

**Zuhair M. Ibrahim, Ph.D., P.E.**  
**Managing Engineer**

**Professional Profile**

Dr. Zuhair M. Ibrahim is a Managing Engineer in Exponent's Thermal Sciences practice. Dr. Ibrahim applies mechanical engineering, thermodynamic, and fluid dynamic principles to the study of processes in turbomachinery, fires, explosions, and a variety of combustion devices. He has investigated numerous compressor, gas and wind turbine failures, and provided engineering opinions regarding the design of various components. Dr. Ibrahim has analyzed performance and emissions issues on a wide range of units manufactured by: GE, Rolls-Royce, Pratt & Whitney, Siemens, and Solar Turbines among others.

Dr. Ibrahim has expertise in conducting engineering origin and cause investigations of fires and explosions and has been retained to provide assistance on large and small losses by various utilities, insurance companies, and individual plaintiffs.

Prior to joining Exponent, Dr. Ibrahim worked as a research consultant at Solar Turbines Incorporated where he developed tools to predict and mitigate the impact of combustion-driven acoustic instabilities. He has also worked as a research engineer at United Technologies Research Center (Pratt and Whitney R&D group), where he carried out numerous studies related to the investigation, optimization, and enhancement of turbine, afterburner, and rocket performance. He also served as a country consultant with the United Nations Development Programme in East Africa where he helped oversee the implementation of several infrastructure projects.

**Academic Credentials and Professional Honors**

Ph.D., Aerospace Engineering, University of California, San Diego, 2007  
M.Sc., Management, Rensselaer Polytechnic Institute, 2002  
M. Eng., Aerospace Engineering, University of Alabama, Huntsville, 2000

United Technologies Research Center's Outstanding Technical Achievement Award, June 2003;  
AIAA award for 2<sup>nd</sup> Place Technical Paper in South-Eastern Student Conference, April 2000

**Licenses and Registrations**

Registered Professional Mechanical Engineer, California, #M 34508  
Hazardous Waste Operations and Emergency Response Training (Per Cal-OSHA GISO 5192 and 29 CFR 1910.120); Confined Space Entry Training

Certificate in Helicopter Accident Investigation, University of Southern California  
Certificate in Gas Turbine Accident Investigation, University of Southern California

Certificate in Centrifugal Compressor Design and Performance, Concepts NREC  
Certified Master Scuba Diver, Professional Association of Diving Instructors—PADI

## **Languages**

Arabic

## **Publications**

Ibrahim ZM, Williams FA, Buckley SG, Twardochleb CZ. An acoustic-energy method for estimating the onset of acoustic instabilities in premixed gas-turbine combustors. *Journal of Engineering for Gas Turbines and Power* 2008 Sept; 130.

Ibrahim ZM. An acoustic energy framework for predicting combustion-driven acoustic instabilities in premixed gas-turbines. Ph.D. dissertation, University of California, San Diego, CA, 2007.

## **Presentations and Published Abstracts**

Reza A, Ibrahim Z. Natural gas explosions. Invited presentation to the Sempra Utilities Adjusters Training, October 2008.

Ibrahim ZM, Williams FA, Buckley SG, Twardochleb CZ. A method for estimating the onset of acoustic instabilities in premixed gas-turbine combustors. ASME Turbo Expo, Montreal, Canada, 2007.

Ibrahim ZM, Williams FA, Buckley SG. A study of combustion-driven acoustic instabilities in premixed gas-turbines using an acoustic energy framework. 5<sup>th</sup> Combustion Institute Meeting, San Diego, CA, March 2007.

Gharavi M, Ibrahim ZM, Borchert M, Williams FA, Buckley SG, Arellano LO. Tunable diode laser measurements of equivalence-ratio fluctuations for premixed gas-turbine applications. 5<sup>th</sup> Combustion Institute Meeting, San Diego, CA, March 2007.

Ibrahim ZM, Williams FA, Buckley SG, Lee JCY. An acoustic energy approach to modeling combustion oscillations. ASME Turbo-Expo, Barcelona, Spain, May 2006.

Ibrahim ZM, Landrum DB. CFD modeling of regenerative cooling in a 15 K Fastrac rocket engine. AIAA Southeast Region Student Conference, Savannah, GA, April 2000.

## Technical Reports

Reza A, Ibrahim Z. Investigation of the March 2011 fire at the Funicello/Holt Residence in Encino, CA. Exponent Failure Analysis Associates, March 2011.

Carnahan R, Ibrahim Z. Windland-Tehachapi 1.5 MW AAER wind turbine blade failure investigation. Exponent Failure Analysis Associates, January 2011.

Reza A, Ibrahim Z, Krauss D. Expert rebuttal report: The May 2008 propane explosion at the Byrd Chicken Farm in Danville, AL. Exponent Failure Analysis Associates, November 2010.

Ibrahim Z, Carnahan R. Apex, compressor damage investigation. Exponent Failure Analysis Associates, September 2010.

Reza A, Ibrahim Z. A review of investigations conducted regarding a May 2008 chiller failure at [confidential location]. Exponent Failure Analysis Associates, May 2010.

Ibrahim Z. Investigation of an Explosion at Solus Industries. Exponent Failure Analysis Associates, May 2009

Moore CD, Ibrahim Z, Slee D. Vericor Inc. v. Honeywell Inc. (component design issues). Exponent Failure Analysis Associates, October 2008.

Ibrahim Z. Investigation of Apex Gas turbine combustion nozzle failures. Exponent Failure Analysis Associates, October 2008.

Ibrahim Z, Christiansen E. Fire investigation at a Circle K in Anaheim, CA. Exponent Failure Analysis Associates, September 2008.

Kemal A, Gopalkrishanan P, Owen Z, Ibrahim Z. Hermiston turbine nozzle failures. Exponent Failure Analysis Associates, August 2008.

Slee D, Ibrahim Z. Fire investigation at 901 E. 14th St., Pittsburg, CA, 94565. Exponent Failure Analysis Associates, March 2008

Ibrahim Z, Williams F, Buckley S. A review of prior approaches to combustion instability. Center for Energy Research, University of California, June 2005.

Tillman TG, Lin R, Ibrahim ZM, Bertuccioli L. Flow control for aggressive turbine transition ducts and high-lift airfoils. Prepared for NASA Glenn Research Center under UEET tasks 17 and 19, UTRC, 2001.

Landrum DB, Ibrahim ZM. CFD analysis of a regeneratively cooled Fastrac thrust chamber. Prepared for Space America Inc., University of Alabama, Propulsion Research Center, 2000.

## **Prior Experience**

Engineering Consultant, Solar Turbines Inc., 2005–2007  
Research Engineer, United Technologies Research Center, 2000–2003  
Country Consultant, United Nations Development Programme, 2002–2003

## **Peer Reviewer**

- *Journal of Engineering for Gas Turbine and Power*

## **Professional Affiliations**

- National Fire Protection Association—NFPA  
– Principal Member: Technical Committee on Internal Combustion Engines and Gas Turbines. The committee is responsible for developing NFPA 37.
- The Combustion Institute
- American Institute for Aeronautics and Astronautics—AIAA
- American Society for Mechanical Engineers—ASME
- Institute of Mechanical Engineers—IMECHE