



**Exponent®**  
Engineering & Scientific Consulting

## In Young Hur, Ph.D., P.E., CFEI

Senior Engineer | Thermal Sciences

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### Professional Profile

Dr. Hur specializes in failure investigation and design/performance/safety reviews of rotating machinery, and thermal-fluid systems and processes. He applies his expertise in fluid dynamics, thermodynamics and rotor-dynamics in the analysis of rotating turbo machinery such as gas turbine engines, compressors, pumps, steam turbines, and motor vehicle components. Dr. Hur uses both experimentation and analytical/computational modeling approaches to solve engineering problems.

Dr. Hur's expertise is used in a variety of litigation and arbitration matters. Dr. Hur has investigated failures of various turbomachinery for a range of applications from small-scale kitchen blenders, to medium-scale steam turbines in process plants, to large-scale industrial gas turbines for power generation. In addition to rotating machinery, Dr. Hur applies his expertise in fluid dynamics and heat transfer across a wide range of complex engineering problems involving fires, explosions, pipe flow-induced vibrations and off-gassing of air pollutants. His project experience also includes battery systems, wearable electronics and household appliances.

Prior to joining Exponent, Dr. Hur was a PhD candidate in the Gas Turbine Laboratory at the Massachusetts Institute of Technology. At MIT, he developed a novel forced-response system identification methodology for measuring rotordynamic damping in a full gas turbine aero-engine. During this process he developed a reduced-order modeling framework that captures the full engine dynamics to simulate realistic conditions and characterized the approach using statistical analysis. He devised and proposed guidelines for designing and executing forced-response experiments for aero-engine rotors. He also designed and commissioned an experimental facility for testing a commercial turbofan engine. In addition, in the Whittle Lab at the University of Cambridge, he performed compressor stall experiments to characterize the effect of rotor blade mis-staggering on the onset of premature stall. Dr. Hur's experience also includes wind tunnel testing and experimental analysis of heat sinks for turbo-electric aircraft application.

Prior to graduate school, Dr. Hur was a research engineer at STI C&D in South Korea, where he developed optimal flow patterns in molten metal die-casting of various automobile components using computational fluid dynamics (CFD). He also has experience in analyzing and improving molten steel transport and discharge processes.

### Academic Credentials & Professional Honors

Ph.D., Aeronautical and Astronautical Engineering, Massachusetts Institute of Technology (MIT), 2022

B.A., Aerospace Engineering, University of Cambridge, England, 2013

M.Eng., Aerospace Engineering, University of Cambridge, England, 2013

## Licenses and Certifications

Professional Engineer Mechanical, California, #41653

Professional Engineer Mechanical, Massachusetts, #60806

40-Hour Hazardous Waste Operation and Emergency Response Certification (HAZWOPER)

Certified Fire and Explosion Investigator (CFEI)

## Prior Experience

Research Engineer, STI C&D, 2013-2016

## Professional Affiliations

American Society of Mechanical Engineers (ASME)

ASTM International

National Association of Fire Investigators (NAFI)

## Languages

Korean

## Publications

Hur, I., and Spakovszky, Z. S. (September 2, 2022). "Forced Response System Identification of Full Aero-Engine Rotordynamic Systems for Prognostics and Diagnostics." ASME. J. Eng. Gas Turbines Power. October 2022; 144(10): 101008.

Harri Kytömaa, Achim Wechsung, Georgios Dimitrakopoulos, Neil Cook, Daniel Jaimes, In Young Hur, Sahand Faraji, Industry R&D needs in hydrogen safety, Applications in Energy and Combustion Science, Volume 18, 2024.

## Presentations

Hur I, Spakovszky ZS. Forced Response System Identification of Full Aero-Engine Rotordynamic Systems for Prognostics and Diagnostics. GT2022-84058. ASME 2022 Turbo Expo, Rotterdam, The Netherlands, 2022.

## Project Experience

### Gas Turbines

- Investigated failure of an industrial power generating gas turbine engine involving compressor stall/surge.
- Investigated operation of compressors which are not meeting the contractual requirements, in a process plant.
- Investigated an incident involving partial turbine wheel liberation in an industrial gas turbine.

- Reviewed the root cause analysis of seal damage in a steam turbine observed during its commissioning.

### **Process Piping**

- Investigated flow-induced vibrations in large cross-country natural gas pipelines during extreme pressure operations.
- Investigated the potential for flow-induced vibrations in piping for carbon capture and sequestration using the Energy Institute guidelines.
- Investigated failure of an energy-dissipating valve in a water conveyance system due to flow-induced vibrations.

### **Consumer Products**

- Designed and executed tests to analyze potentially hazardous mechanical failures of kitchen blenders.
- Performed computational fluid dynamics (CFD) simulations using STAR-CCM+ involving consumer wearable electronics to evaluate their heat transfer characteristics and thermal management.
- Performed battery failure testing to characterize the thermal runaway profile.

### **Fires and Explosions**

- Investigated fires and explosions due to gas leaks with model-based calculations of airborne fuel concentrations
- Performed flammability testing of various dusts using NFPA standards