

Exponent®
Engineering & Scientific Consulting

Sergio Mendoza, Ph.D.

Senior Manager | Materials Science and Electrochemistry
Natick
+1-508-652-8523 | smendoza@exponent.com

Professional Profile

Dr. Mendoza specializes in mechanical engineering and system dynamics and control. He consults with clients across industries such as automotive, consumer electronics, consumer products, and medical devices. His expertise is instrumental in implementing data-driven methods to enhance the performance and safety of technologies spanning battery energy storage (BESS), electric vehicles (EVs), and medical devices.

Dr. Mendoza is highly proficient in designing algorithms and testing methods for developing, verifying, and validating software and hardware. He also assists numerous clients in conducting root cause analyses of products, particularly those involving battery failures.

Dr. Mendoza is active in conducting scientific research related to questions that have a direct impact on consumer safety and product performance and reliability. For example, what operating conditions affect the aging of batteries? How does sensor selection affect EV range estimates? How does battery chemistry and capacity the energy released during lithium-ion battery failures? And how can we quantify that energy?

His work has been featured in peer-reviewed publications encompassing experimental and analytical methods aimed at characterizing the effects of operating conditions on battery aging, quantifying the energy released during lithium-ion battery failures, and developing tools for identifying battery module parameters and estimating battery state of charge (SOC) and state of health (SOH).

Before joining Exponent, Dr. Mendoza served as a Battery Controls Software Lead Engineer at General Motors (GM). His responsibilities centered on developing control software for propulsion batteries and battery management systems (BMS). He validated the controls software using hardware in the loop (HIL) setups and executed tests for functional safety and performance validation. Additionally, he contributed to the development and implementation of model-based fuel control strategies and on-board diagnostic (OBD) tools to enable internal combustion engine (ICE) vehicles to meet Environmental Protection Agency (EPA) emission requirements, to optimize fuel consumption, and to improve vehicle drivability.

Dr. Mendoza also brings a background in economics to his expertise, alongside being a certified Six Sigma Green Belt by GM and a certified Scrum Master. With over 10 years of experience, he has adeptly applied his knowledge of economics and project management to various facets such as budgeting, scope analysis, cost tracking, and lifecycle studies.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Penn State University, 2017

M.S., Mechanical Engineering, Penn State University, 2014

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B.A., Economics, University of Memphis, 2011

B.S., Mechanical Engineering, University of Memphis, 2010

Engineering Dean's Award, 2011

Student marshal, Herff College of engineering, class of 2010

Prior Experience

General Motors - Model-based Powertrain Controls Engineer 2/2017 - 5/2018

- Developed control-oriented models of the aftertreatment system in gas engines to improve emissions and fuel consumption
- Designed model-based diagnostic strategies to verify the compliance of different components in the aftertreatment system in gas engines
- Analyzed the implications and potential benefits of different projects on the overall business model

General Motors - Battery Controls Software Lead 5/2018 - 10/2018

- Led development of control software for propulsion batteries used in non-automotive applications
- Developed and execute functional and performance software validation
- Defined diagnostic strategy and implementation
- Led controls system safety analyses including Preliminary Hazard Analyses (PHA) and Design Failure Mode and Effects Analyses (DFMEA)

Professional Affiliations

Vice-Chair SAE Battery Management Systems (BMS) Committee

Vice-Chair IEEE P2686 Recommended Practices for Stationary Energy Storage Applications (IEEE Senior Member)

American Society of Mechanical Engineers (ASME)

Languages

Spanish

Patents

Patent, US 2020/0182179 A1: Three-Way Catalyst Oxygen Storage Module, June 11, 2020 (with Gongshing Qi, Se H. Oh, Min Sun, Wei Li, and Patricia Mulawa).

Publications

M. Yen, A. Kossolapov, S. Mendoza, and F. Colella, "Fractional Thermal Runaway Calorimetry," 2023 39th Semiconductor Thermal Measurement, Modeling & Management Symposium (SEMI-THERM), San Jose, CA, USA

M. Yen, A. Kossolapov, S. Mendoza, and F. Colella, "Fractional Thermal Runaway Calorimetry: A Novel Tool to Assess Battery Thermal Runaway Energy," SAE Technical Paper 2023-01-0510, 202

Z. Cai, S. Mendoza, J. Goodman, J. McGann, B. Han, H. Sanchez, R. Spray, “The Influence of Cycling, Temperature, and Electrode Gaping on the Safety of Prismatic Lithium-ion Batteries”, J. Electrochemical Society, 165.

S. Mendoza, M. Rothenberger, A. Hake, H. Fathy, "Optimization and Experimental Validation of a Thermal Cycle that Maximizes Entropy Coefficient Fisher Identifiability for Lithium Iron Phosphate Cells", Journal of Power Sources, vol 308, pp. 18 - 28, 2016.

S. Mendoza, J. Liu, Mishra, Partha, H. Fathy, "On the Relative Contributions of Bias and Noise to Lithium-ion Battery State of Charge Estimation Errors", Journal of Energy Storage, vol 11, pp. 86-92, 2017.

P. Mishra, G. Mayank, S. Mendoza, J. Liu, C. Rahn, H. Fathy, "How Does Model Reduction Affect Lithium-ion Battery State of Charge Estimation Errors? Theory and Experiments, Journal of the Electrochemical Society, 164 (2), pp.A237-A251, 2017.

Conference Proceedings

M. Yen, S Mendoza, A. Ibarreta, T. Myers, “Using Process Safety Principles to Mitigate the Hazards of Battery Energy Storage Systems”, Proceedings, AiChE Spring Meeting and Global Congress on Process Safety 2020.

S. Mendoza and H. K. Fathy, "Entropy Coefficient and Thermal Time Constant Estimation from Dynamic Thermal Cycling of a Cylindrical LiFeP04 Battery Cell," in Proceedings of the ASME 2014 Dynamic Systems and Control Conference, pp. 1-9, San Antonio, 2014.

J. Liu, S. Mendoza, G. Li, H. Fathy, " Efficient Total Least Squares State Estimation for Differentially Flat Systems", in Proceedings of the ACC 2016 American Controls Conference, Boston, 2016.

S. Mendoza, J. Liu, Mishra, Partha, H. Fathy, " Statistical Quantification of Least-Squares Battery State of Charge Estimation Errors" in Proceedings of the ASME 2016 Dynamic Systems and Control Conference, Minneapolis, 2016.

J. Liu, M. Rothenberger, S. Mendoza, P. Mishra, Y. Sik, H. Fathy, "Can an Identifiability-Optimizing Test Protocol Improve the Robustness of Subsequent Health-Conscious Battery Control? An Illustrative Case Study, in Proceedings of the ACC 2016 American Controls Conference, Boston, 2016

S. Mendoza, M. Rothebenger, H.Fathy, "Maximizing Parameter Identifiability of a Combined Thermal and Electrochemical Battery Model Via Periodic Input Optimization", in the proceedings of the IFAC 2017 Conference, Toulouse France, 2017.

Presentations

S. Mendoza, A. Flyer, “Opportunities and Compliance Challenges in Extending On-Board Diagnostics (OBD) to Electric Vehicles (EVs)”, 2024 SAE On-Board Diagnostics Symposium-Europe, Amsterdam, NLD

S. Mendoza, “Lithium-ion Batteries and Medical Devices: A Modeling Framework”, 2nd USA Medical

Battery Conference as Part of MD&M West, Anaheim, CA

Colella, F., Mendoza, S., Yen, M., Kossolapov A., Thermal Stability of Battery Packs During Cell Thermal Runaway: the Importance of Energy Yields, SAE Thermal Management Systems Symposium, October 3-4, 2023, Plymouth, Michigan.

S. Mendoza, “Data Driven Battery Management System Strategies”, 1st USA Medical Battery Conference as Part of MD&M West, Anaheim, CA

S. Mendoza, “Exponential Rise of Electric Vehicles: Challenges and Opportunities for The Development of Battery Electric Vehicle On-Board Diagnostics”, 2023 SAE On-Board Diagnostics Symposium-Americas, Indianapolis, IN

S Mendoza, M Yen, A. Kossolapov, and F. Colella, “Lithium-ion Battery Energy Release During Failure”, Center for Chemical Process Safety (CCPS) June TSC Meeting.

S. Mendoza, S. Murray, “Battery Industry Basics: A practical Foundation in Battery Technology, Manufacturing, Design, and Safety” 2023 Sidley Austin LLP Battery Summit.

S Mendoza, “Physics-Based Battery Management Systems for Medical Devices”, 2021 International Battery Seminar & Exhibit, Orlando FL

S Mendoza, “Battery Management Systems”, 2020 International Battery Seminar & Exhibit, Orlando FL

S. Mendoza, et al Model-based Control and Diagnostics for TWC Aftertreatment System (GM Kettering Forum, 2018)

S. Mendoza, M. Rothenberger, A. Hake, and H. Fathy, Experimental Parameter Identification of a LiFePO4 Thermal Battery Model through Identifiability Maximization Using Input Trajectory Optimization (ECS Fall Meeting, 2014)

S. Mendoza, J. Marchetta, "Rotary Fuel Cell" (50th AIAA Aerospace Sciences Meeting)

Additional Education & Training

TÜV SUD – Functional Safety Engineer ISO 26262:2018

General Motors Advanced Driver Training, 2018