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**RICHARD G. JOKLIK, Ph.D.**

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**EDUCATION:**

Ph.D., Mechanical Engineering, University of California, 1985.

M.S., Mechanical Engineering, University of California, 1982.

B.S., Mechanical Engineering, Massachusetts Institute of Technology, 1979.

**PROFESSIONAL EXPERIENCE:**

**Director of Combustion Research & Development and Principal Engineer, Combustion Science and Engineering, Inc., Columbia, MD, 2001 to present.**

Responsible for the design and execution of experimental and analytical projects in fire and combustion research. Expertise includes optical and laser based measurement techniques for gas analysis and temperature (absorption and emission spectroscopy, laser induced fluorescence, and FTIR) and fluid flow measurement (flow visualization and hot-wire anemometry), chemical kinetic modeling of combustion and pollutant formation, and sprays and evaporation. Recent projects include: investigation of NO<sub>x</sub> remediation in gas-turbine exhaust and experimental validation of CFD models; chemical kinetic modeling of pollutant formation and control (NO<sub>x</sub> and CH<sub>2</sub>O) in combustion systems; chemical reactor modeling of lean blow-off in jet combustors, effects of H<sub>2</sub> addition in gas turbine combustors, performance of high fuel/air ratio jet combustors, NO<sub>x</sub> and CO emissions from dry-low NO<sub>x</sub> and micro-turbine combustors, and coal gasification; experimental study of UV activated catalytic NO<sub>2</sub> remediation; modeling of NO<sub>2</sub> brown plume in gas turbine exhaust; design of combustors for high pressure steam generation and diesel engine soot trap; development of (involving experimental, modeling, and design work) a system enabling lean, pre-vaporized, pre-mixed combustion of liquid fuels; modeling and experimental investigation of multi-component fuel evaporation; experimental flow study of steam turbine inlet; experimental study of formaldehyde capture in cooling system condensate.

**Consulting Engineer, 1996-2001**

Environmental monitoring technology assessment, research and development, testing design and analysis. Managed particulate matter continuous emissions monitoring projects for Kilkelly Environmental Associates. Developing and implementing Predictive Emissions Monitoring Systems (PEMS) for NO<sub>x</sub> and CO from gas turbines with Midwest Research Institute (2000-2001).

**Engineer, Energy and Environmental Research Corp., Durham, NC, 1993-1996.**

Project manager and principle investigator for an EPA contract to field test continuous emission monitoring systems for particulate matter and metals. Project manager and principle investigator for an EPA contract to survey and assess continuous emission measurement technologies for hazardous waste incineration. Project manager for an EPA contract to develop performance specifications and data quality objectives for multi-metals, particulate matter, and mercury continuous emissions monitors. Managed identification of data needs for regulation of waste incineration and development of associated test programs.

**Engineer, National Institute of Standards and Technology, Gaithersburg, MD, 1987-1992.**

Conducted research in reacting flows and diagnostics development, prepared reports, publications, and proposals for new research. Developed a laser induced fluorescence (LIF) temperature measurement technique for use in gas turbine combustors based on thermally-assisted OH fluorescence. Investigated flame dynamics of an acoustically-forced jet diffusion flame using laser absorption tomography. Investigated SiO<sub>2</sub> particulate formation in an opposed flow diffusion flame using Resonant Enhanced Multi-Photon Ionization (REMPI) spectroscopy.

**Engineer, Aerodyne Products Corp., Billerica, MA, 1986-1987.**

Developed a Raleigh scattering temperature measurement probe under contract to NASA for use in rocket combustors.

**Research Assistant, Mechanical Engineering Department, University of California, Berkeley, CA, 1979-1986.**

Designed and assembled a low-pressure flame facility and laser diagnostics lab. Used laser absorption and emissions spectroscopy to measure CH concentrations over a wide range of flame conditions, compared results to detailed chemical kinetic modeling calculations. Used laser induced fluorescence to study CH collisional transfer rates under flame conditions. Developed and demonstrated a laser based technique for making high speed, non-intrusive temperature measurements in flames.

**PROFESSIONAL STANDING:**

Member, The American Society of Mechanical Engineers

Member, The Combustion Institute

Member, American Institute of Aeronautics and Astronautics

Member, Optical Society of America

**SELECTED PUBLICATIONS:**

Joklik, R., Gokulakrishnan, P., and Klassen, M., "Kinetic Modeling of Plasma-Enhanced Vitiated Combustion," Proceedings of ASME Turbo Expo 2015, Montreal, Canada, GT2015-43772.

- Gokulakrishnan, P., Joklik, R., Viehe, D., Trettel, A., Gonzalez-Juez, E., and Klassen, M., "Optimization of Reduced Kinetic Models for Reactive Flow Simulations," *J. of Eng. For Gas Turbines and power*, **136**, p. 011503 (2014).
- Gokulakrishnan, P., Fuller, C. Joklik, R. and Klassen, M., (2012). "Chemical Kinetic Modeling of Ignition and Emissions from Natural Gas and LNG Fueled Gas Turbines", Proceedings of ASME Turbo Expo 2012, Copenhagen, Denmark, GT2012-69902.
- R. Joklik, L. Eskin, M. Klassen, R. Roby, M. Holton, and T. Mallinson, "Low Emissions Power Generation Using Natural Gas Condensates," paper GT2010-22990, ASME Turbo Expo 2011: Power for Land, Sea and Air, Vancouver, Canada, June 2011.
- Leo D. Eskin, Michael S. Klassen, Richard J. Roby, Richard G. Joklik and Maclain M. Holton, "LOW-EMISSIONS RENEWABLE POWER GENERATION USING LIQUID FUELS," Proceedings of the ASME/JSME 2011 8<sup>th</sup> Thermal Engineering Joint Conference, AJTEC2011-44615, 2011
- Joklik, R., Fuller, C., Turner B., and Gokulakrishnan P., "The Effect of Multi-component Fuel Evaporation on the Ignition of JP-8," paper GT2010-22990, ASME Turbo Expo 2010: Power for Land, Sea and Air, Glasgow, Scotland, June 2010.
- P. Gokulakrishnan, M. J. Ramotowski, G. Gaines, C. Fuller, R. Joklik, L. D. Eskin, M. S. Klassen, R. J. Roby, "A Novel Low NO<sub>x</sub> Lean, Premixed, and Prevaporized Combustion System for Liquid Fuels," *Journal of Engineering for Gas Turbines and Power*, 130, 2008.
- Gokulakrishnan, P., Ramotowski, M.J., Gaines, G., Fuller, C., Joklik, R., Eskin, M.S., and Roby, R.J., "Experimental Study of NO<sub>x</sub> Formation in Lean, Premixed, Prevaporized Combustion of Fuel Oils at Elevated Pressures", paper GT2007-27552, ASME Turbo Expo 2007: Power for Land, Sea and Air, Montreal, Canada, May 2007.
- R.G. Joklik and H.S. Rauenzahn, "Evaluation of Particulate Matter and Total Mercury Continuous Emissions Monitors for Compliance Monitoring at Hazardous Waste Combustion Facilities," *Proceedings of the Air and Waste Management Association 89th Annual Meeting*, June 23-28, 1996, Nashville, TN.
- R.G. Joklik, "OH Vibrational Thermally-Assisted LIF Temperature Measurements in Flames," *Combustion Science and Technology*, **87**, pp. 109-125 (1992).
- R.G. Joklik, J.J. Horvath, and H.G. Semerjian, "Temperature Measurements in Flames Using Thermally Assisted LIF of Ga," *Applied Optics* **30**, pp. 1497-1504 (1991).
- M.R. Zachariah and R.G. Joklik, "Multiphoton Ionization Spectroscopy Measurements of Si Atoms in a Ceramic Particle Forming Flow," *Journal of Applied Physics*, **68**,311 (1990).

R.G. Joklik and J.W. Daily, "LIF Study of CH A-X (0,0) Collision Dynamics in a Low Pressure Oxy-Acetylene Flame," *Combustion and Flame*, 69,211 (1987).

R.G. Joklik, J.W. Daily, and W.J. Pitz, "Measurements of CH Radical Concentrations in an Acetylene/Oxygen Flame and Comparisons to Modeling Calculations," *21st Symposium (International) on Combustion*, pp. 895-904 (1986).