Exponent®
Engineering & Scientific Consulting

Elham Mirkoohi, Ph.D.

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Professional Profile

Dr. Mirkoohi is a mechanical engineer specializing in advanced manufacturing, materials science, and failure analysis. She supports clients across aerospace, automotive, medical devices, defense, and industrial sectors, with expertise in product failure investigations, defect mitigation, and process reliability. Her work integrates multi-resolution experiments, Artificial Intelligence (AI) and computational modeling to deliver data-driven solutions for complex engineering challenges.

HVAC Systems

Dr. Mirkoohi provides engineering support for heating, ventilation, and air conditioning (HVAC) systems, focusing on mechanical failure analysis, thermal stress evaluation, and component reliability. She has investigated failures in compressors, fans, and heat exchangers, using experimental diagnostics and simulation tools to assess performance under cyclic thermal and mechanical loads. She is well-versed in standards such as ASHRAE, AHRI, and UL, helping clients improve system efficiency, durability, and compliance with safety and energy regulations.

Intellectual Property & Trade Secret Disputes

Dr. Mirkoohi supports litigation involving allegations of trade secret misappropriation and theft of proprietary manufacturing processes. Her role includes technical comparison of manufacturing workflows, materials, and performance characteristics to assess claims of process replication or reverse engineering. She applies forensic engineering methods, experimental validation, and industry standards (e.g., ASTM, ISO) to evaluate the originality and distinctiveness of manufacturing techniques. Her analyses help clarify technical facts in support of legal arguments related to intellectual property and competitive advantage.

Machinery Performance and Safeguarding Investigations

Dr. Mirkoohi contributes to forensic investigations involving injuries resulting from mechanical component failures. In these cases, she conducts root cause analysis through physical inspection, material testing, and simulation of failure scenarios. Her work includes evaluating design integrity, manufacturing defects, and maintenance history to determine the cause of malfunction. She applies relevant safety standards such as OSHA, ASME, and ISO, and provides technical insights to support litigation, regulatory compliance, and risk mitigation strategies.

Aerospace

Dr. Mirkoohi conducts failure analysis and root cause investigations of aerospace components such as propellers, gears, and structural assemblies. Her work includes fatigue testing, thermal-mechanical simulations, and microstructural analysis to evaluate failure mechanisms under operational and

environmental loads. She has led experimental studies on propeller fatigue and gear degradation, integrating finite element modeling with metallurgical evaluations. Her assessments align with aerospace industry standards such as ASTM, ASME, and FAA guidelines, supporting clients in ensuring airworthiness and structural integrity.

Automotive

In the automotive sector, Dr. Mirkoohi focuses on drivetrain and electric vehicle systems, with specialized expertise in electrically-induced bearing damage. She has conducted experimental and computational investigations into bearing wear, gear failures, and residual stress effects in high-performance components. Her work includes thermal and mechanical modeling of EV drivetrain components, and she applies standards such as ISO 281 and SAE J1459 in her evaluations. These analyses support defect mitigation, predictive maintenance, and compliance with automotive reliability and safety standards.

Electronic Consumer Products

Dr. Mirkoohi supports clients in the electronics sector by investigating mechanical and thermal failures in consumer devices such as smartphones, wearables, and home appliances. Her work includes root cause analysis of component fatigue, solder joint cracking, and heat-induced material degradation. She combines experimental testing with finite element simulations to assess structural integrity and thermal performance. Her evaluations are guided by standards such as IPC-A-610, JEDEC JESD22, and UL safety protocols, helping manufacturers enhance product reliability and meet regulatory compliance.

Modeling and Simulation

As a consultant, Dr. Mirkoohi applies computational modeling, AI-driven predictive maintenance, and physics-based simulations to identify and understand the causes of mechanical and material failures. Her work focuses on realizing failure mechanisms, diagnosing defects, and assessing structural integrity to support clients in failure prevention and risk mitigation.

Prior to joining Exponent, Dr. Mirkoohi was an assistant professor at Auburn University. She received her PhD from Georgia institute of Technology and worked on projects involving understanding the integrity and performance of mechanical components for various sectors such as aerospace, medical, automotive, and manufacturing machinery.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Georgia Institute of Technology, 2020

M.Sc., Mechanical Engineering, Oregon State University, 2017

B.Sc., Mechanical Engineering, University of Tehran, 2015

SME Young Manufacturing Engineer Award, 2025

Academic Appointments

Assistant Professor, Mechanical Engineering, Auburn University, 2021-2024

Prior Experience

Assistant Professor, Auburn University, 2021-2024

Postdoctoral Research Fellow, Georgia Institute of Technology, 2020-2021

Executive Coordinator, Novelis Innovation Hub, Georgia Institute of Technology, 2021-2021

Graduate Research Assistant, Georgia Institute of Technology, 2017-2020

Mechanical Design Intern, Tesla, 2019

Graduate Research Assistant, Boeing, 2017-2020

Graduate Research Assistant, Oregon State University, 2015-2017

Undergraduate Research Assistant, University of Tehran, 2011-2015

Professional Affiliations

ASME since 2016

SME since 2026

Publications

Mirkoohi, E., Li, D., Garmestani, H. and Liang, S.Y., 2021. Residual Stress Modeling Considering Microstructure Evolution in Metal Additive Manufacturing. Journal of Manufacturing Processes, 68, pp.383-397.

Mirkoohi, E., Tran, H.C., Lo, Y.L., Chang, Y.C., Lin, H.Y. and Liang, S.Y., 2021. Mechanics Modeling of Residual Stress Considering Effect of Preheating in Laser Powder Bed Fusion. Journal of Manufacturing and Materials Processing, 5(2), p.46.

Mirkoohi, E., Mahdavi, M., Li, D., Garmestani, H. and Liang, S.Y., 2021. Microstructure affected residual stress prediction based on mechanical threshold stress indirect metal deposition of Ti-6Al-4 V. The International Journal of Advanced Manufacturing Technology, 112(5), pp.1705-1712.

Mirkoohi, E., Li, D., Garmestani, H. and Liang, S.Y., 2020. Analytical Modeling of Residual Stress in Laser Powder Bed Fusion Considering Volume Conservation in Plastic Deformation. Modelling, 1(2), pp.242-259.

Mirkoohi, E., Dobbs, J.R. and Liang, S.Y., 2020. Analytical mechanics modeling of in-process thermal stress distribution in metal additive manufacturing. Journal of Manufacturing Processes, 58, pp.41-54.

Mirkoohi, E., Tran, H.C., Lo, Y.L., Chang, Y.C., Lin, H.Y. and Liang, S.Y., 2020. Analytical mechanics modeling of residual stress in laser powder bed considering flow hardening and softening. The International Journal of Advanced Manufacturing Technology, 107(9), pp.4159-4172.

Mirkoohi, E., Tran, H.C., Lo, Y.L., Chang, Y.C., Lin, H.Y. and Liang, S.Y., 2020. Analytical modeling of residual stress in laser powder bed fusion considering part's boundary condition. Crystals, 10(4), p.337.

Mahdavi, M., Mirkoohi, E., Hoar, E., Liang, S. and Garmestani, H., 2020. Prediction of the deformation behavior of a selective laser-melted Ti-6Al-4V alloy as a function of process parameters. The International Journal of Advanced Manufacturing Technology, 107(9), pp.4069-4076.

Mirkoohi, E., Sievers, D.E., Garmestani, H. and Liang, S.Y., 2020. Thermo-mechanical modeling of thermal stress in metal additive manufacturing considering elastoplastic hardening. CIRP Journal of Manufacturing Science and Technology, 28, pp.52-67.

Mirkoohi, E., Dobbs, J.R. and Liang, S.Y., 2020. Analytical modeling of residual stress in direct metal

deposition considering scan strategy. The International Journal of Advanced Manufacturing Technology, 106(9), pp.4105-4121.

Ji, X., Mirkoohi, E., Ning, J. and Liang, S.Y., 2020. Analytical modeling of post-printing grain size in metal additive manufacturing. Optics and Lasers in Engineering, 124, p.105805.

Mirkoohi, E., Sievers, D.E., Garmestani, H., Chiang, K. and Liang, S.Y., 2019. Three-dimensional semi-elliptical modeling of melt pool geometry considering hatch spacing and time spacing in metal additive manufacturing. Journal of Manufacturing Processes, 45, pp.532-543.

Ning, J., Mirkoohi, E., Dong, Y., Sievers, D.E., Garmestani, H. and Liang, S.Y., 2019. Analytical modeling of 3D temperature distribution in selective laser melting of Ti-6Al-4V considering part boundary conditions. Journal of Manufacturing Processes, 44, pp.319-326.

Mirkoohi, E., Seivers, D.E., Garmestani, H. and Liang, S.Y., 2019. Heat source modeling in selective laser melting. Materials, 12(13), p.2052.

Mirkoohi, E., Bocchini, P. and Liang, S.Y., 2019. Analytical temperature predictive modeling and non-linear optimization in machining. The International Journal of Advanced Manufacturing Technology, 102(5), pp.1557-1566.

Mirkoohi, E., Bocchini, P. and Liang, S.Y., 2019. Inverse analysis of residual stress in orthogonal cutting. Journal of Manufacturing Processes, 38, pp.462-471.

Tabei, A., Mirkoohi, E., Garmestani, H. and Liang, S., 2019. Modeling of texture development in additive manufacturing of Ni-based superalloys. International Journal of Advanced Manufacturing Technology, 103.

Mirkoohi, E., Bocchini, P. and Liang, S.Y., 2018. An analytical modeling for process parameter planning in the machining of Ti-6Al-4V for force specifications using an inverse analysis. The International Journal of Advanced Manufacturing Technology, 98(9), pp.2347-2355.

Mirkoohi, E., Ning, J., Bocchini, P., Fergani, O., Chiang, K.N. and Liang, S.Y., 2018. Thermal modeling of temperature distribution in metal additive manufacturing considering effects of build layers, latent heat, and temperature-sensitivity of material properties. Journal of Manufacturing and Materials Processing, 2(3), p.63.

Project Experience

Led manufacturing defect assessments for laser-sintered stainless steel 316L, Inconel 718, Inconel 625, Ti-6V-4Al, and similar materials to enhance quality and reliability.

Managed fatigue and residual stress-induced failure assessments for industrial components such as gears, impellers, bearings, etc.

Conducted root cause analysis on electrically-induced bearing damage in electric vehicle designs.

Performed residual stress modeling for components manufactured via machining and additive manufacturing to assess failure risks.

Conducted thermal and mechanical modeling of machining processes to evaluate the impact of loads on part failures.

Analyzed thermal history effects in laser-based metal additive manufacturing to assess failure risks.