Miguel Esparza
Ph.D. in Electrical Engineering

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🌐 Portfolio

📇 Professional Summary

Senior power-electronics and NPI engineer with 14 + years leading multidisciplinary product introductions in industrial, biomedical, and intralogistics sectors. Expert in magnetic-component design—inductors and transformer cores—optimized for low loss through COMSOL FEM and validated with laboratory prototypes (peer-reviewed publication). Proficient in MATLAB/Simulink, C/C++, and gated NPI processes, from concept and feasibility to pilot builds and cost-down, consistently meeting performance, quality, and margin targets. Recognized for clear technical leadership, economic justification (VA/VE, SPC), and cross-functional communication in English and Spanish, delivering efficient, manufacturable power-conversion and transformer solutions aligned with customer requirements.

💼 Professional Experience

R&D Firmware Engineer
Dematic

Feb 2023 - Present

As an R&D Firmware Engineer at Dematic, responsible for developing and maintaining firmware for proprietary devices within the R&D department's controls section. Design firmware, develop CI/CD tools, and create hardware solutions primarily with ARM microcontrollers (M0, M3, M4), managing the complete development cycle from firmware design to tools for PCB manufacturing.

Responsibilities

▪ Developed Docker containers for Hardware-in-the-Loop (HIL) testing on proprietary runners connected to hardware.

▪ Created and implemented CI/CD pipelines for firmware development, including unit testing for firmware modules.

▪ Designed and maintained hardware and firmware solutions for multiple proprietary devices using ARM microcontrollers.

▪ Provided cross-departmental collaboration with mechanical and project management teams.

Project Highlights

▪ **Rtic Project**: Led replacement of obsolete OEM component with custom low-power microcontroller design.

▪ **XMC-G0 Project**: Developed roller motor controller with secure remote bootloader and Profinet/CAN communications.

▪ **Profinet Communication (HAS III)**: Leading development of new HAS sensor system version with IT alignment.

Tech Stack:

| **Hardware**: ARM Cortex M0, M3, M4 microcontrollers, custom PCB design, low-level peripheral debugging. | **Software**: C, C++, Python, C#, Docker, Git, Jira, Sphinx, Doxygen, CI/CD pipelines. | **Testing**: Hardware-in-the-Loop (HIL) testing, unit testing, Test-Driven Development (TDD). |

R&D Manager
Technologies Delee

Aug 2017 - Feb 2023

Led development of innovative biomedical devices designed to automate isolation and counting of cancer cells from blood samples. Oversaw design, prototyping, and manufacturability while collaborating with biotechnologists to meet clinical needs. Devices underwent clinical trials, providing critical data for cancer detection technology advancement.

Responsibilities

- Led multidisciplinary team of 4-10 engineers across mechanical, production, and technological development.

- Directed full-cycle design and development of medical devices, transforming biological processes into manufacturable products.

- Managed OEM component integration with in-house innovations for cost-effective production.

- Collaborated extensively with biotechnologists to align devices with clinical requirements.

Achievements

- Successfully developed six medical devices contributing to groundbreaking clinical trials.

- Mentored two engineers who completed master's theses through projects contributing to core company technologies.

- Co-authored two academic papers based on technological advancements in biomedical engineering.

Project Highlights

- **Sample Preparation System for CTC Blood-Based Assays**: Developed automated system to isolate and prepare circulating tumor cells.

- **Automated Imaging System**: Created multichannel microscope system for epi-illumination analysis.

- **Flow Control Unit**: Designed advanced flow control for microfluidic biological sample handling.

- **High-Voltage Power Source**: Engineered power source for dielectrophoresis cancer cell separation.

Tech Stack:

| **Hardware**: ARM Cortex, STM32, custom PCB design, microcontrollers. | **Software**: Embedded C, Python, MATLAB, LabVIEW, Git, CI/CD for embedded systems. | **Testing**: Hardware-in-the-Loop (HIL) testing, automated testing frameworks, Test-Driven Development (TDD). |

Head Applications Engineer
Solintec

Dec 2011 - Aug 2017

Led design and development of more than 20 automation projects for various industrial clients and educational centers. Utilized industrial automation expertise to develop assembly stations, end-of-line solutions, and training programs. Managed full-cycle projects from client interaction and quoting to mechanical design and PLC programming.

Responsibilities

- Managed client relationships, providing consulting services and technical solutions.

- Designed, developed, and implemented automation systems from mechanical frames to PLC programming.

- Led small team of student partners in constructing assembly stations and wiring systems.

- Provided automation and PLC programming training for industry engineers.

Project Highlights

- **Vision System-Based Assembly Stations**: Developed end-of-line stations with vision systems for automatic defect detection.

- **Production Line Efficiency**: Updated PLC program reducing production time by 50%.

- **Automatic Assembly Machine**: Designed and built automatic assembly machine for collars.

- **Instrumented Inverter (50 kW)**: Developed inverter used in research center for solar panel and power electronics studies.

Tech Stack:

Hardware: PLCs from ABB, Mitsubishi, Automation Direct, Keyence; Keyence vision systems.

Software: SolidWorks for mechanical design, PLC programming languages, custom electrical design.

Engineering Supervisor
YED (Yazaki)

Dec 2009 - Jun 2010

Led design of new machinery and assembly processes, reviewed incoming production lines, and implemented lean manufacturing techniques. Participated in kickoff (APQP) of over 20 new projects.

Process Engineer
YED (Yazaki)

May 2007 - Dec 2009

Managed transference of production processes from Griffin, GA (USA) to Durango (Mexico), including assembly, molding, and stamping operations. Ensured smooth integration and setup of production lines in new facility.

🏛 Academic Employment

Facilitator
Prepa en Línea SEP

Oct 2014 - Sept 2019

Facilitator on a Moodle-based online educational platform. Responsibilities included providing effective feedback to students, scheduling and lecturing online classes, moderating forums, and guiding students through their learning process.

Lecturer - Electrical Circuits I
Universidad Autónoma de San Luis Potosí

Feb 2015 - Aug 2015

Responsible for teaching core electrical engineering concepts to undergraduate students, developing course materials, and evaluating student performance.

Academic Technician - Automation Laboratory
Universidad Autónoma de San Luis Potosí

Feb 2013 - Aug 2015

Responsible for maintaining laboratory equipment, assisting students in practical applications of automation systems, and supporting faculty with lab operations.

Academic Technician - Control Laboratory
Universidad Autónoma de San Luis Potosí

Aug 2012 - Feb 2013

Overseeing lab operations, supporting student projects, and maintaining control systems and equipment.

Lecturer - Electric Installations
Universidad Tecnológica de San Luis Potosí

Jan 2012 - Apr 2012

Taught the fundamentals of electrical installations, covering both theoretical knowledge and practical applications.

🧰 Technical Skills

✓ Engineering Management

- Balance customer requirements with available human, technical and economic resources.
- Provide feedback to colleagues and customers.
- Monitor technological trends and opportunity areas.
- Set standards at development steps for reproducibility and traceability.
- Identify risks that could delay project timeline.

👥 Team Work & Leadership

- Head of more than 4 engineering teams with up to 10 members.
- Mentor peers and provide technical feedback to engineers and managers.
- Self-organized, efficient and objective-oriented time management (GTD).
- Flexible and adaptable to challenging work conditions.

⚙ Automation & Industrial Control

- Excellent PLC programming: Allen Bradley, Siemens, Keyence, Omron, AutomationDirect.
- Systems integration: vision systems, servo drives, robots, VFDs, HMIs, process sensors.
- Industrial communication protocols: Profinet and CAN.
- Electric and mechanical drawing creation and interpretation.
- Upgrade and improve existing automation machinery.
- Lean manufacturing-based design and CAD analysis (SolidWorks, AutoCAD).

🖥 Electronic & Hardware Design

- Test-based hardware design with flexible, modular architecture.
- Advanced EMI/EMC compliant PCB design.
- Hands-on embedded systems development, debugging, and testing.
- FPGA-based prototype development (HDL and Verilog).
- Laboratory equipment proficiency: oscilloscopes, signal generators, dataloggers.
- Strong analog and digital electronic prototyping.

</> Embedded Development

- C/C++ firmware development for ARM-based microcontrollers (M0, M3, M4).
- Reusable code across different microcontroller vendors and families.
- Test-driven, debuggable, and traceable development.
- Low-level drivers: USB, I2C, UART, CAN, SPI communication protocols.
- Secure bootloader design and firmware update strategies.
- Linux Embedded development and RTOS implementation.
- CI/CD pipeline setup using Docker for firmware development.
- Hardware-in-the-loop (HIL) testing for embedded systems.

✏ Technical Communication

- Strong reading, writing, and speaking skills in English and Spanish.

🖼 Automotive Process Engineering

- Industrial process documentation: APQP, PFMEA, Control Plan.
- Kick-off and setup of over 20 automotive production lines.
- Lean manufacturing: VA/VE, standardized work, kaizen, poka-yoke, quick changeover.
- Statistical Process Control (SPC) for assembly and molding lines.

⚡ Power Electronics

- Design, simulation, and modeling of power electronics converters (DC-DC and AC-DC).
- Hardware-in-the-loop (HIL) test-benches for grid-interconnected systems.
- Magnetic component design (inductors and transformers) optimized with COMSOL FEM.

⌨ Software Development

- C#, Python, MATLAB, Julia development with Git version control.
- .NET, WPF/UWP applications, MVVM architecture, Java.
- Agile-based development in medium to large teams.
- Sphinx and Doxygen documentation generation.

- More than 13 published articles in indexed journals.
- TOEFL IBT score: 90.
- Clear technical leadership and cross-functional communication.

🎓 Education

Ph.D. in Electrical Engineering
2013 - 2016

🏛 Universidad Autónoma de San Luis Potosí

Thesis: Modeling of VSC based systems

Publications:
8 peer-reviewed papers in indexed journals

Research Focus: Power electronics, Control systems, Renewable energy

Collaborations: Aalborg University, Denmark (2015)

M.E. in Electrical Engineering
2010 - 2012

🏛 UASLP

Thesis: FPGA-Based System for Induction Motors.

Publications:
1 conference paper

Research Focus: FPGA design, Digital signal processing, Motor control

B.Eng. Electronic Engineering
2001 - 2006

🏛 Instituto Tecnológico de Durango

🎗 Grants & Distinctions

Grants and Research Collaborations

🏆 **Research Internship at Aalborg University, Denmark**

Project: HARMONY
2015 -- 2016

External Advisors: Xiongfei Wang and Frede Blaabjerg

🏆 **ECOES Grant, Universidad Michoacana de San Nicolás de Hidalgo**

External Advisors: Aurelio Médina
2014

Project: Modelado de convertidores trifásicos de potencia basados en la fuente controlada de voltaje para aplicaciones en energías alternativas.

Industry Collaborations

ENERCON, Germany

Industry Advisors: *Roberto Rosso and Soenke Engelken*

2015 -- 2016

Project: Modeling of current hysteresis controllers for interconnected VSC-based systems, focusing on mitigating power quality issues.

Distinctions

🏆 **Level 1 - Sistema Nacional de Investigadores (SNI)**

2018 -- 2023

🎓 Postgraduate Coursework

PhD in Electrical Engineering

• Modeling and Control of Voltage Source Converters and AC Drives ⭐ 03/2016 ET-AAU

Industrial/PhD Course

• Dynamic Modelling Workshop DIgSILENT GmbH

• Nonlinear Control Systems

• Predictive Control

• Robust Control

• Advanced Power Electronics

Master's in Electrical Engineering

• Dynamic Systems Control I

• Optimization

• Digital Signal Processing

📖 Publications and Books

[1]   C. Gurrola-Corral, J. Segundo, M. Esparza, and R. Cruz, "Optimal LCL-filter design method for grid-connected renewable energy sources," *International Journal of Electrical Power and Energy Systems*, vol. 120, p. 105998, 2020, doi: 10.1016/j.ijepes.2020.105998.

[2]   J. Yee *et al.*, "Characterization of a novel automated microfiltration device for the efficient isolation and analysis of circulating tumor cells from clinical blood samples," *Scientific Reports*, vol. 10, p. 7543, 2020, doi: 10.1038/s41598-020-63672-7.

[3]   J. Segundo, A. Bayo-Salas, M. Esparza, J. Beerten, and P. Gómez, "Frequency Domain Methods for Accuracy Assessment of Wideband Models in Electromagnetic Transient Stability Studies," *IEEE Transactions on Power Delivery*, vol. 35, pp. 71–83, 2020, doi: 10.1109/TPWRD.2019.2927171.

[4] C. Aguilar-Avelar *et al.*, "Fully Embedded Flow Control Device for Microfluidic Applications," *IEEE Latin America Transactions*, vol. 18, pp. 446–454, 2020, doi: 10.1109/TLA.2020.9085302.

[5] C. Aguilar-Avelar *et al.*, "High-Throughput Automated Microscopy of Circulating Tumor Cells," *Scientific Reports*, vol. 9, pp. 1–9, 2019, doi: 10.1038/s41598-019-50241-w.

[6] M. Esparza, J. Segundo, C. Gurrola-Corral, N. Visairo-Cruz, E. Barcenas, and E. Barocio, "Parameter Estimation of Grid Connected VSC Using The Extended Harmonic Domain," *IEEE Transactions on Industrial Electronics*, no. , p. 1, 2018, doi: 10.1109/TIE.2018.2870404.

[7] M. Esparza, J. Segundo-Ramirez, J. B. Kwon, X. Wang, and F. Blaabjerg, "Modeling of VSC-Based Power Systems in The Extended Harmonic Domain," *IEEE Transactions on Power Electronics*, no. 99, p. 1, 2017, doi: 10.1109/TPEL.2017.2658340.

[8] M. Esparza, J. Segundo-Ramirez, C. Nunez, X. Wang, and F. Blaabjerg, "A Comprehensive Design Approach of Power Electronic-Based Distributed Generation Units Focused on Power Quality Improvement," *IEEE Transactions on Power Delivery*, no. 99, p. 1, 2016, doi: 10.1109/TPWRD.2016.2584616.

[9] M. Esparza and J. Segundo-Ramírez, "An exact method for analysis and component design of grid connected VSC-based power devices," *International Journal of Electrical Power and Energy Systems*, vol. 78, pp. 489–498, June 2016, doi: 10.1016/j.ijepes.2015.11.108.

[10] M. Esparza and J. Segundo-Ramírez, "Optimal design of power electronics converters using the extended harmonic domain," in *2014 IEEE International Autumn Meeting on Power, Electronics and Computing (ROPEC)*, Nov. 2014, pp. 1–6. doi: 10.1109/ROPEC.2014.7036301.

[11] M. Esparza and J. Segundo-Ramírez, "Switching based modeling of grid interconnected hysteresis current controlled VSC converters," in *2016 IEEE International Autumn Meeting on Power, Electronics and Computing (ROPEC)*, Nov. 2016, pp. 1–6. doi: 10.1109/ROPEC.2016.7830589.

[12] J. Kwon *et al.*, "Measurement of phase dependent impedance for 3-phase diode rectifier," in *IECON 2016 - 42nd Annual Conference of the IEEE Industrial Electronics Society*, Oct. 2016, pp. 7034–7039. doi: 10.1109/IECON.2016.7793253.

[13] M. A. Esparza *et al.*, "Real-time emulator of an induction motor: FPGA-based implementation," in *2012 9th International Conference on Electrical Engineering, Computing Science and Automatic Control (CCE)*, Sept. 2012, pp. 1–6. doi: 10.1109/ICEEE.2012.6421152.