Nazim Yildiz

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Profile

Lead Power Electronics Engineer with 12+ years of full-cycle experience spanning converter topology selection, PCB design, magnetics, thermal analysis, and closed-loop embedded C control. Specialises in high-efficiency isolated DC/DC converters (DAB, IBC, LLC) across a wide range of power levels, from prototype validation to production-grade industrial programmes. Deep hardware expertise combined with production-grade embedded firmware development enables complete ownership of complex converter programmes — from literature review to laboratory validation — without handoff between hardware and firmware teams.

Experience

EATON – Europe Innovation Center — Czech Republic, Roztoky

Lead Power Electronics Engineer — *Mar 2022 – Present*

▸ **Solid State Transformer (SST) for Data-Centres – DAB Stage Design** — *Mar 2026 – Present*

Contributing to an EU-funded programme targeting ∼15 kV_{AC} grid input with 3.3 kV SiC devices. Responsible for the DAB DC/DC stage: currently in the modelling phase, building analytical models to reduce the number of series input stages. The topology splits the conventional single large transformer into two independent units, reducing core size and simplifying thermal management — improving Eaton's existing SST platform.

▸ **200 kW Cascaded Interleaved Boost Converter (IBC) & LLC Program** — *Oct 2025 – Present*

- **IBC PEBB (70 kW):** Designed PCB; DC-link capacitance calculations, time- and frequency-domain simulations, capacitor selection for input and output DC-links.
  - DPT on SiC modules at 800 V / 100 A: ∼**74 V overshoot** at ∼**51 MHz** (power-loop: 1.13 nH PCB + 5 nH module parasitic).
  - Continuous power tests: 6 kW at 90 V, 10 kW at 200 V, 20 kW at 300 V input.
- **LLC input power stage (70 kW):** Designed PCB; DC-link capacitance calculations, simulations, and capacitor selection for input and output DC-links.
  - DPT on SiC modules at 800 V / 104 A peak turn-off: ∼**89 V overshoot**.
- Developed STM32G474 embedded SW for DPT and continuous power tests; built a Python/Qt GUI using agentic-AI to control duty cycles, phase-shifts, and switching frequencies over USB — used for hardware verification of both converters before handover to the control engineer.

▸ **Full-Cycle DAB DC/DC Converter (fuel-cell application)** — *Jan 2024 – Sep 2025*

Led every stage of a Dual Active Bridge converter from topology selection through full system validation.

- **Control:** Derived and implemented analytical Triple Phase Shift (TPS) modulation equations (closed-form, no look-up tables), which inherently covers all DPS and SPS operating points; closed-loop strategy based on Virtual Direct Power Control (VDPC).
- **Hardware:** Designed controller, gate-driver, power-stage, and CAN extension PCBs (STM32G4) with rigorous signal-integrity practice: PWM traces routed as 50 Ω single-ended lines; ADC inputs shielded with coplanar waveguide geometry; USB data pairs matched and length-tuned per standard; analog and switching domains segregated on separate planes; return-current paths managed throughout to minimise loop inductance and EMI.
- **Firmware:** Entire embedded C control stack implemented as a reusable, platform-independent library; optimised until the full control loop (analytical TPS + VDPC) executes in ∼**800 ns**.
- **Thermal:** Heat-sink sizing via Elmer-FEA; validated at 10 kW: ∼**11 °C rise** (LV side) and ∼**5 °C rise** (HV side).
- **Key results: 98.1%** peak efficiency at 100 kHz; ZVS/ZCS confirmed; bidirectional power reversal in ∼**450 µs**; peak transformer current ∼77 A_{rms}; minimal transient overshoot.
- **Optimisation roadmap:** removal of LV-side DC-blocking capacitors via control-level DC-bias stabiliser; transformer core material upgrade beyond 3C90; replacement of external series inductor with an integrated magnetic design to eliminate high-flux AC toroid losses.

▸ **MVDC Circuit Breaker – Thomson Coil Actuator & Solid-State Breaker** — *2022 – Feb 2024*

- **Thomson Coil Actuator (TCA):** Designed and validated an LC-resonant pulsed-power drive for a two-coil (open/close) electromagnetic actuator. Capacitor bank charged to 720 V; **15 kA peak** half-sine current on the opening coil; switching in <**2 ms**. Designed thyristor gate-driver boards and STM32-based controller with all embedded software.
- **Solid-State Circuit Breaker (SSCB):** Contributed to an SSCB topology for 14 kV_{DC} operation. Designed the controller board with a plug-in 230 $V_{AC} \rightarrow 24\ V_{DC}$ daughter-board power supply; fibre-optic thyristor gate signals used to meet the extreme isolation requirement at medium voltage.
- Full system (TCA + SSCB) validated up to **11 kV_{DC}** in laboratory.

▸ **DC Circuit Breaker Emulator** — *2023 – 2024*

- Architected a modular hardware emulator for a hybrid DC circuit breaker DUT comprising an IGBT-based SSCB, bypass relay (BPR), and galvanic-separation relay (GSR), with bus-side and load-side voltage and current sensors.
- Designed mainboard plus dedicated daughter boards for BPR, GSR, and all sensor channels — modular architecture enables reuse across DUT variants. Full schematic design for all boards; PCB layout for all daughter boards.
- Emulator significantly streamlined product testing workflows, removing dependency on physical DUT availability.

▸ **Aerospace Power Distribution Unit (PDU)** — *2022 – 2023*

- Collaborated with a Senior Specialist to model the selected topology in LTspice; contributed to topology optimisation by reducing total component count. Contributed to the resulting patent filing.
- **PBIT:** co-designed analog circuits to test the health (pass/fail) of fuses, diodes, and contactors during the power-up phase.
- **CBIT:** co-designed continuous monitoring circuits for fuses and contactors; proposed a voltage/current-sensor-based diagnostic method for diodes and prepared the implementation flowchart.
- Delivered PBIT/CBIT schematic designs in Altium to the system integration team for inclusion in the full PDU (FPGA, power supply, sensors).

ENKO Electronic Control Systems İzmir, Turkey

Research and Design Engineer *Sep 2013 – Feb 2022*

- **Reusable Embedded C Software Architecture** *2018 – 2022*

  Architected a platform-independent embedded C library from scratch — portable from Windows to ARM Cortex-M4 — adopted across all product lines and still in active use years after handover; **reduced customer-specific integration time by 85%**.

  - **Modules:** Modbus RTU (Slave/Master), Modbus TCP (Server/Client), CAN J1939, fault/alarm management, CRC-protected FRAM/Flash parameter storage, multi-level authentication with dynamic passwords, generic ADC with unit-conversion layer, grid-RMS calculation, phase-sequence detection — all abstracted behind interface/adapter patterns via function pointers for easy porting.
  - **Automated testing:** built a Windows Modbus TCP client for week-long regression testing of Ethernet-connected products before customer release.

- **Compressor Controller – Full HW & SW Design (2 products launched)** *2018 – 2022*
  - Implemented USB composite device (CDC + MSC) with FAT12 from scratch — first USB interface in the product line; enabled drag-and-drop parameter and firmware management.
  - Redesigned parameter system: eliminated per-customer `#ifdef` binaries via `parameter.bin` drag-and-drop; eliminated manufacturing errors and removed customer-service dependency for parameter changes.
  - Added CANopen-based paralleling for up to 12 compressors with equal-aging algorithm; **secured Dalgakıran** (largest Turkish compressor OEM) as a new customer. Paralleling enabled customers to scale systems by stacking standard units instead of designing larger ones, and provided fault-tolerant operation to prevent manufacturing downtime.
  - Equal-aging algorithm extended product lifespan by **20%**; zero-user-configuration design required no setup from the end user.

- **Military Projects: Canrouter & IO Extension Unit** *2020*

  Designed HW and embedded SW for CAN-J1939 source-address conflict resolution (Canrouter) — enabling two Volvo diesel engines with hard-coded addresses to coexist on the same bus — and a Modbus-RTU/CAN IO expander for large cabinet monitoring.

- **Generator Controller – Synchronous Transfer & Equal Aging** *2019 – 2020*

  Adapted AMF5.1 for dual Volvo diesel engine military application; implemented generator-to-grid, generator-to-generator, and grid-to-generator transfers with **zero interruption** to critical loads.

- **FOC Algorithm – Universal Motor Driver (Government-Funded)** *2013*

  Implemented Field-Oriented Control for a universal motor driver platform supporting BLDC, PMAC, and ACIM motors. Developed SVPWM module and Clarke/Park (and inverse) transforms from scratch; platform-portable design. Validated on 4.5 kW PMAC and 1 kW ACIM with a 1024-pulse encoder.

- **Product Maintenance & Feature Development (12+ products)** *2013 – 2022*

  Maintained and extended generator and compressor controller product lines; delivered customer-driven features including new I/O functions, GUI updates, and parameter additions. Majority of generator-controller extensions were for military applications.

- **Embedded C Upskilling Sessions** *2021*

  Organised and delivered training on reusable embedded C architecture (interface/adapter patterns via function pointers); sessions were motivated by the success of the software infrastructure, which had already enabled two new products.

Personal Projects

AI-Powered Job-Finder Assistant | *Full-stack agentic-AI web application* Ongoing

- Retrieves and ranks job postings by match quality against a provided CV and preference profile; includes a financial analysis module (estimates gross salary from savings goals and itemised expenses); generates tailored cover letters with feedback-driven revision cycles and full version history.

GaN-based 1.2 kW Solar Microinverter | *Full hardware design* 2021

- **98.4% efficiency** at 1.2 kW, 100 kHz, 400 $V_{DC} \rightarrow 220\ V_{AC}$ 50 Hz. Open-loop SPWM implemented by discretising the sine-wave reference into the Z-domain; duty-cycle values computed on-chip and validated under resistive load.

500 W ZVS Full-Bridge Converter | *Super-capacitor charging* 2018

- Designed and validated ZVS-capable full-bridge topology during MSc research.

Self-Hosted Infrastructure Ongoing

- Operates 6 Storj blockchain storage nodes on Raspberry Pi; self-hosts Forgejo git platform; manages all services via Docker on Linux.

Education

Pamukkale University Denizli, Turkey

MSc. in Power Electronics *2015 – 2019*

- Thesis: *Dual Active Bridge Converter with ML-Based PID Optimisation*

Pamukkale University Denizli, Turkey

B.S. in Electrical & Electronic Engineering – GPA 3.78/4.00, Graduated with Honours *2009 – 2013*

- Final project: Designed a Sine PWM Single-Phase Inverter.

Certifications

Deep Learning Specialisation (5 courses) | Coursera, Andrew Ng – Stanford University 2020

Technical Strengths

Power Electronics	DAB (analytical TPS, VDPC), IBC, LLC, ZVS Full-Bridge, GaN/SiC, Thomson Coil Actuators, Solid-State Circuit Breakers (MVDC)
Embedded Systems	C (bare-metal STM32), Modbus RTU/TCP, CAN (J1939, CANopen), USB (MSC, CDC, DFU)
Programming	C, Python (Qt, agentic-AI), Git, GitHub, Docker, Linux, LaTeX
CAD / Hardware	Altium Designer, FreeCAD, KiCAD
Simulation	QSPICE, LTspice, Elmer-FEA, PLECS, MATLAB/Simulink