

## **PONNUTHURAI GOKULAKRISHNAN, Ph.D.**

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### **RESEARCH INTERESTS**

- Combustion Phenomena of Flame Instability and Emissions in Gas Turbines and Augmentors
- Surrogate Kinetic Models for Practical Fuels such as Diesel, Aviation Fuels, etc.
- Reduced Kinetic Models for CFD Simulation to Predict Emissions and Static Instability
- Thermal Cracking and Coke Deposition in High Speed Propulsion Systems

### **EDUCATION**

NSERC Post-Doctoral Fellow	<b>Princeton University</b> Princeton, NJ, U. S. A., 2002-2003
Ph.D. in Chemical Engineering	<b>Queen's University</b> Kingston, ON, Canada. 2002
M.Sc. in Chemical Engineering	<b>Queen's University</b> Kingston, ON, Canada. 1997
B.Sc. in Chemical Engineering	<b>University of Moratuwa</b> Moratuwa, Sri Lanka, 1994

### **EMPLOYMENT**

7/2008 — Current	<b>Principal Engineer</b> Combustion Science & Engineering, Inc.; Columbia, MD
12/2003 — 6/2008	<b>Senior Engineer</b> Combustion Science & Engineering, Inc.; Columbia, MD
7/2002 — 11/2003	<b>Post-doctoral Research Fellow</b> Dept. of Mechanical & Aerospace Engineering; Princeton University, Princeton, NJ
1/1995 — 5/2002	<b>Graduate Research Assistant and Teaching Assistant</b> Dept. of Chemical Engineering, Queen's University; Kingston, Ontario, Canada

### **PROFESSIONAL ACTIVITIES**

- Member of the "Combustion & Fuels Committee" of the International Gas Turbine Institute
- Senior Member, American Institute of Aeronautics and Astronautics (AIAA)
- Senior Member, American Institute of Chemical Engineers (AIChE)
- Member, American Society of Mechanical Engineers (ASME)
- Member, The Society of Automotive Engineers (SAE)
- Member, Combustion Institute

### **PATENTS**

- "Method and Apparatus for Conditioning Liquid Hydrocarbon Fuels", Patent# 8702420, April 2014.
- "System, Method and Apparatus for Hydrogen-Oxygen Burner in Downhole Steam Generator", Patent# 7770646, August 2010.

## SELECTED PUBLICATIONS

### Book Chapter

- Gokulakrishnan, P. and Klassen, M. S. (2013), "Chapter 7: NO<sub>x</sub> and CO Formation and Control," in Gas Turbine Emissions, T. Lieuwen and V. Yang, (Eds.), Cambridge University, New York, NY, pp. 175-208.

### Journal Publications

- Gokulakrishnan, P., Fuller, C. C., Klassen, M. S., Joklik, R. G., Kochar, Y. N., Vaden, S. N., Lieuwen, T. C. and Seitzman, J. M. (2014) "Experiments and Modeling of Propane Combustion with Vitiation" *Combust. Flame*, Vol. 161; pp. 2038–2053.
- Gokulakrishnan, P., Joklik, R., Viehe, D., Trettel, A., Gonzalez-Juez, E. and Klassen, M. (2014), "Optimization of Reduced Kinetic Models for Reactive Flow Simulations", *J. Eng. Gas Turb. Power*, Vol. 136, p. 011503-1.
- Holton, M., Gokulakrishnan, P., Klassen, M., Roby, R., and Jackson, G. (2010), "Autoignition Delay Time Measurements of Methane Ethane and Propane Pure Fuels and Methane-Based Fuel Blends", *J. Eng. Gas Turb. Power*, Vol. 132, p. 091502-1.
- Gokulakrishnan, P., Ramotowski, M. J., Gaines, G., Fuller, C., Joklik, R., et al. (2008), "A Novel Low NO<sub>x</sub> Lean, Premixed, and Prevaporized Combustion System for Liquid Fuels", *J. Eng. Gas Turb. Power*, Vol. 130, pp. 051501:1-7.
- Gokulakrishnan, P., Gaines, G., Currano, J., Klassen, M. S. and Roby, R. J. (2007), "Experimental and Kinetic Modeling of Kerosene-Type Fuels at Gas Turbine Operating Conditions", *J. Eng. Gas Turb. Power*, Vol. 129, pp. 655–663.
- Gokulakrishnan, P., McLellan, P. J., Lawrence, A. D. and Grandmaison, E. W. (2005), "Kinetic Analysis and Model Reduction of NO–Sensitized Methane Oxidation", *Chem. Eng. Sci.*, Vol. 60, pp. 3683–3692.
- Gokulakrishnan, P., McLellan, P. J., Lawrence, A. D. and Grandmaison, E. W. (2004), "Application of Functional–PCA to Analyze and Reduce Complicated Chemical Mechanisms", *Comp. Chem. Eng.*, Vol. 30, pp. 1093–1101.
- Gokulakrishnan, P. and Lawrence, A. D. (1999), "An Experimental Study of the Inhibiting Effect of Chlorine in a Fluidized Bed Combustor", *Combust. Flame*, Vol. 116, pp. 640–652.
- Lawrence, A. D., Bu, J. and Gokulakrishnan, P. (1999), "The Interaction between SO<sub>2</sub>, NO<sub>x</sub>, HCl and Ca in a Bench–Scale Fluidized Combustor", *J. Inst. Energy*, Vol. 72, pp. 34–40

### Conference Proceedings

- Huelskamp, B., Gokulakrishnan, P., Klingshirn, C., Kuprowicz, N. J. and Belovich, V. (2015), "Addition of Ammonia to a Bluff-Body Stabilized Flame and Its Effect on NO<sub>x</sub> Emissions and Static Stability", 53<sup>rd</sup> AIAA Aerospace Sciences Meeting, AIAA 2015-0673.
- Gokulakrishnan, P., Fuller, C. C., Klassen, M. S. and Kiel, B. V. (2014), "Ignition Characteristics of Alternative Jet Fuels under Vitiated Conditions", 50<sup>th</sup> AIAA Joint Propulsion Conference, Cleveland, OH, AIAA 2014-3664.
- Gokulakrishnan, P., Fuller, C. C., Joklik, R. and Klassen, M. (2012), "Chemical Kinetic Modeling of Ignition and Emissions from Natural Gas and LNG Fueled Gas Turbines", ASME Turbo Expo 2012, Copenhagen, Denmark, GT2012-69902.
- Fuller, C. C., Gokulakrishnan, P., Klassen, M. S. et al. (2012), "Effects of Vitiation and Pressure on Laminar Flame Speeds of n-Decane", 50<sup>th</sup> AIAA Aerospace Sciences Meeting, Nashville, TN, AIAA 2012-0167.
- Gokulakrishnan, P., Fuller, C. C., Klassen, M. S. and Huang, H. (2011), "Kinetic Modeling of Thermal and Catalytic Cracking of Paraffinic Surrogate Fuels Relevant to Hypersonic Applications", 47<sup>th</sup> AIAA Joint Propulsion Conference, AIAA-2011-6106.
- Fuller, C. C., Gokulakrishnan, P., Klassen, M. S., Roby, R. J., and Kiel, B. V. (2011), "Investigation of the Effect of Nitric Oxide on the Autoignition of JP-8 at Low Pressure Vitiated Conditions", 49<sup>th</sup> AIAA Aerospace Sciences Meeting, Orlando, FL, AIAA-2011-96.
- Gokulakrishnan, P., K. Foli, M. Klassen, R. Roby, M. Soteriou, B. Kiel and B. Sekar (2009), "LES-PDF Modeling of Flame Instability and Blow-out in Bluff-Body Stabilized Flames", 45<sup>th</sup> AIAA Joint Propulsion Conference, AIAA-2009-5409.
- Gokulakrishnan, P., Bikkani, R., Klassen, M. S., Roby, R. J., & Kiel, B. V. (2009), "Influence of Turbulence-Chemistry Interaction in Blow-out Predictions of Bluff-Body Stabilized Flames", 47<sup>th</sup> AIAA Aerospace Sciences Meeting, AIAA-2009-1179.
- Gokulakrishnan, P., Klassen, M. S. and Roby, R. J. (2008), "Ignition Characteristics of A Fischer-Tropsch Synthetic Jet Fuel", ASME Turbo-Expo, Berlin, Germany, GT2008-51211.
- Gokulakrishnan, P., Gaines, G., Klassen, M. S. and Roby, R. J. (2007), "Autoignition of Aviation Fuels: Experimental and Modeling Study", 43<sup>rd</sup> AIAA Joint Propulsion Conference, Cincinnati, OH, AIAA 2007-5701.
- Chaos, M., Zhao, Z., Kazakov, A., Gokulakrishnan, P., Angioletti, M. and Dryer, F. L. (2007), "A PRF+Toluene Surrogate Fuel Model for Simulating Gasoline Kinetics", Fifth US Combustion Meeting, The Combustion Institute, San Diego, CA.
- Gokulakrishnan, P., S. Pal, M. S. Klassen et al. (2006), "Supersonic Combustion Simulation of Cavity-Stabilized Hydrocarbon Flames using Ethylene Reduced Kinetic Mechanism", 42<sup>nd</sup> AIAA Joint Propulsion Conference, Sacramento, CA, AIAA 2006-5092.
- Gokulakrishnan, P., Kwon, S., Hamer, A. J., Klassen, M. S. and Roby, R. J. (2006), "Reduced Kinetic Mechanism for Reactive Flow Simulation of Syngas/Methane Combustion at Gas Turbine Conditions", ASME Turbo-Expo, Barcelona, Paper# GT2006-90573.
- Gokulakrishnan, P., Kazakov, A. and Dryer, F. L. (2003), "Comparison of Numerical and Experimental Kinetic Data for Flow Reactor Systems: Mixing Effects", Third US Combustion Meeting, The Combustion Institute, Chicago, IL.