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EDUCATION

2019 - 2024

The University of Newcastle, Australia

Bachelor of Electrical and Electronic Engineering (Honours)

Bachelor of Mathematics

- University Medalist
- Honours Class I
- WAM: 95.21

HONOURS & AWARDS

- University Medal (2024) - Awarded to **fewer than 1%** of graduates
- College Medal (2024)
- Best Final Year Project (2023)
- College Commendation List (2019, 2020, 2021, 2022, 2023)
- Institution of Engineering & Technology (IET) Prize (2021)
- Physics Staff Prize in PHYS1220 Advanced Physics II (2019)
- FEBE Summer Scholarship (2020 & 2021)
- SIPS Summer Scholarship (2022)
- Vice-Chancellor's Award for Academic Excellence (2019)

RELEVANT COURSES

- Programmable Logic Design (92)
- Machine Learning (100)
- Signal Processing (97)
- Analog and Digital Communications (95)
- Non-linear Control and Estimation (100)
- Partial Differential Equations (94)
- Complex Analysis (99)
- Statistics (97)

LACHLAN COOKE

Graduate electrical engineer blending a deep passion for mathematical analysis with the practical applications of engineering. Following my bachelor's degrees in electrical/electronic engineering and mathematics, my technical expertise has been broadened via a range of personal and industry projects in hardware design, embedded systems, and machine learning. I thrive where innovation, teamwork, and real-world impact intersect.

EXPERIENCE

Mechanical Designer & Small Business Owner　　　2025 - PRESENT
TrefoilTechAU (eCommerce)

- Designed, manufactured, and optimised 3D-printed aftermarket components, scaling from prototype to 220+ sales across Oceania and North America.
- Optimised mechanical design by rapidly prototyping various solutions, evaluating them via thorough destructive testing.
- Handled full business operations, including product design, manufacturing, finances, marketing (SEO), and customer relations.

Electrical Engineering Intern　　　2023 - 2024
Reach Robotics (Sydney, Australia)

- Worked under supervision of the electrical and mechatronics engineering teams in the R&D department on various technical aspects of subsea robotic manipulators.
- Collaborated with colleagues in cross-disciplinary meetings at the end of each 3-week sprint cycle to evaluate solutions, identify weaknesses and set measurable goals for the next cycle.
- Developed circuit schematics and designed PC boards in Altium Designer to handle data logging from various sensors. These signals, from a variety of sources including thermocouples, load cells and current-sense resistors (CSRs), had to be buffered, filtered and scaled to interface correctly with a DAQ (LabJack T7-Pro).
- Mathematically analysed analog and digital filter topologies in the Laplace and Z-domains, respectively, to attenuate noise and condition signals for analog-to-digital conversion. For the analog signal chain, a 1st order RC LPF was selected. For the DSP, a 4th order Butterworth (IIR) LPF filter was selected.
- Used the LabJack Python SDK to read from the DAQ programmatically to a PC. Using Flask and WebSocket, a lightweight web-app was developed to graphically show the data acquisition in real time using JavaScript and chart.js.
- Enabled R&D engineers to monitor the vitals of robotic manipulators in real-time from anywhere in the lab. The web-app also allowed for one-click recording and saving of data in a .csv format.

Casual Academic　　　2021 - 2023
The University of Newcastle, Australia

- Taught laboratory and tutorial classes for first and second year courses across both engineering and mathematics. Notable courses include ELEC1310 (circuit theory) and MATH2310 (ordinary differential equations and multivariable calculus).
- Teaching materials include linear ODEs, systems of ODEs, Jacobians, Green's theorem, Stoke's theorem, divergence theorem, Kirchhoff's laws, complex arithmetic, phasors and balanced three-phase AC.
- Responsible for lab demonstrations, marking, tutorials, project development and helping students with queries or concerns.

SKILLS

- **Programming & Scripting:** C, C++, Python, JavaScript, SystemVerilog, VHDL, MATLAB, HTML, CSS
- **Hardware & Electronics:** PCB Design (Altium Designer, KiCAD), FPGA Development (Altera Cyclone V, Quartus), LTSpice, Analog Filter Design, DSP, Digital Communications (ASK, FSK, PSK, QAM), RF & Antenna Design
- **Embedded Systems:** Microcontrollers (ESP32, STM32, AVR/Arduino), I^2C, SPI, UART, Interrupts, DMA, Timers, PlatformIO, Real-Time Operating Systems (FreeRTOS), WiFi & Bluetooth (BLE)
- **Machine Learning & AI:** Artificial Neural Networks, CNNs, RNNs, Transformers, PyTorch, TensorFlow, Backpropagation, SGD, Adam, k-Nearest Neighbours, Vector Embedding, Computer Vision (OpenCV)
- **Control Systems & Robotics:** Simulink, Kalman Filters, State Estimation, PID Control, LQR, Inverse Kinematics, Servo Motor Control, Stepper Motors & Drivers, Power Electronics (SMPS, Linear Regulators, LDOs)
- **Mathematics:** Real & Complex Analysis, Fourier Analysis, Numerical Methods, Ordinary & Partial Differential Equations, Abstract Algebra, Group Theory, Number Theory, Multivariable Calculus
- **Software & Tools:** Git, GitHub, VSCode, Linux Shell (Bash/Zsh), Jupyter Notebooks, LaTeX, Microsoft & Google Suites
- **Collaboration & Communication:** Technical writing & documentation, cross-disciplinary teamwork, problem-solving, adaptability and presenting complex ideas to technical and non-technical audiences

PORTFOLIO HIGHLIGHTS

Rubik's Cube Solving Robot (Honours Project)

- Engineered an integrated Rubik's Cube solving system, leveraging computer vision, real-time motion control, and custom PCB design.
- Implemented OpenCV-based cube state detection algorithm with dual-camera input & real-time processing.
- Computed near-optimal 20-move solutions using the Iterative Deepening A∗ graph traversal algorithm.
- Designed a custom PCB to interface a Raspberry Pi, Atmega328p MCU, buck converter and five stepper motor drivers.
- Achieved solve times as quick as 3 seconds before instability due to high-speed actuation.

'Scratch-built' MNIST Handwritten Digits Neural Classifier

- Derived full backpropagation algorithm from first principles using matrix calculus & the chain rule. Sketched out the structure of a 2-hidden-layer deep neural network, labelling weights, biases and activation functions and their partial derivatives to establish a pattern.
- Implemented stochastic gradient descent (SGD) for weight updates after each training mini-batch.
- Developed end-to-end neural network training pipeline exclusively in Python & NumPy, bypassing high-level ML frameworks (PyTorch, TensorFlow).
- Achieved 94% accuracy on MNIST test set, optimizing learning rate & acceleration strategies for convergence.

Smart IoT RGB LED Wearable + React Native iOS App

- Developed smart IoT sunglasses, featuring 48 addressable RGB LEDs around each 'lens'.
- Chassis was designed in AutoDesk Fusion360 and rapidly prototyped with a 3D printer.
- Front LED PCB: Arranged 96 WS2812B ICs in a daisy-chained (dataOut -> dataIn) circular pattern.
- Logic PCB: Integrated ESP32-C3, push buttons, RGB status LED, USB-C power delivery, and UART debugging interface.
- Developed firmware in C++ using FreeRTOS to handle WiFi, LED modes, and HTTP request processing.
- Built a React Native iOS app for wireless control of LED modes & brightness.

Dynamic Pressure Controller

- Designed & simulated the analog signal chain for a dynamic pressure control system in a medical application.
- Developed anti-aliasing & reconstruction filters (4th-order Butterworth) using Analog Devices Filter Wizard.
- Simulated circuits in LTSpice in both time and frequency domains to verify transient and frequency-sweep response.
- Designed the PCB in Altium Designer, then assembled and tested the circuit by hand.
- Implemented an adaptive active cooling system, via a thermistor, fan and heatsink, to prevent overheating.

REFERENCES

Dr. Stephan Tornier

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Prof. Zhiyong Chen

Professor (SEEC) / UoN

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