

Christopher Mailer

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EDUCATION

MSc. Electrical Engineering (Specialising in Robotics), University of Cape Town Dec 2023

- Awarded a Research Fellowship from the Harry Crossley Foundation
Thesis: Control of Rapid Acceleration in a Planar Legged Robot
Advisers: Amir Patel, Reuben Govender

BSc. Mechanical and Mechatronic Engineering, University of Cape Town July 2021

- Class Medal (highest GPA & First Class Honours)
Thesis: Online Gait Adaptation of the RARL Hexapod Robot
Advisers: Leanne Raw, Geoff Nitschke

EXPERIENCE

Aerospace Hardware Engineer Starting June 2023
CubeSpace Satellite Systems

Graduate Robotics Researcher/Engineer Feb 2021 - June 2023
African Robotics Unit, University of Cape Town

- Design, control, simulation and testing of Kema, a planar legged robot which combines quasi-direct drive BLDC motors and pneumatic pistons for exploring agile animal-like manoeuvres.
- Developed a contact-implicit trajectory optimisation framework for motion generation with various legged robots.
- Designed and built a carbon fibre planarising boom to support the legged robots in the lab and provide state feedback for control. Implemented a Kalman filter for velocity estimation with encoders and an IMU.
- Redesigned and built an upgraded planar Hopping robot with double the torque, half the weight, an improved 5-bar linkage leg design, and implemented a leg impedance and Raibert style hopping controller.
- Performed characterisation of BLDC motors and pneumatic pistons, and built a high power automatic shunt regulator for dissipating motor regenerative power.
- Created a Simulink library for using the ODrive, Mini-Cheetah actuators, Boom feedback, and ATI force/torque sensors with a Speedgoat Real-Time Target Machine to reduce development time for other lab members.
- Designed various sensor housings, and actuated calibration setups for the remote animal vitals monitoring group.

Undergraduate Robotics Researcher Feb 2020 - Dec 2020
Robotics and Agents Research Laboratory, University of Cape Town

- Built a simulation of an existing Hexapod robot in PyBullet and optimised it for parallel execution with MPI on the South African Lengau high performance cluster to experiment with evolutionary gait adaptation.
- Developed a foot trajectory controller and modified the existing robot C++ firmware on its STM32 microcontroller.
- Executed walking controllers evolved in simulation on the actual robot and demonstrated fast online gait adaptation to the Sim2Real gap and various full leg failures.

Robotics Research Intern Summer 2019
African Robotics Unit, University of Cape Town

- Designed and built a planar Hopping leg robot based on the Stanford Doggo leg for a PhD research project.
- Performed FEM analysis for components to ensure design could withstand impact forces.
- Implemented BLDC motor control with ODrive and derived system dynamics and leg position and impedance controllers for the 4-bar leg.

Practical Training Course Summer 2018
Cape Peninsula University of Technology

- An 8-week course on CNC programming & machining, precision metrology and measurement, electrical automation/robotics, pneumatics, welding, fitting, and turning.

Software Intern Summer 2016 & 2017
Prescient Investment Management

- Built a program in R to provide a daily preliminary inflation estimate from 80k online prices, and present data to analysts with an interactive GUI as an additional tool to inform investment decisions.
- Returned for a second summer vac to adapt the previous project to track online property sale and rental prices.

CONFERENCE PUBLICATIONS

1. **C. Mailer**, S. Shield, R. Govender, and A. Patel, "Getting Air: Modelling and Control of a Hybrid Pneumatic-Electric Legged Robot", in *IEEE International Conference on Robotics and Automation (ICRA)*, 2023
2. **C. Mailer**, G. Nitschke, and L. Raw, "Evolving Gaits for Damage Control in a Hexapod Robot", in *ACM Proceedings of the Genetic and Evolutionary Computation Conference (GECCO)*, 2021

SKILLS

Programming: Python, MATLAB, C/C++, L^AT_EX, R

Software: SolidWorks, Simulink, PyBullet, STM32 HAL

Techniques: Design for Manufacture & Assembly, FEA, GD&T, Trajectory Optimisation (IPOPT)

PROJECTS

Ice Claw: A Crane Attachment for Gripping Large Ice Floes

Dec 2018 - Feb 2020

Our team of 4 won the design proposal and built a scale prototype for an S.A. Agulhas II crane attachment capable of picking up large ice floes in the marginal ice zone. The design featured a self-clamping mechanism using the weight of the ice to produce clamping force.

Mentally: An iOS App for Memorisation Through Spaced Repetition

Published Jan 2018

Designed and built a free iOS app to aid rote memorisation with quiz style push notifications and spaced repetition.

Unfortunately no longer available on the App Store.

VOLUNTEERING

High School Arduino Educational Outreach

Sep 2021 – Dec 2021

Instructor

- Co-facilitated an 8-session workshop introducing Portlands High School students to programming with Arduino, electronics, soldering and 3D printing.
- Taught and assisted students in building a heart rate sensor, a motion alarm, and a sweet colour sorter. They each completed a project and could take it home to share what they had created with their friends and family.

LANGUAGES

English (Native), Afrikaans (Conversational)

INTERESTS

Cycling (6x Cape Town Cycle Tour), Sailing (Competed in Cape2Rio 2023), Surfing, Wood Turning