Exponent®
Engineering & Scientific Consulting

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

Engineer | Mechanical Engineering
Natick
+1-508-903-4674 | trussell@exponent.com

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 across various industries. He specializes in the analysis of rolling element bearings, seals, gears, and other critical machine components. Dr. Russell applies his expertise through performing failure investigations, component analysis, and designing custom test fixtures. He also has experience investigating machinery safety by inspecting and analyzing workplace accidents and developing proactive risk assessments.

Failure Investigations

Dr. Russell has conducted failure analyses on various machines across the energy, transportation, consumer products, and marine industries. He has experience in the analysis of Supervisory Control and Data Acquisition (SCADA) data, the interpretation of complex assembly drawings and technical documentation, and the investigation into the effects of lubricant supply on system performance. Dr. Russell has used his experience in the analysis of plain and rolling element bearings to assist clients in identifying causes of failure in large gearboxes, train wheelsets, wind turbines, compressor pumps, and other machines.

Component Analysis

Dr. Russell analyzes individual machine components to determine relevant performance characteristics and potential failure modes. Experimentally, he uses optical microscopy, surface profilometry, and other non-destructive analysis methods to identify evidentiary features on components which help reveal their operational history and potential reasons for failure. Analytically, he investigates the effects of hydrodynamic, elasto-hydrodynamic, and hydrostatic lubrication on component behavior. Dr. Russell has conducted such analysis on ball and roller bearings, gears, crankshafts, valves, and seals in a variety of applications.

Custom Test Fixture Design

Test stands constructed by Dr. Russell have ranged from relatively simple fixtures for the evaluation of mechanical properties of materials to fully custom apparatuses for the evaluation of in-situ component behavior or the characterization of material durability through highly accelerated lift testing (HALT). Through the construction of custom test stands, Dr. Russell assists clients by collecting experimental data on specific, often previously unmeasurable, phenomena. Additionally, Dr. Russell has experience operating manufacturing equipment including manual and CNC mills, lathes, waterjet cutters, laser cutters, and 3D printers. He is experienced in using LabView, Matlab, Python, and C for data collection, data analysis and custom test operation.

Machinery Safety

Dr. Russell has performed investigations related to machinery safety in the construction, logistics, manufacturing, healthcare, agricultural, and consumer product industries. He has examined cases involving mobile cranes, tunnel boring machines, material handlers, factory assembly lines, loading docks, tractors, and gym equipment. He also has expertise identifying and evaluating potential hazards for machines through the development of task-based risk assessments in accordance with industry standards.

Prior to joining Exponent, Dr. Russell was a Research Assistant in the Mechanical Engineering Tribology Laboratory (METL) at Purdue University. His Ph.D. research was focused on experimentally and analytically characterizing the lubrication mechanism of ball bearing cages. He constructed a one-of-a-kind test rig for the investigation of ball bearing cage friction and developed a series of 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 lubricant viscosity at high pressure, lubricant behavior in anerobic environments, and the friction and wear behavior of nickel-based superalloys at elevated temperatures. Experimental techniques employed by Mr. Russell include single and multi-axis sensing, thin-film pressure sensing, high-speed videography, computer vision, optical profilometry, viscometry, and the operation of various commercial tribological test stands. Dr. Russell's hands-on and analytical experience with bearings includes deep groove ball bearings, angular contact ball bearings, tapered roller bearings, spherical roller bearings, cylindrical roller bearings, and needle roller bearings.

Dr. Russell also served as a Journal Assistant to the Editor in Chief of the ASME Journal of Tribology from 2022-2023, where he provided production support to the journal and aided in the distribution of articles to a worldwide network of technical experts across the field of tribology.

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., 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