Christopher Mailer

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EDUCATION

MSc. Electrical Engineering (Specialising in Robotics), University of Cape Town — Feb 2021 - Dec 2023
- Awarded a Research Fellowship from the Harry Crossley Foundation
  <u>Thesis</u>: Control of Rapid Acceleration in a Planar Legged Robot
  <u>Advisers</u>: Amir Patel, Reuben Govender

BSc. Mechanical and Mechatronic Engineering, University of Cape Town — Feb 2017 - July 2021
- Class Medal for top graduate (highest GPA)
  <u>Thesis</u>: Online Gait Adaptation of the RARL Hexapod Robot
  <u>Advisers</u>: Leanne Raw, Geoff Nitschke

EXPERIENCE

Robotics Graduate Researcher/Engineer — Feb 2021 - present
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 powerful agile animal-like manoeuvres with low bandwidth actuation.
- Performed characterisation of BLDC motors and pneumatic pistons using custom made setups.
- Designed and built a carbon fibre planarising boom to support the various planar legged robots in the lab and provide state feedback for control. Implemented a Kalman filter for velocity estimation with encoders and an IMU.
- Designed various sensor housings, and actuated calibration setups for the remote animal vitals monitoring group.
- Built an upgraded planar Hopping robot with double the torque, half the weight, a more rigid leg design, and wrote a leg impedance and a Raibert style hopping controller.
- Developed a trajectory optimisation motion generation framework for various robots, and built a high power automatic shunt regulator for using BLDC motors with a power supply.

Undergraduate 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 Lab 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 coaxial shaft and flange components to ensure design could withstand impact forces.
- Implemented BLDC motor control with ODrive and wrote leg force and position controllers.

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

PROJECTS

Ice Claw: A Crane Attachment for Gripping Large Ice Floes date

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 date

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.*

SKILLS

Programming: Python, MATLAB, C/C++, LaTeX, R
Software: SolidWorks, Simulink, PyBullet, STM32 HAL
Techniques: Design for Manufacturing & Assembly, FEA, GD&T, Trajectory Optimisation (IPOPT)

LANGUAGES

English (Native), Afrikaans (Conversational)

INTERESTS

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