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**CHRISTOPHER J. BRAND, P.E.**  
**PRINCIPAL**  
**MANAGER OF MINNESOTA OPERATIONS**

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Chris Brand is a Principal for ESi. He is a licensed professional Mechanical Engineer with over twenty 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 products 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 recreational equipment including Zip Lines. He has investigated 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.

**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



## **Education**

M.S.M.E. Mechanical Engineering, University of Minnesota, Minneapolis, MN, 2009

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

## **Licenses/Certifications**

State of Minnesota..... P.E. License 48686

State of Oklahoma ..... P.E. License 33879

State of Wisconsin ..... P.E. License 45977

## **Professional Affiliations/Honors**

### **American Society of Mechanical Engineers (ASME)**

Member

### **ASM International**

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**

## **Positions Held**

### **Engineering Systems Inc., Plymouth, Minnesota**

Principal, 2023 – Present

Manager of Minnesota Operations, 2020 – Present

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

**Professional Training and 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

**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 5<sup>th</sup> 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  
4<sup>th</sup> CIRP International Workshop on Modeling of Machining Operations, p. 7

**Presentations/Newsletters**

“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

## **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 27<sup>th</sup> Annual Environmental and Ground Water Quality Conference, Pierre, SD, 2015

## **Peer Reviewer**

Journal of Failure Analysis and Prevention, ASM International

## **Selected Project Experience**

- 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.
- 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.
- 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.

- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.

- 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.
- 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.
- 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.
- Investigated the failure of a boat steering cable. Utilize non-destructive and destructive means to characterize and document the condition and wear of the wire rope cable. Analysis indicated that the failure was progressive in nature.
- 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.