Christopher J. Brand

PE

Principal, Vice President of Regional Operations

Chris Brand is a Principal for ESi. He is a licensed professional Mechanical Engineer with over twenty-five years of experience. He holds a BSE and MSME in mechanical engineering. He performs machine design and machine safety analysis on a wide variety of productions including gear boxes, CNC machining centers, cryogenic freezers and generators. His extensive experience with finite element analysis and computational fluid dynamics along with his understanding of mechanical and materials issues on the component level (including fasteners, bearings, gears, etc.) provide him with a strong base for failure and forensic investigations. He specializes in applying engineering simulations to failure investigations, e.g., fuel gas leaks. He provides consulting and expertise on industrial and commercial safety including automatic doors. He has experience in investigating accidents involving large machinery such as cranes, agriculture equipment and wind turbines. He performs investigations into piping system failures from residential water losses to industrial chemical leaks.

Prior to joining ESi, Mr. Brand worked as a Principal Design/Development Engineer with Rosemount, Inc. (a business unit of Emerson Electric). At Emerson, he primarily worked on inline flowmeters including vortex shedding and magnetic types. He worked as an application engineer for a company that produced commercially available finite element analysis and machining simulation software. He also has experience in the automotive industry having worked at a Tier 1 supplier and at the University of Michigan Engineering Research Center.

Education

M.S.M.E. Mechanical Engineering. University of Minnesota. 2009

B.S.E. Mechanical Engineering, Magna Cum Laude. University of Michigan. 2000

Licenses & Certifications

- State of Minnesota P.E. License 48686
- State of New Jersey P.E. License 24GE06441800

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Areas of Specialization

- Agricultural/Farming Equipment Failure Analysis
- Computational Fluid Dynamics
- Engineering Analysis/Simulation
- Failure Analysis
- Finite Element Analysis
- Fluid Mechanics
- Hydraulics
- Industrial Safety
- Machining and Manufacturing Processes
- Machine Design
- Machine Guarding and Safety
- Mechanical
- Piping and Pressure Vessel Analysis
- Products Liability/Design
- Recreational Products Failure Analysis
- Solid Mechanics

- State of Oklahoma P.E. License 33879
- State of Pennsylvania P.E. License 099232
- State of Wisconsin P.E. License 45977

Positions Held

Engineering Systems Inc., Plymouth, Minnesota

- Vice President of Regional Operations, 2025 – Present
- Principal, 2023 – Present
- Manager of Minnesota Operation, 2020 – 2025
- Senior Managing Consultant, 2019 – 2022

Crane Engineering, Plymouth, Minnesota

- Mechanical Engineer, 2012 – 2018

Emerson Electric Co. (Rosemount, Inc.), Eden Prairie, Minnesota

- Principal Design/Development Engineer, 2010 – 2012
- Senior Design/Development Engineer, 2005 – 2010

Third Wave Systems, Inc., Minneapolis, Minnesota

- Applications Engineer, 2000 – 2005

Magna Seating Systems, Livonia, Michigan

- Design and Manufacturing Engineering Intern, 1998 – 1999

University of Michigan Engineering Research Center – RMS, Ann Arbor, Michigan

- Research Assistant, 1999

Continuing Education

- **40 Hour Hazardous Waste Site Worker Training Course (Hazwoper) Refresher**, 2024
- **Essentials-B30 Safety Standard** – ASME, 2014
- **Symmetry Solutions: Solid Works Flow Simulation Training**, 2014
- **Practical Applications of Drones for Pes** – MNSPE, 2013
- **EAG: Intro to Analytical Techniques**, 2013
- **ANSYS Mechanical Structure Nonlinearities**, 2012

Professional Affiliations/Honors

ASM International

- Member

American Society of Mechanical Engineers (ASME)

- Member

American Society of Safety Professionals (ASSP)

- Member
- Z244 Control of Hazardous Energy – Lockout/Tagout and Alternative Methods Committee – ASSP Representative
- Z244.1 The Control of Hazardous Energy Lockout, Tagout and Alternative Methods Subcommittee

Pi Tau Sigma

Project Experience

Investigations

Mechanical Failure Analysis & Fracture Mechanics

- Investigated and determined cause of a bead seater (pressure vessel) failure. The investigation involved material composition determination and aluminum welding evaluation.
- Climbed to the top of a 240-foot-tall wind turbine to investigate a gear box failure. The failure involved the fatigue fracture of a helical gear tooth.
- Analysis of an air cannon failure used in the annual “Punkin’ Chunkin’” contest. The failure involved the fatigue and failure of bolts used to contain the pumpkin being propelled.
- Investigated the failure of a wastewater treatment clarifier bearing. A clarifier separates out solid matter from wastewater using a skimmer and rake system that rotates at a relatively low speed. The shaft rides on plastic bearings that keep it centered. That plastic component wore down to the metal. The metal on metal contact ultimately cut through the wall thickness of the main shaft.
- Analyzed the failure of several journal bearings in natural gas-powered generators (gensets) at a dairy farm. The fuel used in the gensets was biogas generated on the farm from cattle manure, which is a sour gas (i.e. contains a high concentration of hydrogen sulfide). The failures were caused by using an engine oil that was not compatible with the hydrogen sulfide levels in the biogas.
- Analyzed the separation of a mechanical coupling used in an underground water service line. The separation caused a water loss in an apartment complex. Bolts used in the coupling were not properly tightened, which allowed the pipe to move axially and separate from the coupling.

- Investigated the failure of a gear box that resulted in a 60-gallon kettle of boiling hot soup tilting and spilling onto the leg of an employee. The gear box had been repaired and modified compared to the original design. A component was missing that would have prevented the kettle from tilting.

Industrial & Occupational Safety Investigations

- Performed an analysis on an egg grader machine that injured a worker. During cleaning operations, a guard was removed, which exposed an unguarded rotating shaft. The machine was running during cleaning contrary to lock-out/tag-out requirements.
- Performed a comprehensive machine safety and guarding analysis of an industrial horizontal grinder involved in a severe hand injury during jam-clearing operations. The investigation included site inspection, operational testing, evaluation of interlocks and rundown time, and detailed analysis of compliance with OSHA regulations and ANSI B11 and Z244.1 standards. Assessed the adequacy of safeguarding, lockout/tagout alternatives, and feasibility of safer alternative designs, concluding that the grinder's interlock system allowed access to hazardous moving parts and did not meet applicable safety standards.
- Analyzed an automatic door at an electronics retailer that was allegedly involved in an injury. The door's operation was tested with respect to applicable standards.

CFD, Thermal, and Fluid Systems Analysis

- Mechanical analysis of a liquid nitrogen cryogenic freezer failure. Utilized testing to evaluate a hypothesis of the cause of the failure that was mechanical in nature. Ultimately, the failure was related to the software.
- Performed an underground gas migration analysis of a natural gas leak using Computational Fluid Dynamics (CFD). The leak was caused by a horizontal drilling operation which struck an underground gas line. The gas migrated into an adjacent restaurant and was ignited. Several scenarios of potential pre-incident actions were simulated to determine whether gas would have migrated to the restaurant in those alternate scenarios.
- Investigation of an exploding fondue pot used at a restaurant. The work entailed a site inspection, water chemistry testing and exemplar testing in a laboratory.
- Performed computational fluid dynamics analysis of a factory-built wood burning fireplace that allegedly caused a fire. Analyzed the fluid flow of hot gases generated by the burning fuel and the heat transfer to the surrounding environment.
- Investigated the eruption of water in a heated ultrasonic cleaning machine. The machine had several modifications from the original design including disabling of a circulation pump, installation of additional heating elements and bypassing thermal protections. Analysis of video of the incident showed that the eruption occurred when the ultrasonic cleaning function was activated.

Product Liability & Consumer Safety

- Evaluated a product that was claimed to not be dishwasher safe and because of that it fractured and caused an injury. Several exemplars were tested to applicable industry standards. The results show that the product was in fact dishwasher safe.

- Investigation of an ADA pool lift at a hotel involved in an injury to a guest. The lift had been setup counter to manufacturer's instructions and had a broken coupling that allowed it to rotate freely.
- Performed mechanical analysis and testing of a personal blender involved in an amputation. The subject container fractured and the plaintiff's hand contacted the rotating blades. Testing was performed using exemplar containers and human finger surrogates.
- Conducted a forensic engineering investigation into an electric pressure cooker incident involving burn injuries. The work included inspection and testing of the subject cooker and an exemplar unit, evaluation of pressure-relief and lid-interlock safety systems, review of applicable UL standards, and hypothesis testing of potential failure modes.

Stability Analysis

- Performed analysis and testing of a heavy vault door that tipped over causing injury to a construction worker. The vault door was removed from its hinges and then leaned up against a wall at a construction site. The door weighed 2,780 pounds [1,260 kg]. The subject door was propped up consistent with deposition testimony and its stability (i.e. the perturbation force required to tip) measured.
- Evaluation of the stability of a rolling commode chair used by a muscular dystrophy patient. The chair had been modified from its original design and did not have optional anti-tippers installed. Center of gravity measurements were performed and stability testing was done using a surrogate with similar height and weight as the patient.

Invited Speaking Engagements

"More Than Just a 'Pretty Picture': Use of Finite Element Analysis in Failure Analysis," **C.J. Brand**, presented at ASM International – Minnesota Chapter, Symposium Hennepin Technical College, Brooklyn Park, MN, 2017.

"Forensic Testing for Tank System Failures," **C.J. Brand**, presented at the 27th Annual Environmental and Ground Water Quality Conference, Pierre, SD, 2015.

Peer Reviewer

Journal of Failure Analysis and Prevention, ASM International

Publications

"Flanged Reducer Vortex Flowmeter," **Brand, C.J.**, Patent No. 9,016,138, Issued: Apr. 28, 2015.

"Leak Check Device for Vortex Sensor Replacement", Foster, JD, **Brand, C.J.**, Graber, WF, Patent No. 7,637,170, Issued: Dec. 29, 2009.

"Ductile Regime Machining of Silicon Nitride: A Numerical Study Using Drucker-Prager Material Model," Aijarapu, SK et al, 2003, Proceedings of the Third National Conference on Precision Engineering.

"Simulation and Analysis of Chip Breakage in Turning Processes," Maruisch, TD, Thiele, JD, **Brand, C.J.**, 2002, Proc. of the 5th CIRP International Workshop on Modeling of Machining Operation, pp. 139-148.

"Numerical Simulation of Ductile Machining of Silicon Nitride with a Cutting Tool of Defined Geometry," Kumbera, TG, Cherukuri, HP, Patten, JA, **Brand, C.J.**, Maruisch, TD, 2001, Proceedings of the 4th CIRP International Workshop on Modeling of Machining Operations, p. 7.

Presentations/Newsletters

"Comparative Analysis of Fasteners Utilized in a Crane – Threaded Plate vs. Nut and Bolt," **C. Brand** presented at IMAT – ASM's Annual Meeting, Cleveland, OH, 2024.

"Frozen in Time – Use of Data and Testing to Understand the Mechanics of a Cryogenic Loss," **C. Brand** and J. Buckley presented at Engineering Systems, Inc. Webinar, May 13, 2020.

"Computer Modeling—Why, When and How (and the Pitfalls)," **C.J. Brand**, Tom Crane, P.E., presented at Crane Engineering Smart Sessions, Plymouth, MN, 2019.

"Virtual Testing: Use of Computer Simulation for Better Products," **C.J. Brand** presented at Crane Engineering Smart Sessions, Plymouth, MN, 2018.

"Timing in Fuel Gas Migration: Modeling and Analysis", Crane Engineering Newsletter, 2017.

"Computational Fluid Dynamics: It's Not Just for NASA Anymore," **Brand, C.J.**, Crane Engineering Newsletter, 2016.