SIVAKUMAR SANTHANAKRISHNAN, PhD

Assistant Professor
Department of Mechanical Engineering
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RESEARCH INTERESTS

- Oxyfuel combustion, energy efficiency, waste heat recovery systems, thermodynamic modeling, pollution reduction,
- Infrared and optical diagnostics, emission measurements, sensors for biomedical and food-related applications
- Engineering education, active learning, peer review

TEACHING INTERESTS

Thermodynamics, Heat Transfer, Fluid mechanics, Combustion, Compressible Flow, Optics, Experimental Methods in Engineering.

EDUCATION

Ph.D. in Aerospace Engineering, **University of Michigan,** Ann Arbor, MI, 2000
M.S. in Aerospace Engineering, **University of Michigan,** Ann Arbor, MI, 1997
B.Tech. in Aerospace Engineering, **Indian Institute of Technology (IIT),** Madras, INDIA, 1995

ACADEMIC APPOINTMENTS

- Assistant Professor, Department of Mechanical Engineering, Indiana University- Purdue University Indianapolis, IN (September 2002 – present)
- Adjunct Assistant Professor, School of Mechanical Engineering, Purdue University, West Lafayette, IN (September 2002 – present)
- Research Associate, School of Mechanical Engineering, Purdue University, West Lafayette, IN (March 2000 – December 2002)

AWARDS/ HONORS

- Trustees TERA (Teaching Excellence Recognition Award) Award , 2008
- Fourth Place (among 8 finalists) Burton D. Morgan Entrepreneurial Competition, 2002.
- Seventh Place (among 21 finalists) University of Oregon New Venture Championship, 2002.
- Lexington's Who's Who of professionals, 1999
- London International Youth Science Fortnight, Indian representative, 1991

STUDENT AWARDS

- J.M. Abshire, AIAA Annual Region III Student Conference, West Lafayette, IN, Graduate Presentation Award - Second Place (2004).
- J.M. Abshire, AIAA Annual Region III Student Conference, Paducah, KY, Graduate Presentation Award - First Place (2003).

PROFESSIONAL AFFILIATIONS

- Member, USGBC (US Green Building Council), Indiana Chapter, 2008 - present
- Member, ASEE (American Society of Engineering Education), 2005 - present
- Member, Combustion Institute, 2003 – present
- Member, AIAA (American Institute of Aeronautics and Astronautics), 2003 – present
- Member, SPIE (Society of Photonics and Instrumentation Engineers), 2001

TEACHING ASSIGNMENTS*

Semester	Course	Title	Lec. Hrs.	Lab Hrs.	Enrollment
Fall 08	ME 310	Fluid Mechanics	3	1	43
Fall 08	ME 314	Heat and Mass Transfer	3	1	35
Summer 08	ME 200	Thermodynamics	3		18
Spring 08	ME 505	Intermediate Heat Transfer	3		13
Spring 08	ME 314	Heat and Mass Transfer	3	1	25
Spring 08	ME 491	Independent Study	1		1
Fall 07	ME 310	Fluid Mechanics	3	1	31
Fall 07	ME 314	Heat and Mass Transfer	3	1	14
Fall 07	ME 491	Independent Study	1		1
Spring 07	ME 505	Intermediate Heat Transfer	3		16
Spring 07	ME 314	Heat and Mass Transfer	3	1	25
Summer 06	ME 491	Independent Study	1		1
Spring 06	ME 505	Intermediate Heat Transfer	3		14
Spring 06	ME 314	Heat and Mass Transfer	3	1	23
Spring 06	ME 597	Graduate Project	3		1
Fall 05	ME 314	Heat and Mass Transfer	3	1	17
Fall 05	ME 200	Thermodynamics	3		11
Spring 05	ME 505	Intermediate Heat Transfer	3		9
Spring 05	ME 314	Heat and Mass Transfer	3	1	28
Spring 05	ME 491	Independent Study	1		1
Fall 04	ME 314	Heat and Mass Transfer	3	1	25
Fall 04	ME 491	Independent Study	2+1		2
Spring 04	ME 505	Intermediate Heat Transfer	3		6
Fall 03	ME 314	Heat and Mass Transfer	3	1	17
Spring 03	ME 505	Intermediate Heat Transfer	3		12

*Apart from the courses listed above, the following list includes course proctoring and review course duties for the semesters listed:

Semester	Course	Title	Enrollment
Spring 08	ME 571	Reliability-Based Design	12
Spring 08		FE (Fundamentals of Engineering) Exam Review - Thermodynamics	5
Fall 07	ME 505	Intermediate Heat Transfer (Purdue Pro Ed)	3
Spring 07		FE Exam Review - Thermodynamics	6
Spring 06		FE Exam Review - Chemistry, Thermodynamics	5
Spring 05		FE Exam Review - Chemistry, Thermodynamics	12
Spring 05	ME 510	Compressible Flow (Purdue CEE)	2
Spring 04	ME 565	Vehicle Dynamics (Purdue CEE)	3

STUDENT SUPERVISION

Graduate Students

As Thesis Advisor / Thesis Co-Chair (5 M.S. and 2 Ph.D. students)

1. "Waste Heat Recovery System for Diesel Engines – Design and Concepts Evaluation", William Donelson – MSME, IUPUI – expected to graduate in 2008.
2. "Simulations of Normal and Inverse Laminar Diffusion Flames under Oxygen Enhancement and Gravity Variation", Pramod Bhatia – Ph.D. (ME), Purdue University, West Lafayette, May 2008.
3. "Effect of Oxygen Enhancement and Flame Configuration on Radiation and Flame Structure", Manish Saini –MSME, Purdue University, West Lafayette, August 2006.
4. "Effects of Oxygen Enhancement and Gravity Variation on Soot Properties of Inverse and Normal Jet Diffusion Flames", Sravan Ravinutala – Ph.D. (ME), IUPUI – discontinued in December 2005.
5. "Laminar Diffusion Flame Shapes Under Earth-Gravity and Micro-gravity Conditions", Jason Abshire - MSME, IUPUI, July 2004.
6. "Design of a Multifluid Heat Exchanger", Sang Bae Park - MSME, IUPUI, December 2003.

As Thesis Committee Member (9 M.S. and 2 Ph.D. students)

1. "Wave Rotor Performance Analysis and Numerical Study of its Transient Heat Transfer," Hongwei Li – Ph.D. (ME), Purdue University, West Lafayette, expected to graduate in May 2009.
2. "Exhaust Gas Cooling in Modern Truck Engines," John Bowman – MSME, IUPUI – expected to graduate in May 2008[1].
3. "Numerical Analysis of Hot Gas Injection and Premixed Flame Propagation in a Channel," Dhruv Baronia – MSME, IUPUI, December 2006.
4. "Detection of Pathogens in Food using FTIR Spectroscopy," Yash Burgula - Ph.D. (Food Science), Purdue University, WL, August 2006.
5. "Prediction and Design of Fuel-Air Mixing in a Combustion Wave Rotor Using Two-Dimensional Unsteady Moving Mesh Flow Computation," Arnab Banerjee – MSME, IUPUI, November 2005.
6. "A Probability Density Function Based Monte Carlo Scheme for Two-Phase Flow Simulation," Jie Huang – MSME, IUPUI, October 2004.
7. "The Development of a CFD Chemistry ODE Solver for Ethylene Fuel," Keith Bandi – MSME, IUPUI, July 2004.
8. "The Effectiveness of High Pressure in Fuel-Air Mixing and Design of Flow Passage," Snehaunshu Chowdhury – MSME, IUPUI, December 2003.
9. "Infrared Sensors for Rapid Identification of Select Foodborne Pathogens", Daniel Khali - MSME, Purdue University, WL, December 2003.
10. "Statistical Design-of-Experiments in the Investigation of the Wave Ejector," Tao Geng – MSME, IUPUI, November 2003.

Non-Thesis Project Advisor

11. "Demonstration and Modeling of Combustion-generated Oscillations," (ME 597) Eisuke Tanabe – MSME, IUPUI.
12. "Use of Thermochromic Liquid Crystals for a Heat Transfer Experiment", (ME 597) Michael Armbrester – MSME, IUPUI, Spring 2006.

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[1]*Supervised thesis research during Spring 2005 and part of Summer 2005 during the sabbatical leave of the student's major advisor, Dr. Razi Nalim.*

Undergraduate Students (22 undergraduate students in projects -4 teams and 7 as independent study)

1. "Sensitivity of Top-of-Atmosphere outgoing SW Radiation to Changes in Surface Albedo", (ME491), Project Advisor, Multidisciplinary Undergraduate Research Institute (MURI), Spring 2008.
2. "Redesign of a Soot Sampling Probe", Project Advisor, ME 491, Zachary Lightner – BSME student, IUPUI – Fall 2007.
3. "Soot Extinction and Scattering Measurements in Flames", Project Advisor, ME 491, Andrew Wall – BSME student, IUPUI – Summer 2006.
4. "Study of Thermodynamic Cycles of Relevance to Power Generation using CO_2 as the Working Fluid", MURI (Multidisciplinary Undergraduate Research Initiative) Team Advisor, Brandin Ray – BSME, Andrew Wall BSME, Anand Bojja –BSEET – Spring 2006.
5. "Ergonomic Redesign of Flame Diagnostics Setup", Project Advisor, ME 462, Team of 4 undergraduate students, Spring 2006.
6. "IUPUI Moonbuggy Team", Project Advisor, ME 462, Team of 4 undergraduate students, Spring 2006.
7. "Flame Sheet Location using SiC Filaments", Project Advisor, ME 491 / Honors Project, Michael Hughett/ David Langenderfer, Spring 2005.
8. "Design of a Two Axis System for Radiation Flux Measurements", Project Advisor, McNair Scholarship, Gareth Coote, Fall 2004.
9. "Design of a Soot Sampling System for Diffusion Flames", Project Advisor, ME 491, Justin Allen Zenn, Fall 2004.
10. "Redesign of Existing Residential Heating Equipment to Meet ASHRAE Standards 62.2 P", Project Advisor, ME 462, Team of 3 undergraduate students, Fall 2004.
11. "Cooling System for a Planar Chromatograph", Project Advisor, ME 491, Shahid Osman, Fall 2004.

GRANTS AND CONTRACTS (Total = $245,619)
(Title, Sponsor, Participation, IUPUI Budget / Total Budget, Duration, PI and Affiliation)

1. "Waste Heat Recovery System for Diesel Engines – Design and Concepts Evaluation" Cummins Engine Company, PI, $71,000, September 1, 2005 – September 30, 2007.
2. "Oxygen and Fuel Jet Diffusion Flame Studies in Microgravity Motivated by Spacecraft Oxygen Storage Fire Safety" NASA OBPR (Office of Biological and Physical Research), PI, $70,819/$480,000, October 1, 2003 - May 31, 2007. (Co-PIs: Dr. Jay Gore, School of Mechanical Engineering, Purdue University, West Lafayette, Dr. Peter Sunderland, Department of Fire Protection Engineering, College Park, MD)
3. "Flame Shapes of High Oxygen Flames under Normal and Low Gravity Conditions" New Faculty Development OPD (Office for Professional Development, IUPUI) Grant, PI, $10,000/$10,000, March 15, 2003 – March 31, 2004.
4. "Study of Thermodynamic Cycles of Relevance to Power Generation using CO_2 as the Working Fluid" MURI (Multidisciplinary Undergraduate Research Institute, IUPUI) Grant, Mentor, $7,500, January 1, 2006 – June 31, 2006.
5. "Engine Cooling System Design and Evaluation" Cummins Engine Company, Co-I, January 1, 2005 – July 31, 2005 (PI: R. Nalim, IUPUI).
6. "Infrared Sensors for Rapid Identification of Biological Foodborne Contaminants" CFSE (Center for Food Safety Engineering), Purdue University, Co-I, $2,200/$184,237, January 2003 – December 2004. (PI: Dr. Lisa Mauer, Department of Food Science, Purdue University, West Lafayette, IN)

7. "Development and Testing of a Mid Infrared Absorption based Glucose Sensor Prototype", Purdue University, West Lafayette, PI, $7143, Sep. 3rd, 2002 – Dec. 31st, 2002.
8. "Upgrading the Heat Transfer Laboratory", UTC- Carrier Laboratory Equipment Grant, $72,000, Spring 2008, 2007, 2005, 2004.
9. "Design Modification Of A Gas Furnace To Meet ASHRAE (American Society of Heating Refrigeration and Air-Conditioning Engineers) Standard 62.2" – Undergraduate Student Project Grant, $5,000, Fall 2004. (along with Dr. Pidaparti)

PROFESSIONAL SERVICE

- Faculty Advisor, AIAA, 2003 – present
- Affiliate Director (IUPUI), INSGC (Indiana Space Grants Consortium), 2003 – 2008
- Grand Awards Judge, ISEF (Intel International Science and Engineering Fair) 2006
- Session Chair (Globalization), FIE (Frontiers in Education) Conference, San Diego, CA, 2006
- Reviewer, MURI (Multidisciplinary Undergraduate Research Institute) Review Board, 2008
- Reviewer, IEEE (Institute of Electrical and Electronics Engineers) Sensors Journal, 2008
- Reviewer, ASEE (American Society of Engineering Education – Recent Trends, 2007
- Reviewer, ASEE (American Society of Engineering Education) - Energy Conversion and Conservation Division, 2006
- Reviewer, ASEE (American Society of Engineering Education) - Energy Conversion and Conservation Division, 2005
- Reviewer, ASME (American Society of Mechanical Engineers) - Internal Combustion Engine Division, Spring Technical Conference, 2003
- Reviewer, LEBENSMITTEL-WISSENSCHAFT und –TECHNOLOGIE FOOD SCIENCE and TECHNOLOGY, 2003

Department Committees

- Chair, Lab Equipment and Safety Committee (September 2005 – present)
- Member, Faculty Search and Screen (Renewable Energy) Committee (April – July 2007)
- Member, Graduate Education and Research Committee (September 2002 – present)
- Acting Graduate Chair, Mechanical Engineering Department (January 2005 – August 2005)
- Chair, Seminar Committee (April 2003 – December 2005)

School Committees

- Distributed Learning Committee (August 2004 – present)
- Member, School Research Committee (January 2005 – present)
- Member, Educational Policy Committee, (August 2004 – August 2005)

LIST OF SELECTED PUBLICATIONS

1. S.S. Krishnan, J.M. Abshire, P.B. Sunderland, Z.-G. Yuan and J.P. Gore (2008) "Analytical Predictions of Laminar Diffusion Flame Shapes in Microgravity and Earth Gravity," in press, *Combustion Theory and Modeling*.
2. J.P. Bowman, S.S. Krishnan and R. Nalim, (2005) "Cooling Challenges of Modern Truck Diesel Engines" Proceedings of ICES2005 ASME Internal Combustion Engine Division 2005 Spring Technical Conference, Chicago, IL, Paper Number ICES2005-1093.

3. S.S. Krishnan, J.M. Abshire, J.P. Gore, P.B. Sunderland and Z.-G. Yuan, (2005) "Experimental and Analytical Laminar Diffusion Flame Shapes in Microgravity and Earth-gravity" 43rd AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, Paper AIAA-2005-0714.
4. S. Ravinutala, S.S. Krishnan, P.B. Sunderland, and J.P. Gore, (2005) "SiC Filament-based Flame Shapes in High Oxygen Flames," Eastern States Section of the Combustion Institute Meeting, Orlando, FL, Proceedings.
5. P.B. Sunderland, S.S. Krishnan, and J.P. Gore (2004) "Effects of Oxygen Enhancement and Gravity on Normal and Inverse Laminar Jet Diffusion Flames," Brief Communication, *Combustion and Flame,* Vol. 136:254-256.
6. Krishnan, S. S., Lin K.-C., and Faeth G.M. (2001)[2] "Extinction and Scattering Properties of Soot Emitted from Turbulent Diffusion Flames," *ASME Journal of Heat Transfer*, Vol. 123, pp. 331 – 339.
7. J.C. Abel, S.S. Krishnan, L.X. Xu, and J.P. Gore (2001) "Measurement Of Specific Heat Of Biological Tissue Using IR Imaging And Spectroscopy," Proceedings of 2001 ASME International Mechanical Engineering Congress and Exposition, New York, NY.
8. Wu, J.-S., Krishnan, S.S., and Faeth, G.M. (1997) "Refractive Indices at Visible Wavelengths of Soot Emitted from Buoyant Turbulent Diffusion Flames," *ASME Journal of Heat Transfer*, Vol. 119, pp. 230 – 237.

Oral Presentations

1. Technical presentation, "Low Emission Burners for Residential Applications," Carrier Corporation, Indianapolis, IN, February 2008.
2. Invited talk, "Thermodynamic Analysis and Component Sizing for Waste Heat Recovery Systems," The Energy and Resources Institute, New Delhi, INDIA, July 2007.
3. Technical paper, "Comparisons of Model Predictions with Measurements of Normal and Microgravity Laminar Diffusion Flame Shapes," Spring Technical Meeting of the Combustion Institute Central States Section, Austin, TX, March 2004.
4. Poster presentation, "Oxygen and Fuel Jet Diffusion Flame Studies in Microgravity Motivated by Spacecraft Oxygen Storage Fire Safety," Seventh International Microgravity Combustion Workshop, Cleveland, OH, March 2003.

[2] *Cited in a textbook, Michael F. Modest, Radiative Heat Transfer (Second Edition), Academic Press.*