

Exponent®
Engineering & Scientific Consulting

Thomas Russell, Ph.D., P.E.

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Professional Profile

Dr. Russell is a tribologist and mechanical engineer who investigates the effects of lubrication, friction, wear, and fatigue on the performance of machines in transportation, energy, industrial, aerospace, medical device, and consumer product applications. He specializes in rolling element bearing and hydrodynamic bearing analysis, and has investigated these components in wind turbines, marine gearboxes, train wheelsets, industrial compressors, and other critical machinery. Dr. Russell also leverages his expertise in machine design to investigate machinery safety incidents, conduct risk assessments, and design custom experimental test fixtures to assess the performance and reliability of mechanical systems.

Rolling Element Bearing Analysis

Dr. Russell has conducted analyses on various types of rolling element bearings, including deep groove ball bearings, angular contact ball bearings, tapered roller bearings, spherical roller bearings, cylindrical roller bearings, thrust bearings, and needle roller bearings. In performing these analyses, he interprets assembly drawings and technical documentation, analyzes SCADA and operational data, and assesses the effects of lubricant supply on system performance. Dr. Russell uses optical microscopy, surface profilometry, and other non-destructive laboratory analysis methods to identify evidentiary features on components that reveal operational history and failure mechanisms. He has completed Basic Safety Training from the Global Wind Organization (GWO) and has hands on up-tower experience inspecting wind turbine bearings and other components.

Hydrodynamic Bearing Analysis

Dr. Russell performs analytical and computational investigations of hydrodynamic bearing systems, including bushings, plain bearings, slider bearings, sleeve bearings, and tilting pad bearings, under hydrodynamic, elasto-hydrodynamic, and hydrostatic lubrication. His work includes film thickness modeling, bearing leakage analysis, and rotor dynamic analysis to predict the coupled response of shaft-bearing systems. Dr. Russell's work in this space has been used to help clients identify and address consequential design factors and inform root cause analyses for arbitration and litigation proceedings.

Machinery Safety Investigations and Risk Assessments

Dr. Russell performs machinery safety investigations across the construction, logistics, manufacturing, healthcare, agricultural, oil and gas, and consumer product industries. He has examined cases involving mobile cranes, tunnel boring machines, horizontal directional drills, pile drivers, material handlers, factory assembly lines, loading docks, tractors, and gym equipment. He also has expertise in identifying and

evaluating potential hazards through the development of task-based risk assessments in accordance with industry standards.

Experimental Testing and Custom Test Fixture Design

Dr. Russell designs and constructs custom test stands ranging from simple fixtures for mechanical property evaluation to fully custom apparatuses for the evaluation of in-situ component behavior or accelerated life testing (HALT). He is experienced with various methods of instrumentation including multi-axis sensors, thin-film pressure sensors, high-speed videography, computer vision, viscometry, and commercial tribological test stands. Dr. Russell is experienced with LabView, Matlab, Python, and C for data collection and analysis. Additionally, Dr. Russell has experience operating manufacturing equipment including manual and CNC mills, lathes, waterjets, laser cutters, and 3D printers.

Prior to joining Exponent, Dr. Russell was a Research Assistant in the Mechanical Engineering Tribology Laboratory at Purdue University. His Ph.D. research focused on experimentally and analytically characterizing the lubrication mechanism of ball bearing cages. He constructed a specialized test rig for investigating ball bearing cage friction and developed models of cage performance including cage pocket lubrication, external drag force, and dynamic motion in a full bearing. In addition to his thesis research, Dr. Russell assisted with projects studying high pressure lubricant viscosity, anaerobic lubricant behavior, and the friction and wear behavior of nickel-based superalloys at elevated temperatures.

Dr. Russell served as a Journal Assistant to the Editor in Chief of the ASME Journal of Tribology from 2022–2023 and continues to peer review articles on machine component tribology and failure analysis.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Purdue University, 2023

MSME, Mechanical Engineering, Purdue University, 2021

B.S., Mechanical Engineering, Purdue University, 2018

STLE Walter D. Hodson Best Paper Award, 2024

STLE Captain Alfred E. Hunt Best Paper Award, 2023

Young Presenter Award, Rolling Element Bearing Section, STLE Annual Meeting 2023

Society of Tribologists and Lubrication Engineers Chicago Section Scholarship, 2022

Society of Tribologists and Lubrication Engineers Chicago Section Scholarship, 2021

Licenses and Certifications

Professional Engineer Mechanical, California, #42616

Prior Experience

Research Assistant, Mechanical Engineering Tribology Laboratory, Purdue University, 2018 – 2023

Journal Assistant to the Editor in Chief, ASME Journal of Tribology, 2022 – 2023

Analysis Intern, John Deere, 2018

Product Design Intern, John Deere, 2017

Professional Affiliations

American Society of Mechanical Engineers (ASME), 2019 - Present

Society of Tribologists and Lubrication Engineers (STLE), 2019 - Present

Publications

Russell, T., Sadeghi, F., Kang, Y.S. and Mazzitelli, I., 2024. The influence of cage pocket lubrication on the simulation of deep groove ball bearing cage motion. Journal of Tribology, 146(2).

Shafiee, A., Russell, T., Lorenz, S.J., Sadeghi, F. and Wilmer, M.G., 2023. Optical measurement of roller slip, tilt, and skew in a spherical roller bearing. Journal of Tribology, 145(4), p.044302.

Arya, U., Sadeghi, F., Conley, B., Russell, T., Peterson, W. and Meinel, A., 2022. Experimental investigation of cage dynamics and ball-cage contact forces in an angular contact ball bearing. Proceedings of the Institution of Mechanical Engineers, Part J: Journal of Engineering Tribology, 236(12), pp.2522-2534.

Aamer, S., Sadeghi, F., Russell, T., Peterson, W., Meinel, A. and Grillenberger, H., 2022. Lubrication, flow visualization, and multiphase CFD modeling of ball bearing cage. Tribology Transactions, 65(6), pp.1088-1098.

Russell, T. and Sadeghi, F., 2022. The effects of lubricant starvation on ball bearing cage pocket friction. Tribology International, 173, p.107630.

Shafiee, A., Russell, T., Sadeghi, F. and Wilmer, M.G., 2022. Analytical investigation of roller skew and tilt in a spherical roller bearing. Journal of Tribology, 144(7), p.071201.

Russell, T., Shafiee, A., Conley, B. and Sadeghi, F., 2022. Evaluating load distribution at the bearing-housing interface using thin film pressure sensors. Tribology International, 165, p.107293.

Russell, T., Sadeghi, F., Peterson, W., Aamer, S. and Arya, U., 2021. A novel test rig for the investigation of ball bearing cage friction. Tribology Transactions, 64(5), pp.943-955.

Peterson, W., Russell, T., Sadeghi, F. and Berhan, M.T., 2021. Experimental and analytical investigation of fluid drag losses in rolling element bearings. Tribology International, 161, p.107106.

Singh, K., Sadeghi, F., Russell, T., Lorenz, S.J., Peterson, W., Villarreal, J. and Jinmon, T., 2021. Fluid–structure interaction modeling of elastohydrodynamically lubricated line contacts. Journal of Tribology, 143(9), p.091602.

Peterson, W., Russell, T., Sadeghi, F., Berhan, M.T., Stacke, L.E. and Ståhl, J., 2021. A CFD investigation of lubricant flow in deep groove ball bearings. Tribology International, 154, p.106735.

Peterson, W., Russell, T., Sadeghi, F. and Berhan, M.T., 2020. A strongly coupled finite difference method–finite element method model for two-dimensional elastohydrodynamically lubricated contact. Journal of Tribology, 142(5), p.051601.

Presentations

Russell, T., Brooke, P., Swanger, L. Identifying Facts from Failure in Forensic Bearing Investigations.

2025 Society of Tribology and Lubrication Engineers Annual Meeting, Atlanta, GA, 2025.

Russell, T., Sadeghi, F. An Improved Dynamic Bearing Model Considering Cage Lubrication. Society of Tribology and Lubrication Engineers Annual Meeting, Long Beach, CA, 2023.

Russell, T., Sadeghi, F. An Experimental and Analytical Investigation of Cage Pocket Lubrication. Bearing World Conference by FVA, Wurzburg, Germany, 2022

Russell, T., Sadeghi, F. An Experimental and Analytical Investigation of Cage Pocket Lubrication. Society of Tribology and Lubrication Engineers Annual Meeting, Orlando, FL, 2022.

Russell, T., Sadeghi, F. A Novel Test Rig for the Investigation of Ball Bearing Cage Friction. Society of Tribology and Lubrication Engineers Virtual Annual Meeting, 2021.

Russell, T., Sadeghi, F. A Novel Test Rig for Friction and Flow Visualization in Oil Lubricated Ball Bearing Cages, European Lubrication and Grease Institute – Society of Tribology and Lubrication Engineers Virtual Tribology Workshop, 2021

Peer Reviews

ASME Journal of Tribology

Tribology Transactions

Journal of Failure Analysis and Prevention

Discover Mechanical Engineering

Lubricants