Shoalin Harischandre

Electronic engineer: analog and mixed-signal CMOS, power electronics, embedded control

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Profile

Final-year BEng Electronic Engineering student at the University of Pretoria, planning an MEng in microelectronics focused on analog CMOS design. My capstone took a three-phase motor driver from transistor-level design in a 0.18 µm HV CMOS process to a working discrete inverter, field-oriented control firmware and a complete bilateral haptic system. I want to design mixed-signal chips that drive real hardware.

Education

BEng Electronic Engineering, University of Pretoria — 2023 to 2026

- Final-year project: CMOS co-design of a haptic drill press feed controller (EPR 400), study leader Dr D. J. de Beer
- Coursework includes analog and digital electronics, power electronics, control systems, RF and microwave engineering, electromagnetics and robotics

MEng Microelectronic Engineering (planned), University of Pretoria — from 2027

- Proposed direction: analog and mixed-signal CMOS motor-driver ICs

National Senior Certificate, Raisethorpe High Secondary School — 2017 to 2022

- Four distinctions: Mathematics, English, Accounting and Life Orientation

Projects

DJDB8: CMOS co-design of a haptic drill press feed controller — Capstone, 2026

A motorised lever that feeds a bench drill press and reproduces the measured drilling thrust in the operator's hand. Designed, built, programmed and tested end to end.

- Designed the three-phase gate driver at transistor level in the X-FAB XH018 0.18 µm HV process in Cadence Virtuoso, simulated in Spectre, one-phase cell laid out DRC and LVS clean
- Built the same driver as a discrete inverter PCB (IRLZ44N, bootstrap high side, RC dead-time channels), fabricated by JLCPCB, **330 ns** measured dead time and no shoot-through
- Wrote voltage-mode field-oriented control from first principles on an STM32F405 (no motor-control libraries), with an α-β observer and current estimated from a measured drive model
- Closed a **1 kHz** bilateral link to an ESP32 drill controller with a four-cell load platform: force at the grip within **1.3 %** of command from 10 to 40 N, quill within **0.05 mm** of the lever, **1.00 ms** link delay
- Implemented latched E-stop, 60 ms link-loss safe state, force and thrust caps, and a browser diagnostics console over Web Serial
- Drilled pine, hardwood and 6082 aluminium through the lever, up to **16.8 kg** peak thrust

MARV line-following robot, EMK310 — University of Pretoria

- Autonomous robot that detects five track colours with a photodiode and transimpedance amplifier front-end and RGB LED illumination
- PIC18F45K22 firmware in assembly for sensing, decision logic and PWM motor control, chassis and shielded sensor housing designed in CAD and 3D printed

MARV maze solver

- Maze-solving robot designed and built from first principles

NYX quadruped robot — In progress

- Four-legged robot using computer vision for real-world obstacle avoidance

Personal portfolio website, sharischandre.com

- Hand-coded site, including a 60-second Blender film of the DJDB8 system

Technical skills

IC design	Cadence Virtuoso, Spectre, transistor-level analog design, layout with DRC and LVS, X-FAB XH018 PDK
Power and PCB	Three-phase inverters, gate drive, bootstrap supplies, level shifters, KiCad, EasyEDA, LTspice, board bring-up
Embedded and control	STM32 (HAL, CubeIDE), ESP32, PIC18 assembly, C and C++, field-oriented control, observers, PI tuning
RF and analysis	Smith chart and matching networks, S-parameters, LNA design, MATLAB
Lab and tools	Oscilloscope, bench supplies, soldering, load cells, Onshape CAD, 3D printing, Python, JavaScript, LaTeX, Blender

Languages

English (fluent), Afrikaans (second language)

References

Available on request.