

David Shmail

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TECHNICAL SKILLS

Languages: C, C++, Python, MATLAB, Verilog, SystemVerilog, VHDL, TCL, LaTeX & Markdown, Basic Assembly, Basic Bash.

Simulation and Analysis: Matlab (Signal Processing, Control System, System ID, Antenna and RF, PDE, Symbolic Math Toolboxes), Simulink and Simscape, SPICE (LTSpice, KiCad, OrCAD), SymPy, Solidworks Simulation (non-linear & fatigue FEA, adaptive meshing), Ansys.

RTL Silicon Engineering: SystemVerilog RTL, Quartus Prime (Cyclone V synthesis & place-and-route), formal verification (Yosys/SymbiYosys/Z3, k-induction, SMT-LIB), cocotb + pytest regression, Verilator & Verible lint, Icarus Verilog, gate-level netlist & synthesis-pipeline analysis, transmission-line & signal-integrity modelling, basic static timing analysis.

Electromechanical Integration: Parametric CAD & Assemblies (Solidworks, Onshape), Embedded Control (Arduino, ESP32, STM32Cube; PWM, PID, sensor systems, memory-optimisation, thermal & safety), Motor & Gear Train Design, Bench Electronics (supplies, AWG, oscilloscopes, AD2, spectrum analyser, soldering), Manufacturing Workflows (FDM additive, metal machining, laser cutting), Thermally Managed & Mission-Critical Enclosures.

PROJECTS - See davidshmail.com for more

Broadband Amplitude-Shift Keying Transceiver | **Tech Stack:** MATLAB/Simulink (Signal Processing, System ID Toolboxes), Python (SciPy), SPICE (KiCad, LTSpice)

- Designed and deployed a modulation–demodulation chain integrating a BJT series-switch mixer, high-Q multiple-feedback bandpass filter, Gilbert-cell four-quadrant multiplier, and Schmitt-trigger decision device - validated from SPICE to hardware, against frequency and time - domain models and via System Identification.
- Characterised ICs against documentation, accounting for non-ideal properties (slew rate, gain-bandwidth, saturation-rail headroom, input offset, CMRR) in the LTI TF model, and exploited device non-idealities - parasitic-capacitance/ft roll-off used as the envelope-smoothing pole - rather than suppressing them.

Formally-Verified Multi-Mode Digital Timepiece – SV RTL on Cyclone V FPGA | **Tech Stack:** SystemVerilog, Quartus, Yosys/SymbiYosys/Z3 (k-induction, SMT-LIB), cocotb + pytest, Verilator & Verible, Docker, git

- Built a multi-mode timepiece (settable clock, lap stopwatch, editable countdown, PWM brightness) as fully synchronous RTL through a complete industry-representative flow - ~20 reusable parametrised modules, with k-induction formal proofs closed over every sequential submodule and cocotb simulation covering sequence-dependent integration behaviour.
- Maintained a zero-warning lint bar (Verilator/Verible) with a pytest-orchestrated CI-style regression suite, two-ff CDC synchronisation, and gate-level netlist inspection through full Yosys pipeline.

Stochastic Microgrid Energy Management - State-Space Battery Modelling & Techno-Economic Optimisation | **Tech Stack:** MATLAB/Simulink (State-Space, Bode, Function blocks, model callbacks), stochastic signal modelling, rule-based finite-state dispatch, techno-economic & design-space analysis

- Delivered an end-to-end PV-battery-grid-load microgrid simulation platform: a fourth-order state-space battery plant model with sensor dynamics, characterised in frequency and time domains against closed-form benchmarks, driving closed-loop Simulink operation with stochastic generation/demand profiles, market-rate cost settlement, and dispatch extended to bidirectional export under asymmetric feed-in tariffs.
- Produced investment-grade storage economics: factorial design-space optimisation over battery capacity and dispatch thresholds for total cost of ownership - correcting a short-horizon bias to establish the true ~580-day capacity break-even, stress-testing costs against live 2026 market pricing to revise a nominal 120-day payback to 5+ years, and sizing an islanded system from first principles (worst-case seasonal generation, multi-day autonomy, discharge derating) for a ten-year off-grid vs grid-tied comparison.

Covert sUAS: Attitude Control & Instrumented Ground Station | **Tech Stack:** Embedded C (Arduino, STM32), IMU Sensor Filtering, MATLAB and Simulink (Control System Toolbox), Solidworks & 3D printing

- Following an interest in UAVs and high-performance control, built a quadrotor platform and tuned its attitude controller for stable regulation under actuator saturation and disturbance inputs - with a dedicated axis-isolating test rig to tune gains from measured step responses rather than trial flight.
- Refined the controller through root-locus/Bode analysis and practical compensations - derivative filtering, anti-windup, setpoint ramping - with discrete-time sampling and sensor-filtering handled explicitly.

PROFESSIONAL EXPERIENCE

Space Resources Engineer | UniMelb Rover Team (Melbourne, Australia) | 2025-2026

Year-long effort, placing 9/30th overall at the competitive 2026 Australian Rover Challenge. [Space Resources task scored in Top 5.](#)

- Delivered a precision gantry subsystem supporting a spectrometer, focused imaging module, and regolith preparation mechanism within strictly specified integration and competition rule constraints.
- Integrated structural framing, instrumentation mounting interfaces, drilling and water-extraction subsystems in a shared rover architecture for in-situ resource analysis.
- Engineered through late-design and manufacturing stages of the 2025-26 development cycle. Manufactured through electronic benchtop, additive manufacturing and 3D printing, metal machining and laser cutting workflows.

Optical Calibration Hardware - Contract Mechanical Design | GTT (Melbourne, Australia) | 2025

- Designed and iterated a tolerance-controlled calibration reference cone for a machine vision-based dart tracking system - datum-referenced CAD documentation for direct manufacturing handoff, with 3D-printed prototypes refined against team principals' feedback, closing the gap between as-built hardware and software calibration accuracy.

Lead Educator | STEM Academic Service (Melbourne, Australia) | 2022 - 2023

- Founded a VCE-aligned maths and physics tutoring service, providing tailored worksheets, assignments and marking, with a maintained version-controlled educational library in Notion.
- Led local marketing to a client base of 10+ concurrent students, sustaining income opportunities for myself and three peers.

EDUCATION

Bachelor of Science | Electrical Engineering Systems | The University of Melbourne (2023-2026)

- Completed Mechanical Engineering Systems before switching majors. Supplementing the major with deliberate advanced software and physics tracks.

Master of Electrical Engineering | Autonomous Systems and Machine Learning | The University of Melbourne (2027-2028, expected)

LEADERSHIP AND EXTRACURRICULAR EXPERIENCE

Course Liaison | Faculty of Engineering, University of Melbourne | 2025-2026

- Course Liaison for Signals and Systems (ELEN30012), Numerical Algorithms (ENGR30004), Thermodynamics and Fluid Mechanics (MCEN30018).
- Provided deep technical guidance in course discussion forums. Liaised across committees within Electrical, Mechatronics, and Mechanical Engineering Departments.

Spy-o-T Hackathon (2025) | Project ALARM: Covert, distributed keyword-detection system.

Simon Marais Mathematical Competition (2025) | Competed in the Asia-Pacific's premier university proof-based mathematics competition.

Unimelb Chess Club Participant (2023-Present) | Interest in engine play led to building a performance-oriented C++ chess engine with full rule-complete logic and an OpenGL GUI.