certifications: Ontario G driver's license, first aid/CPR-B, Canadian Amateur Radio Operator Certificate (VA3HCF).

Software: Experienced with C, C++, Java, C#, and Python in professional environments.

Communication: Excellent verbal and written communication developed during work placements.

Testing & QA: Experienced in load testing, verification, EMI/EMC evaluation.

Prototyping: Adept with metal & woodworking.

Computer literacy: Experienced with Windows, Linux, Office, Git, SVN, and Mercurial.

Relevant Experience

System Design Engineer, Test Systems

June – August 2017

Flex

Markham, ON

- Entrusted to represent Flex at contractor site to execute test.
- Wrote control program for thermal controller and rate table.
- Designed & produced **high-current** (120 A) power distribution PCB for test equipment.
- Designed turbine-based rotary encoder signal synthesis equipment.
- Performed characterization tests on accelerometer systems.
- Debugged and repaired test systems electronics.
- Produced **effective documentation** for ongoing use of hardware and software technical solutions.
- Produced test plans and software for **electromagnetic compatibility** and **electrostatic discharge** testing.
- Debugged **CAN**, **RS232**, Ethernet, and LVDS communication.
- Developed remote control system from spec for reconfiguring Cisco networking equipment. Achieved 50,000 cycles repeatability.

Software Developer, Personal Robotics

September – December 2017

Engineering Services Inc.

Markham, ON

- Developed **autonomous navigation** and **obstacle avoidance** system for mobile robots (*OMNIBOT* product line) from basic principles of **robotic control theory**.
- Added odometry sensor fusion to **particle filter localizer**, decreasing sensor failure rate by 10x.
- Designed **UDP** communication protocols for sensor (**LiDAR**, **ultrasonic**) and navigation (obstacle and localization) data.
- Developed autonomous initialization algorithm for particle filter LiDAR localizers.
- Created RPC command-and-control server for integration with existing operation systems.

Robotics Software Developer

January – April 2017

Ross Video

Ottawa, ON

- Designed and implemented **collision avoidance system** for studio camera robots, finishing one month ahead of schedule.
- Assisted with robotic camera dolly rollover testing to verify increased safe turning speeds on *Furio*-series robots.
- Wrote **SLAM algorithm** for robot tracking with 16-segment **solid-state LiDAR** as proof of concept based on the iterative closest point algorithm.
- Designed RS232 interface board for ultrasonic sensor array.

Quality Assurance and Load Testing

Summer 2015, 2016

Halogen Software

Ottawa, ON

- Developed automated testing methods for web applications, eliminating 2 hours for daily load tests.
- Designed and implemented program to select resources to monitor, reducing assessment time by 7 hours.

Projects

Skid-Steer Ground Robot

January 2018 – Ongoing

Entirely custom-designed remote-controlled electric vehicle.

- 1000 W, differential drive. 30 km/h in a straight line.
- Custom motor controller **PCB** and **microcontroller** firmware.
 - **Dual H-bridge** operating at 30 A, 24 V.
- Designed chassis and drivetrain components in **SolidWorks**.
- Hand machined chassis, 3D-printed drivetrain, laser-cut mounting plate.
- Developed embedded software for motor control system.
- Produced control software for user base station.
- Designed frame and drivetrain.
- **Documented progress** in a reader-friendly manner (More details [on my website.](#))



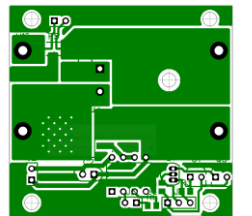
Electromagnetic accelerator – “Coil-gun”

June 2017 – Ongoing

High-current pulsed solenoid for firing projectiles

Continuing to iterate on design for coil-gun

- Using **power MOSFETs** for control.
- Model 2: Planned output power of 5000 Watts, per stage. ([Further details](#))
 - 48 V lithium battery pack, 120 A coil current.
 - Modelled coil and flyback behaviour in **LTSpice** to optimize design.
 - Planned six stages with amplified photogates for timing control.
 - Designed with **ESD** and **conducted radiation** protection in mind.
 - Currently in progress, awaiting PCBs. Prototype completion planned for December 2018.
- Model 1: Output power of 1700 Watts. 60 V, 6600 μ F capacitor bank driven. ([Further details](#))
 - **Custom designed PCB** for power circuitry.
 - Hand machined solenoid spool.



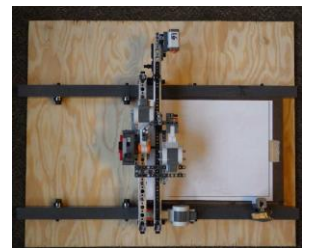
LEGO Plotter

September – December 2016

Mechatronics term project

Pen plotter built from LEGO Mindstorms NXT kit and hand machined parts.

- Lead team of four from concept to execution.
- Control software and G-code interpreter written in C.
- **G-code** operated.
- **PID** controlled motion for precise plotting of drawings.
- Wrote SVG parser to generate G-code.



Further projects

Custom brushless motor: Non-Halbach “outrunner” motor. Achieved 22,000 RPM. Designed in Autodesk Inventor. 3D-printed, tested until failure, then CNC machined.

Ballistic chronograph: Photogate timer, Arduino based. Achieved 99% accuracy for 50% price.

USB volume wheel: Reading a hard disk platter’s motion using an op-amp trigger and an AVR microcontroller.

Activities and Interests

Creative writing: Producing and edit stories of novella length.

Sports: Recreational curling, airsoft, and biking.

Video game development: Unity 3D, SFML, C++, C#, Java.

Charity work: Frequent participant in Homes of Hope Tijuana charity house building.

Digital artwork: Photo manipulation in Krita, Photoshop.