

Dr. Steven Lorenz is a Senior Staff Consultant at Engineering Systems Inc. (ESi) with expertise in applied mechanics, fatigue and failure analysis, finite element analysis (FEA), machine design, probability and reliability analysis, and tribology. In addition to his analytical background, Dr. Lorenz has experience in instrumentation and testing, including custom test fixture development and data acquisition.

Dr. Lorenz has extensively investigated fatigue, friction, lubrication, reliability and wear of bearings, gears and other critical machine components in aerospace, automotive and nuclear industries. His investigative background involves research and development of material behavior models to capture the progressive damage and failure of the material, e.g. metal failure. Moreover, Dr. Lorenz has designed, developed and conducted physical testing ranging from simple fixtures to evaluate performance of a component, to bespoke apparatuses to enable detailed investigation of component behavior.

Dr. Lorenz has demonstrated commitment to the broader scientific community throughout his career. His research has been published in peer-reviewed scientific journals and presented at prestigious technical conferences. In addition to his research contributions, Dr. Lorenz actively contributes to the scientific community as a reviewer for journals specializing in general failure analysis as well as tribology. Dr. Lorenz has also served as a Journal Assistant to the Editor in Chief of ASME's Journal of Tribology, where he aided in the distribution of articles to technical experts in the field of tribology and provided production support.

Prior to joining ESi as a mechanical engineering consultant, Dr. Lorenz was a Visiting Assistant Professor of Mechanical Engineering and a part of the Mechanical Engineering Tribology Laboratory (METL) at Purdue University. While at Purdue, he taught Machine Design and conducted tribological research.

Education

PhD, Mechanical Engineering. Purdue University. 2023.

MS, Mechanical Engineering. Purdue University. 2022.

BS, Mechanical Engineering. Purdue University. 2018.

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ESi Atlanta

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Areas of Specialization

- Applied Mechanics
- Bearings
- Computational Modeling
- Custom Test Fixture Development
- Design Analysis and Optimization
- Failure Analysis
- Fatigue and Fracture Mechanics
- Finite Element Analysis
- Mechanical Engineering
- Mechanical and Machine Design
- Mechanics of Materials
- Mechanical Testing
- Reliability Modeling, Simulation, and Testing
- Statistical Analysis and Probability Modeling
- Stress Analysis
- Tribology

Licenses & Certifications

- State of California P.E. License (Mechanical) 42926

Positions Held

Engineering Systems Inc., Atlanta, GA

- Senior Staff Consultant, 2024 – Present

Purdue University, West Lafayette, Indiana

- Visiting Assistant Professor, 2024

Mechanical Engineering Tribology Laboratory, Purdue University, West Lafayette, Indiana

- Graduate Research Assistant, 2017 - 2023

MED Institute Inc., West Lafayette, Indiana

- Bench Testing Team Intern, 2015 - 2016

Continuing Education

- **Society of Tribologists and Lubrication Engineers (STLE)** – Advanced Lubrication: Lubrication Regimes, Wear and Failure Analysis, 2025.

Professional Affiliations/Honors

American Society of Mechanical Engineers (ASME)

- Member
- ASME Journal of Tribology – Reviewer
- ASME Journal of Tribology – Journal Assistant to Editor in Chief, 2022 – 2023

ASM International

- Member

Society of Tribologists and Lubrication Engineers (STLE)

- Member
- Chicago Section Scholarship, 2021

Project Experience

Mechanical Components and Tribology

- Evaluated suitability of rolling element and sliding bearings designs in consumer and marine power transmission applications. Assessed load capacity, operating conditions, observed damage mechanisms, and performance relative to intended design requirements.
- Evaluated the performance of mechanical components, including bearings, fasteners, welded connections, and rotating shafts, as well as load-bearing structures subjected to static, dynamic, and cyclic loading conditions. Applied first-principles engineering calculations and finite element analysis (FEA) to assess stress distribution, fatigue life, and fitness-for-service relative to intended design requirements.

Industrial Equipment and Structural Systems

- Used finite element analysis (FEA) to evaluate structural performance and load-carrying capacity from an alleged failure of an industrial overhead crane system.
- Investigated structural integrity and operational performance of an overhead jib crane hoist. Conducted controlled laboratory testing to evaluate design suitability and structural capacity under representative service scenarios.
- Analyzed the structural performance of a hydraulic lifting assembly using finite element analysis (FEA).
- Investigated the performance of wastewater treatment screening assemblies following reported operational failure. Conducted mechanical evaluation of screening elements, support structures, and system design.

Pressure Systems and Energy Infrastructure

- Evaluated structural integrity and failure mechanisms of pressurized vessels, including pipelines, propane cylinders, and pressurized transport vessels. Utilized finite element analysis (FEA) to evaluate stress response under internal pressure and service loading conditions.
- Investigated fretting wear behavior of superalloy pairs for nuclear applications at temperature and in anaerobic environments.

Automotive and Transportation

- Evaluated structural performance of an automotive seat assembly subjected to prescribed occupant loading conditions using finite element analysis (FEA).
- Investigated reported transit damage to a large industrial assembly following a vehicular collision event. Conducted field inspection and mechanical evaluation to assess impact-related damage.

Consumer and Commercial Products

- Applied finite element analysis (FEA) to evaluate structural performance of plumbing products under representative installation and service loading conditions to support design assessment and suitability.
- Investigated design of reusable metallic beverage containers with threaded caps.

Publications

“Investigation of Microstructural Modifications on Rolling Contact Fatigue Performance of Aerospace Bearing Contacts,” **S.J. Lorenz**, Doctoral Dissertation, Purdue University, 2023.

“RCF Performance of M50 Steel: A Combined Experimental and Analytical Approach to Determine Life,” **S.J. Lorenz**, F. Sadeghi, *International Journal of Fatigue*, Vol. 176, 2023.

“An Investigation into Various Failure Criteria on RCF Through an Improved Probabilistic Model,” **S.J. Lorenz**, F. Sadeghi, C. Wang, B. Wang, *Tribology International*, Vol. 188, 2023.

“Investigation into Rolling Contact Fatigue Performance of Aerospace Bearing Steels,” **S.J. Lorenz**, F. Sadeghi, H.K. Trivedi, M.S. Kirsch, *International Journal of Fatigue*, Vol. 172, 2023.

“Optical Measurement of Roller Slip, Tilt, and Skew in a Spherical Roller Bearing,” A. Shafiee, T. Russell, **S.J. Lorenz**, F. Sadeghi and M.G. Wilmer, *Journal of Tribology*, Vol. 145(4), 2023.

“A CFD-FEM based partitioned FSI model to investigate surface cracks in EHL,” K. Singh, F. Sadeghi, W. Peterson, **S.J. Lorenz**, J. Villarreal and T. Jinmon, *Tribology International*, Vol. 171, 2022.

“Effect of Spatial Hardness Distribution in Rolling Contact Fatigue Performance of Bearing Contacts,” **S.J. Lorenz**, F. Sadeghi, C. Wang, *Tribology International*, Vol. 171, 2022.

“FSI Modeling of EHL Line Contacts,” K. Singh, F. Sadeghi, W. Peterson, T. Russell, **S.J. Lorenz**, J. Villarreal and T. Jinmon, *Journal of Tribology*, Vol. 143(9), 2021.

“An approach for predicting failure mechanism in rough surface rolling contact fatigue,” **S.J. Lorenz**, F. Sadeghi, H.K. Trivedi, L. Rosado, M.S. Kirsch, C. Wang, *Tribology International*, Vol. 158, 2021.

“A CDM-FE model for investigating effects of surface roughness on RCF,” **S.J. Lorenz**, F. Sadeghi, H.K. Trivedi, L. Rosado, M.S. Kirsch, C. Wang, *International Journal of Fatigue*, Vol. 143, 2021.

Presentations

“The Influence of Key Microstructural Features on Rolling Contact Fatigue: A Combined Experimental and Analytical Approach to Determine Life,” presented at the Spring 2024 MAHA Webinar Series, **S.J. Lorenz**, West Lafayette, IN, April 2024.

“Investigation into Rolling Contact Fatigue Performance of Aerospace Bearing Steels,” presented at the Society of Tribologists and Lubrication Engineers Annual Meeting, **S.J. Lorenz**, F. Sadeghi, Long Beach, CA, May 2023.

“The Effect of Spatial Microstructure – Property Relations on Rolling Contact Fatigue Life,” presented at the 4th International Bearing World Conference by FVA, **S.J. Lorenz**, F. Sadeghi, Würzburg, Germany, July 2022.

“An Investigation of the Effects of Grain Refinement on Rolling Contact Fatigue,” presented at the Society of Tribologists and Lubrication Engineers Annual Meeting, **S.J. Lorenz**, F. Sadeghi, Orlando, FL, May 2022.

“An Investigation of the Effects of Grain Refinement on Rolling Contact Fatigue,” presented at the Inaugural Invited Speaker Series for Propulsion and Power Systems Alliance (PPSA) Mechanical Systems Technical Area Team (TAT), **S.J. Lorenz**, F. Sadeghi, (Virtual) February 2021.

“An Investigation of the Effects of Surface Roughness on Rolling Contact Fatigue,” presented at the Society of Tribologists and Lubrication Engineers Annual Meeting, **S.J. Lorenz**, F. Sadeghi, (Virtual) May 2021.