Exponent®
Engineering & Scientific Consulting

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## Professional Profile

Dr. Amini offers his clients a robust and diverse expertise in vehicle engineering, supported by over a decade of experience in the automotive industry and academia. He specializes in the development and evaluation of advanced driver assistance systems (ADAS), connected and automated vehicles (CAV), and battery management technologies for electric vehicles (EVs) and other battery powered devices. Dr. Amini has hands-on experience, from research and development to production, verification, and validation, and deep understanding of automotive control algorithm software and hardware. Additionally, he has expertise in artificial intelligence and machine learning, which are integral to the development and assessment of emerging vehicle technologies and critical for diagnosing and prognosticating potential safety-critical vehicle faults and malfunctions.

Prior to joining Exponent, Dr. Amini was a technical specialist at Stellantis focused on battery control and estimation algorithms, contributing to the development of software-defined EV platforms with stringent safety and reliability functional requirements. At Ford Motor Company's Research and Advanced Engineering department, he advanced cooperative adaptive cruise control and autonomous driving technologies. As a research scientist at the University of Michigan in Ann Arbor, he led multiple federally (Department of Energy, Office of Naval Research) and industry (Ford, Toyota) sponsored projects, pushing the boundaries of electrification and advanced automated driving technologies with a focus on enhancing vehicle safety and performance.

During his tenure at Ford, Dr. Amini conducted and led successful demonstrations that showcased the potential of infrastructure-informed cooperative adaptive cruise control (CACC) for connected vehicles. He played a crucial role in the design and integration of cutting-edge control algorithms that were instrumental in fostering cooperative driving capabilities, thereby transforming connected vehicle ecosystems. His efforts were pivotal in setting new benchmarks for safety and enhancing the overall comfort of the driving experience.

In a partnership between the University of Michigan and Ford between 2018 to 2023, Dr. Amini harnessed the power of machine learning to develop and create patents for innovative methods in electric vehicle (EV) range and speed prediction. Leveraging real-world traffic data, his research yielded a 20-30% improvement in the accuracy of EV range estimations. The predictive algorithms he developed not only optimized driving range but also amplified fast-charging efficiency and reduced energy consumption for electrified vehicles. These advancements were substantiated through comprehensive simulations and rigorous road tests.

Dr. Amini's academic journey culminated in a Ph.D. in Mechanical Engineering from Michigan Tech in 2017. His research in system dynamics and control, electrified mobility, intelligent transportation, and energy storage systems has yielded over 50 peer-reviewed articles and patents. Dr. Amini is a member of the Transportation and Automotive Controls Technical Committees within IEEE and ASME, where he has

 

been instrumental in organizing and chairing numerous technical sessions and panels at internationally recognized conferences on emerging vehicle technologies since 2017.

## Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Michigan Technological University, 2017

M.S., Mechanical Engineering, K.N. Toosi University of Technology, Iran, 2012

B.S., Mechanical Engineering, K.N. Toosi University of Technology, Iran, 2010

Best Paper Award, 2022, Internal Short Circuit Detection for Parallel-Connected Battery Cells Using Convolutional Neural Network, Journal of Automotive Innovation, Springer.

Best Paper Award Finalist, 2022, Automotive and Transportation Systems Technical Committee, American Control Conference, Atlanta, GA, USA

Ph.D. Finishing Fellowship, 2017, Michigan Tech. University, Houghton, MI, USA

## Academic Appointments

Assistant Research Scientist, Department of Naval Architecture & Marine Engineering, University of Michigan, Ann Arbor, MI USA, 2019-2023

## Prior Experience

Technical Specialist – EV Battery Control and Estimation Algorithms, Stellantis, Auburn Hills, MI, USA, 2023-2024

Sr. Research Engineer, Research and Innovation Center, Ford Motor Company, Dearborn, MI, USA 2023

Ford Faculty Fellow, Research and Innovation Center, Ford Motor Company, Dearborn, MI, USA, 2020

Postdoctoral Research Fellow, Department of Naval Architecture & Marine Engineering, University of Michigan, Ann Arbor MI, USA, 2017-2019

## Professional Affiliations

Institute of Electrical and Electronics Engineers (IEEE) - Automotive Controls Technical Committee, 2017 – Current

The American Society of Mechanical Engineers (ASME) - Automotive and Transportation Systems Technical Committee, 2016 - Current

The American Society of Mechanical Engineers (ASME) - Energy Systems Technical Committee, 2016 - Current

## Patents

US Patent 11,960,298: Multi-range vehicle speed prediction using vehicle connectivity for enhanced energy efficiency of vehicles, April 2024 (Amini MR, Feng Y, Yang Z, Kolmanovsky I, Sun J)

US Patent 10,954,845: Actively controlled coolant tank to increase thermal storage capacity of hybrid electric vehicles, March 2021 (Amini MR, Sun J, Kolmanovsky I, Wang H)

## Publications

Hu, Q., Amini, M.R., Wiese, A., Kolmanovsky, I. and Sun, J., 2023. Robust model predictive control for enhanced fast charging on electric vehicles through integrated power and thermal management. In proceedings of the 62nd IEEE Conference on Decision and Control, Singapore.

Zhang, J., Li, X., Amini, M.R., Kolmanovsky, I., Tsutsumi, M. and Nakada, H., 2023. Modeling and control of diesel engine emissions using multi-layer neural networks and economic model predictive control. In proceedings of the 22nd IFAC World Congress, Yokohama, Japan.

Amini, M.R., Hu, Q., Wiese, A., Kolmanovsky, I., Seeds, J.B. and Sun, J., 2022. A data-driven spatio-temporal speed prediction framework for energy management of connected vehicles. IEEE Transactions on Intelligent Transportation Systems, 24(1), pp.291-303.

Yang, N., Song, Z., Amini, M.R. and Hofmann, H., 2022. Internal short circuit detection for parallel-connected battery cells using convolutional neural network. Automotive Innovation, 5(2), pp.107-120.

Hu, Q., Amini, M.R., Kolmanovsky, I., Sun, J., Wiese, A. and Seeds, J.B., 2021. Multihorizon model predictive control: An application to integrated power and thermal management of connected hybrid electric vehicles. IEEE Transactions on Control Systems Technology, 30(3), pp.1052-1064.

Amini, M., Hu, Q., Wang, H., Feng, Y., Kolmanovsky, I., Sun, J., 2021, “Experimental Validation of Eco-Driving and Eco-Heating Strategies for Connected and Automated HEVs,” SAE Technical Paper 2021-01-0435.

Amini, M.R., Kolmanovsky, I. and Sun, J., 2020. Hierarchical MPC for robust eco-cooling of connected and automated vehicles and its application to electric vehicle battery thermal management. IEEE Transactions on Control Systems Technology, 29(1), pp.316-328.

Amini, M.R., Feng, Y., Yang, Z., Kolmanovsky, I. and Sun, J., 2020. Long-term vehicle speed prediction via historical traffic data analysis for improved energy efficiency of connected electric vehicles. Transportation Research Record, 2674(11), pp.17-29.

Wang, H., Amini, M.R., Hu, Q., Kolmanovsky, I. and Sun, J., 2020. Eco-cooling control strategy for automotive air-conditioning system: Design and experimental validation. IEEE Transactions on Control Systems Technology, 29(6), pp.2339-2350.

Amini, M.R., Wang, H., Gong, X., Liao-McPherson, D., Kolmanovsky, I. and Sun, J., 2019. Cabin and battery thermal management of connected and automated HEVs for improved energy efficiency using hierarchical model predictive control. IEEE Transactions on Control Systems Technology, 28(5), pp.1711-1726.

**Presentations**

Amini MR, Prediction, estimation, and control of connected and electrified vehicles, Joby Aviation, San Carlos, CA, USA, September 2023.

Amini MR, Model predictive control for eefficient propulsion systems, Blue Origin, Kent, WA, USA, August 2023.

Amini MR, Prediction, estimation, and control of connected and electrified vehicles, MathWorks, Natick, MA, USA, August 2023.

Amini MR, Intelligent control of electrified, connected, and automated vehicles, Ford Motor Company, Dearborn, MI, USA, October 2023.

Amini MR, Learning from data for eefficient and resilient control of connected and autonomous systems, University of Michigan, Ann Arbor, MI, USA, February 2020.

Amini MR, Wang H, Gong X, Sun J, Kolmanovsky I, Optimization-based cabin and battery thermal management of connected and automated HEVs for improved energy efficiency, SAE Thermal Management Systems Symposium, San Diego, CA, USA, October 2018.

Amini MR, Adaptive robust discrete sliding mode controls with application to automotive powertrains, General Motors Global Research & Development, Pontiac, MI, USA, January 2017.

## Editorships & Editorial Review Boards

IEEE CSS Technology Conference Editorial Board, IEEE Conference on Control Technology and Applications 2019 - Current

Associate Editor, American Control Conference, Toronto, Canada, 2024

Program Committee and Associate Editor, American Control Conference, San Diego, CA, USA, 2023

## Peer Reviews

IEEE Transactions on Control Systems Technology

IEEE Transactions on Intelligent Transportation Systems

IEEE Transactions on Vehicular Technology

IEEE Transactions on Transportation Electrification

Annual Reviews in Control (IFAC/Elsevier)

ASME Journal of Dynamic Systems, Measurement, and Control

Vehicle System Dynamics (Taylor & Francis)

American Control Conference (ACC)

IEEE Conference on Decision and Control (CDC)

Transportation Research Board (TRB) Annual Meeting

Society of Automotive Engineers (SAE) World Congress