Faculty Vita: Promotion and Tenure

Date: January 9, 2012
Name: **Shankar Subramaniam**
Department: Mechanical Engineering
Current Rank: Associate Professor

I. PERSONAL HISTORY AND PROFESSIONAL EXPERIENCE

A. Educational Background

Name of Institution	Degree	Field of Study	Year
Cornell University	Ph.D.	Aerospace Engineering	1997
University of Notre Dame	M.S.	Aerospace Engineering	1990
Indian Institute of Technology (Bombay)	B.Tech.	Aeronautical Engineering	1988

B. List of Academic Positions since Final Degree

Name of Institution	Title	Dates
Iowa State University	Associate Professor	2008-present
	Assistant Professor	2002-2008
Ames, IA 50011	Department of Mechanical Engineering	
Rutgers, The State University of New Jersey, Piscataway, NJ 08854	Assistant Professor (tenure-track)[*] Department of Mechanical and Aerospace Engineering	1999-2002

C. Other Professional Employment

Name of Institution	Title	Dates
Los Alamos National Laboratory Los Alamos, NM 87544	Postdoctoral Research Associate Fluid Dynamics Group T-3 Theoretical Division	1997-1999
General Motors R&D R&D Center Warren, MI	Research Intern	1996

D. Honors, Recognitions, and Outstanding Achievements

- *Outstanding Conference Paper Award* at the *International Conference on Multiphase Flow*   2010

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[*] Successfully reappointed in 2002.

- DOE Early Career Principal Investigator Award   2002
- President's Silver Medal, IIT Bombay   1988
- National Talent Search Scholarship, India   1982

Other noteworthy achievements

o Nominated for *International Conference on Multiphase*   2007
Flow, Junior Researcher Award

o Finalist, Margaret Ellen White Graduate Faculty Award   2006

E. Formally Invited Lectures and Invited Conference Presentations

Invited Seminars at Universities

1. S. Subramaniam, "Modeling and Simulation of Turbulent Reactive Flows", Mechanical Engineering Department, The Ohio State University, Columbus, OH, July 2002

2. S. Subramaniam, "Modeling Growth and Structure of Nanoparticles Aggregating in Liquid Suspension", Condensed Matter Seminar, Physics Department, Kansas State University, Manhattan, KS, May 2007

3. S. Subramaniam, "Modeling Effects of Clustering in Multiphase Flow through a Transport Theory of Fluctuations", Fall 2007 Fluid Mechanics Seminar, Stanford University, Stanford, CA, November 2007

4. S. Subramaniam, "Modeling and Simulation of Nanoparticle Aggregation in Liquid Suspensions", University of Iowa's Mechanical Engineering Department Seminar, University of Iowa, Iowa City, IA, September 2008

5. S. Subramaniam, "Gas-Solid Flows: Progress and Challenges in Theory, Modeling and Simulation", University of Minnesota's Mechanical Engineering Department Seminar, University of Minnesota, Minneapolis, MN, September 2009

6. S. Subramaniam, "Gas-solid flows and Particle clustering", at the University of Florida, Gainesville, Department of Mechanical Engineering in Professor Balachandar's group, Feb 2010

Invited Workshop and Conference Presentations

7. S. Subramaniam, "Consistent Modeling of Multiphase Flows", Sondersforschungsbereich-412: Workshop on Modeling, Simulation and Design in Process Engineering, University of Stuttgart, Germany, March 2003

8. S. Subramaniam, "The Role of Volume and Surface Measure in Statistical Models of Multiphase Flow", Special Session on Modeling and Simulation of Complex Fluid Systems, American Mathematical Society, Sectional Meeting, Tallahassee, FL, March 2004

9. S. Subramaniam, "Modeling Droplet Heat and Mass Transfer in Sprays: Progress and Challenges", Spray '05 International Conference on Heat and Mass Transfer, Antalya, Turkey, June 2005

10. S. Subramaniam, "Progress and Challenges in Spray Combustion", ASME International Mechanical Engineering Congress and Exposition, Seattle, WA, November 2007

11. S. Subramaniam, "Modeling and Simulation of Multiphase Flow", Indo-US Science and Technology Forum's *Frontiers of Liquid Atomization* Workshop at IIT Madras, Chennai, India, Dec 19-20, 2011

Invited Presentations to Industry

12. S. Subramaniam, "Multiphase Flow Computations For Process Simulation: Breaking The Accuracy vs. Speed Trade-Off Barrier", Dow Chemical Company, Freeport, TX, July 2007

13. S. Subramaniam, "Computational Fluid Dynamics for Understanding Transport in Thermochemical Processes", Conoco-Phillips Meeting, Iowa State University, May 2008

Invited Seminars at National Laboratories

14. S. Subramaniam, "Direct Numerical Simulation of Heat and Mass Transfer in Gas-Solid Flow: Effect of Particle Clustering" at the National Energy Technology Laboratory, Morgantown, WV, Apr 2, 2010

F. Offices Held in Professional Societies

- Symposium Organizer, Society for Engineering Science Annual Meeting 2011, Northwestern University
- Symposium Organizer, Society for Engineering Science Annual Meeting 2010, Iowa State University
- Member, Scientific Committee, 2010 International Conference on Multiphase Flow
- Technical Program Chair, Institute for Liquid Atomization and Spray Systems (ILASS Americas), 2005-2007
- Co-chair, Technical Committee on Computational Modeling, Institute for Liquid Atomization and Spray Systems (ILASS Americas), 2002-2005
- Chair, Honors and Awards Committee, International Liquid Atomization and Spray Systems Society (ILASS Americas), 2003-2005

G. Editorships of Journals or Other Learned Publications

- Member, Editorial Board, *International Journal of Spray and Combustion Dynamics,* 2008-present
- Member, Editorial Board, *Atomization and Sprays,* April 2004-2008

H. Grants and Contracts Received Since Last Promotion at ISU

1. Investigators (list principal investigator first): Shankar Subramaniam
   Title of Grant: Stability Limits for Gas-Solid Suspensions with Finite Fluid Inertia using Particle-Resolved Direct Numerical Simulations
   Granting Agency: National Science Foundation
   Dates of beginning and end of grant: Sep 2011-Aug 2014
   Total dollar amount of grant and dollar amount allocated to your work: $250,499

2. Investigators (list principal investigator first): Seckin Gokaltun and Shankar Subramaniam
   Title of Grant: Development of a Two-fluid Drag Law for Clustered Particles Using Direct Numerical Simulation and Validation through Experiments
   Granting Agency: DOE (HBCU/OMI program)
   Dates of beginning and end of grant: 08/15/11 -08/14/14

Total dollar amount of grant and dollar amount allocated to your work: $200,000 ($52,643)

3. Investigators (list principal investigator first): Shankar Subramaniam and Michael G. Olsen
Title of Grant: Multiphase Models for CO2 Cleanup: Heat and Mass Transfer in Fluid-Particle Suspensions through Direct Numerical Simulation and Laser-Based Measurements
Granting Agency: National Science Foundation
Dates of beginning and end of grant: September 1, 2010 to August 31, 2013
Total dollar amount: $ 349,999
Amount allocated to candidate: $175,000
Role or responsibilities of the candidate: Direct project and develop computational model and perform simulations of heat transfer in gas-solid flows.

4. Investigators: Kejin Wang (CCEE), Sriram Sundararajan (ME), Shankar Subramaniam (ME)
Title of Grant: Understanding Rheology Of Cement-Based Materials Through Intergrated Experiments And Computations At Multiple Scales
Granting Agency: National Science Foundation
Dates: August 2009 to July 2012
Total dollar amount: $300,000
Amount allocated to candidate: $80,000
Role or responsibilities of the candidate: Develop computational model and perform simulations of rheology of cement-based materials.

5. Investigators: Robert Brown (ISU), Rodney O. Fox (Ames Lab/ISU)
Title of Grant: A Systems Approach to Bio-Oil Stabilization
Granting Agency: Department of Energy, NREL Golden Office
Dates: October 2008 to September 2010
Total dollar amount: $2,100,000
Amount allocated to candidate: $120,000
Role or responsibilities of the candidate: Simulate granular filtration of hot gases after fast pyrolysis of biomass using direct numerical simulation.

6. Investigators: Shankar Subramaniam, Rodney O. Fox
Title of Grant: Kinetic Theory of Multiphase Flow
Granting Agency: Department of Energy, National Energy Technology Laboratory
Dates: October 2007 to September 2011
Total dollar amount: $470,000
Amount allocated to candidate: $235,000
Role or responsibilities of the candidate: Co-principal investigator responsible for direct numerical simulation of heat transfer in particle assemblies

I. Proposals for Grants and Contracts Pending

K. Proposals for Grants and Contracts not funded since Last Promotion at ISU

1. Investigators (list principal investigator first): Cecil F. Higgs and Shankar Subramaniam

Title of Grant: Collaborative Research: Constitutive modeling of granular flows in the intermediate regime: Experiments, Modeling, and Simulations
Granting Agency: NSF
Dates of beginning and end of grant: 05/15/11 -05/14/14
Total dollar amount of grant and dollar amount allocated to your work: $439,141 ($184,072)

2. Investigators (list principal investigator first): Shankar Subramaniam
Title of Grant: Multiphase Models for Clean Energy: Drag Law and Stability Limits for Gas-Solid Suspensions with Particle Clustering using Direct Numerical Simulations
Granting Agency: NSF
Dates of beginning and end of grant: 05/15/11 -05/14/14
Total dollar amount of grant and dollar amount allocated to your work: $217,822 ($217,822)

3. Investigators (list principal investigator first): Shankar Subramaniam, Baskar Ganapathysubramanian and Theodore J. Heindel
Title of Grant: Uncertainty-quantification (UQ) framework for simulation of fluidized beds through integrated multiscale computations and X-ray tomography
Granting Agency: DOE (NETL)
Dates of beginning and end of grant: 08/15/11 -08/14/14
Total dollar amount of grant and dollar amount allocated to your work: $300,000 ($100,000)

4. Investigators: Gap-Yong Kim and Shankar Subramaniam
Title of Grant: Processing and Synthesis of CNT-reinforced Metal Matrix Composites by Spray Dispersed Semisolid Powder Processing
Granting Agency: NSF
Date of Submission: 10/01/2009
Total dollar amount of grant: $367,236

5. Investigators: Shankar Subramaniam and Michael G. Olsen
Title of Grant: Improved Understanding of Heat and Mass Transfer in Fluid-Particle Suspensions through Direct Numerical Simulation and Laser-Based Measurements
Granting Agency: NSF
Date of Submission: 09/15/2009
Total dollar amount of grant: $495,000

6. Investigators: Baskar Ganapathysubramanian (ME), Sumit Chaudhury, Umesh Vaidya, (EcPE), Monica Lamm (CBE)
Title of Grant: CDI-Type II: Computational engine for the design of high-efficiency organic solar cells
Granting Agency: NSF
Date of Submission: November 2008
Total dollar amount of grant: $1,183,846

7. Investigator: Shankar Subramaniam, Rodney O. Fox (CBE), Hui Hu (AeroE), Eugene S. Takle (Geol. and Atmos. Sci.)
Title of Grant: CDI-Type II: Understanding the Transport of Particles by Fluid Flow: Cyber-guided Exploration and Data-driven Coarse-graining
Granting Agency: NSF
Date of submission: November 2008
Total dollar amount: $1,528,546

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K. <u>Grant Review Panels (e.g., for Governmental Agencies, Educational Institutions)</u>

- Served on NSF CAREER Program review panel, Arlington VA, November 2011

- Served on a DOE Early Career Principal Investigator Program review panel, Rockville, MD, June 2005

L. <u>Policy, Advisory or Corporate Panels or Boards (e.g., for Governmental Agencies, Educational Institutions, Companies)</u>

- Invited participant, co-chair of "Dilute Gas-Solids Flow" session, *Workshop on Multiphase Flow Research,* National Energy Technology Laboratory, Morgantown, WV, June 2006
- Chair, Executive Committee of Granular Flow and Kinetics Project, 2002 to 2003
- Presented the annual report on Granular Flow and Kinetics Project to the Technology Steering Group at the Center for Synthesis and Processing Annual Review, Germantown MD in 2003 and 2004

II. PUBLICATIONS AND CREATIVE WORKS

A. <u>Doctoral thesis title</u>

Probability Density Function Models for Mixing in Turbulent Reactive Flows, Cornell University, May 1997

B. <u>Books Authored or Co-Authored (in print or accepted)</u>

None

C. <u>Books Edited or Co-Edited (in print or accepted)</u>

None

D. <u>Chapters in Books (in print or accepted)</u>

Garg, R., Tenneti, S., Mohd.-Yusof, J. and **Subramaniam, S.**," Direct Numerical Simulation of Gas-Solids Flow Based on the Immersed Boundary Method", in: Pannala, S., Syamlal, M., O'Brien, T. J. (Eds.), *Computational Gas-Solids Flows and Reacting Systems: Theory, Methods and Practice*, accepted July 2009, in press

E. <u>Monographs (in print or accepted)</u>

None

F. <u>Articles in Journals (in print or accepted)</u>

# Denotes any publication derived from the candidate's thesis.

*   Denotes publication that has undergone stringent editorial review by peers.
+   Denotes publication that was invited and carries special prestige and recognition.
@ Denotes publication from work done at Iowa State University
    Denotes candidate's post-doctoral advisee
♦ Denotes candidate's graduate student advisee

1.   * # A. R. Masri, **S. Subramaniam** and S. B. Pope, "A Mixing Model to Improve the PDF Simulation of Turbulent Piloted Flames", *Twenty-sixth Symposium (International) on Symposium*, v. 1, pp. 49-57, (1996)

2.   * # **S. Subramaniam** and S. B. Pope, "A Mixing Model for Turbulent Reactive Flows based on Euclidean Minimum Spanning Trees", *Combustion and Flame*, v. **115**(4) pp. 487-514 (1998)

3.   * # **S. Subramaniam** and S. B. Pope, "Comparison of Mixing Model Performance for Nonpremixed Turbulent Reactive Flow", *Combustion & Flame*, v. **117**(4) pp. 732-754 (1999)

4.   * **S. Subramaniam**, "Minimum Error Fickian Diffusion Coefficients for Mass Diffusion in Multicomponent Gas Mixtures", *Journal of Non-equilibrium Thermodynamics*, v. **24**(1) p. 1-39 (1999)

5.   * **S. Subramaniam** and D. C. Haworth, "Development of a Hybrid Finite-Volume/PDF-Monte Carlo Method on Unstructured Three-Dimensional Deforming Meshes for Stratified Charge Engine Simulation", *International Journal of Engine Research*, v. **1**(2), p. 171-190 (2000)

6.   * **S. Subramaniam**, "Statistical Representation of a Spray as a Point Process", *Physics of Fluids*, vol. **12** (10), p. 2413-2431 (2000)

7.   * **S. Subramaniam**, "Statistical Modeling of Sprays using the Droplet Distribution Function Approach", *Physics of Fluids*, vol. **13** (3), p. 624-642 (2001)

8.   @ * D. Gao ( ), **S. Subramaniam**, R. O. Fox and D. K. Hoffman, "Objective Decomposition of the Stress Tensor in Granular Flows", *Physical Review E*, **71**, 021302, (2005)

9.   @ * G. M. Pai (♦) and **S. Subramaniam**, "Accurate Numerical Solution of the Spray Equation using Particle Methods", *Atomization and Sprays* 16 (2): 159-194 (2006)

10. @ * D. Gao ( ), **S. Subramaniam**, R. O. Fox, G. S. Grest and D. K. Hoffman, "Momentum Transfer between Polydisperse Particles in Granular Flow", *ASME Journal of Fluids Engineering*, 128 (1), pp. 62-68, (2006)

11. @ * Y. Xu (♦) and **S. Subramaniam**, *"*A Multiscale Model for Dilute Turbulent Gas–particle Flows based on the Equilibration of Energy Concept", *Physics of Fluids*, 18 (3), 033301, (2006)

12. @ * G. M. Pai (♦) and **S. Subramaniam**, "Modeling Interphase Turbulent Kinetic Energy Transfer In Lagrangian-Eulerian Spray Computations", *Atomization and Sprays*, 16 (7): 807-826 (2006)

13. @ * Sun, J. (♦), Battaglia, F. and **Subramaniam, S**. "Dynamics and Structures of Segregation in a Dense, Vibrating Granular Bed", *Physical Review E*, 74(6):061307–13, (2006)

14. @ * G. M. Pai (♦) and **S. Subramaniam**, "Modeling Droplet Dispersion and Interphase Turbulent Kinetic Energy Transfer Using a New Dual-Timescale Langevin Model", *International Journal of Multiphase Flow*, 33(3): 252-281 (2007)

15. @ * Y. Xu (♦) and **S. Subramaniam**, "Consistent Modeling of Interphase Turbulent Kinetic Energy Transfer in Particle-Laden Turbulent Flows", *Physics of Fluids*, 19 (8), 085101, (2007)

16. @ * Sun, J. (♦), Battaglia, F. and **Subramaniam, S**. "Hybrid Two-Fluid DEM Simulation of Gas-Solid Fluidized Beds", *ASME Journal of Fluids Engineering*, 129 (11), 1394-1403, (2007)

17. @ * R. Garg (♦), C. Narayanan, D. Lakehal and **S. Subramaniam**, "Accurate Numerical Estimation of Interphase Momentum Transfer in Lagrangian-Eulerian Simulations of Dispersed Two-Phase Flows", *International Journal of Multiphase Flow*, 33 (12), 1337-1364, (2007)

18. + @ * S. Markutsya (♦), **S. Subramaniam,** R. D. Vigil and R. O. Fox, "On Brownian Dynamics simulation of nanoparticle aggregation", *Industrial and Engineering Chemistry Research*, 2008, 47, 3338-3345

19. @ * R. Garg (♦), C. Narayanan and **S. Subramaniam**, "A numerically convergent Lagrangian–Eulerian simulation method for dispersed two-phase flows", *International Journal of Multiphase Flow*, **35** (4), p. 376-388 (2009)

20. @ * M. G. Pai (♦) and **S. Subramaniam**, "A comprehensive probability density function formalism for multiphase flows", *Journal of Fluid Mechanics*, **628**, p. 181-228 (2009)

21. @ * Passalacqua, A., Fox, R. O., Garg, R. (♦) and **Subramaniam, S.** "A fully coupled quadrature-based moment method for dilute to moderately dilute fluid–particle flows", *Chemical Engineering Science*, **65**(7) Special Issue: Sp. Iss. SI, p. 2267-2283 (2010)

22. @ * Tenneti , S. (♦), Garg, R. (♦), Hrenya, C. M., Fox, R. O., and **Subramaniam, S.**," Direct numerical simulation of gas-solid suspensions at moderate Reynolds number: quantifying the coupling between hydrodynamic forces and particle velocity fluctuations", *Powder Technology , * **203**, p. 57-69 (2010)

23. @ * Ying, X. (♦) and **Subramaniam, S.**, "Effect of Particle Clusters on Carrier Flow Turbulence: A Direct Numerical Simulation Study", *Flow Turbulence Combust.* **85**:735–761 DOI 10.1007/s10494-010-9298-8 (2010)

24. @ *   Qin, Z., Fox, R. O., **Subramaniam, S.**, Pletcher, R. H., and Zhang L., "On the apparent particle dispersion in granular media", *Advanced Powder Technology*, Volume 22, Issue 6, November 2011

25. @ * ♦ S. Tenneti, R. Garg, and **S. Subramaniam**, "Drag law for monodisperse gas-solid systems using particle-resolved direct numerical simulation of flow past fixed assemblies

of spheres", *International Journal of Multiphase Flow*, Nov. 2011, Vol. 37(9), p.1072(21)

26. @ * G. Lomboy, S. Sundararajan, K. Wang, **S. Subramaniam**, "A test method for determining adhesion forces and Hamaker constants of cementitious materials using atomic force microscopy", *Cement And Concrete Research*, Volume: 41 Issue: 11 Pages: 1157-1166, Nov 2011

27. @ * ♦ Vidyapati, M. Kheiripour Langroudi, J. Sun, S. Sundaresan, G.I. Tardos, **S. Subramaniam**, "Experimental and computational studies of dense granular flow: Transition from quasi-static to intermediate regime in a Couette shear device", *Powder Technology,* In Press, available online Nov 2011, doi:10.1016/j.powtec.2011.09.032

28. @ * ♦ Vidyapati and **S. Subramaniam**, "Granular rheology and phase transition: DEM simulations and order-parameter based constitutive model", *Chemical Engineering Science,* Accepted, Dec 2011, doi:10.1016/j.ces.2011.12.037

G. <u>Creative Works (Exhibitions, Commissions, Competitions, Performances, Art or Architecture Executed)</u>

None

H. <u>Bulletins, Reports, or Conference Proceedings That Have Undergone Stringent Editorial Review by Peers (in print or accepted).</u>
[Indicate acceptance rate of submissions to conferences.]

\# Denotes any publication derived from the candidate's thesis.
* Denotes publication that has undergone stringent editorial review by peers.
\+ Denotes publication that was invited and carries special prestige and recognition.
@ Denotes publication from work done at Iowa State University
 Denotes candidate's post-doctoral advisee
♦ Denotes candidate's graduate student advisee

1. * S. Subramaniam, "A Vaporization Model Problem to Validate Statistical Models of Sprays", *Eighth International Conference on Liquid Atomization and Spray Systems*, Pasadena, CA (2000) [Acceptance rate to this conference is not published or readily available]

2. * S. Subramaniam, "Eulerian and Lagrangian statistical representations of multiphase flow", *Fourth International Conference on Multiphase Flow*, New Orleans, LA (2001) [Acceptance rate to this conference is not published or readily available]

3. @ * D. Gao ( ), R. Fan, S. Subramaniam, R. O. Fox, and D. K. Hoffman, "Momentum Transfer between Polydisperse Particles in Granular Flow", *Proceedings of 2004 ASME International Mechanical Engineering Congress & Exposition IMECE 2004,* Anaheim, California, USA, (2004) [acceptance rate is estimated at 75% by conference organizers]

4. @ * Y. Xu (♦) and S. Subramaniam, "An improved multiscale model for dilute turbulent gas-particle flows based on the equilibration of energy concept", *Proceedings of the ASME Fluids Engineering Division Summer Conference 2005,* vol. 1, pp. 605–614 (2005) [acceptance rate is estimated at 75% by conference organizers]

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5. @ * J. Sun (♦), F. Battaglia, and S. Subramaniam, "Hybrid two-fluid DEM simulation of gas-solid fluidized beds", *Proceedings of 2006 ASME International Mechanical Engineering Congress and Exposition, IMECE2006 - Fluids Engineering Division* (2006) [acceptance rate is estimated at 75% by conference organizers]

6. @ * S. Subramaniam, and S. Markutsya (♦), "Modeling and simulation of nanoparticle aggregation in liquid suspensions", 17th International Conference on the Discrete Simulation of Fluid Dynamics, August, 4-8, 2008, Florianópolis, Brazil

7. @ * S. Subramaniam and M. G. Pai, "Transport due to fluctuations in granular systems and its implication for continuum modeling", 17th International Conference on the Discrete Simulation of Fluid Dynamics, August, 4-8, 2008, Florianópolis, Brazil

I. <u>Bulletins, Reports, or Conference Proceedings That Have Not Undergone Stringent Editorial Review by Peers (in print or accepted).</u>

\#   Denotes any abstract or presentation derived from the candidate's thesis
@   Denotes abstract or presentation from work done at Iowa State University
     Denotes candidate's post-doctoral advisee
♦   Denotes candidate's graduate student advisee

1. \# H. M. Atassi, S. Subramaniam and J. R. Scott, "Acoustic Radiation from Lifting Airfoils in Compressible Subsonic Flow", *NASA Technical Memorandum* 1036501, Notre Dame, IN (1990)

2. \# S. Subramaniam and S. B. Pope, "Comparison of PDF Mixing Models for Nonpremixed Turbulent Reacting Flow", *FDA Report* 97–03, Cornell University, Ithaca, NY (1997)

3. S. Subramaniam, "A Spectral Model for the Primary Breakup of Round Turbulent Jets", *Los Alamos Unclassified Report* LA–UR–98–1811, Los Alamos National Laboratory, Los Alamos, NM (1998)

4. S. Subramaniam, "A Spectral Model for Primary Breakup of Round Turbulent Jets", *ILASS Americas 12th Annual Conference on Liquid Atomization and Spray Systems*, Indianapolis, IN, (1999)

5. S. Subramaniam, "A Test Problem to Validate Statistical Models of Vaporizing Sprays", *SIAM Eighth International Conference on Numerical Combustion*, Amelia Island, FL (2000)

6. S. Subramaniam, "Relationship between Lagrangian Statistical Spray Models and Eulerian Statistical Models of Two-phase Flow", *ILASS Americas 14th Annual Conference on Liquid Atomization and Spray Systems*, Dearborn, MI (2001)

7. S. Subramaniam, "Properly Constrained Interphase Momentum Transfer Models for Constant-Density Two-Phase Flow: Resolution of the Ill-posedness issue in Canonical Problems", *ILASS Americas 15th Annual Conference on Liquid Atomization and Spray Systems*, Madison, WI (2002)

8. S. Subramaniam, Final Project Report on "Improving Spray Models for Aerospace Propulsion Applications", *NASA/New Jersey Space Grant Consortium* (2003)

9. @ S. Subramaniam, Annual Project Report on "Developing New Mathematical Models for Multiphase Flows based on a Fundamental Probability Density Function Approach", *Early Career Principal Investigator Program*, Mathematical, Informational and Computational Sciences, Office of Science, Department of Energy (2003)

10. @ S. Subramaniam, "Modeling Turbulent Two Phase Flows", *ILASS Americas 16th Annual Conference on Liquid Atomization and Spray Systems*, Monterey, CA (2003)

11. @ G. M. Pai (♦) and S. Subramaniam, "Accurate Numerical Solution of Spray Vaporization Models using Particle Methods", *ILASS Americas 16th Annual Conference on Liquid Atomization and Spray Systems*, Monterey, CA (2003)

12. @ G. M. Pai (♦) and S. Subramaniam, "Analysis of turbulence models in Lagrangian-Eulerian spray computations", *ILASS Americas 17th Annual Conference on Liquid Atomization and Spray Systems*, Washington, DC (2004)

13. @ G. M. Pai (♦) and S. Subramaniam, "A new dual-timescale Langevin model for droplet-laden turbulent flows", *ILASS Americas 18th Annual Conference on Liquid Atomization and Spray Systems*, Irvine, CA (2005)

14. @ M. G. Pai (♦), S. Subramaniam, J. B. Lechman, G. S. Grest, and R. O. Fox, "Fully-coupled Direct Simulation of Dense Multiphase Flow", DOE Center for Excellence for the Synthesis and Processing of Advanced Materials, *Research Briefs* (2006)

15. @ S. Markutsya (♦), S. Subramaniam, R. O. Fox and R. D. Vigil, "Using Brownian Dynamics to model nanoparticle aggregation under shear", *AICHE 2006 Annual Meeting*, San Francisco, CA (2006)

16. @ J. B. Lechman, G. S. Grest, G. M. Pai (♦) and S. Subramaniam, "Feasibility of a coupled Discrete-Time Immersed Boundary-Discrete Element Method for Numerical Simulation of Granular Multiphase Flow", *AICHE 2006 Annual Meeting*, San Francisco, CA (2006)

17. @ R. Garg (♦) and S. Subramaniam, "Accurate Spray Simulations using the Lagrangian-Eulerian Method", *ILASS Americas 20th Annual Conference on Liquid Atomization and Spray Systems*, Chicago, IL (2007)

18. @ R. Garg (♦), A. Passalacqua, S. Subramaniam, and R. O. Fox, "Comparison of Euler-Euler and Euler-Lagrange simulations of finite-Stokes-numbers gas-particle flows in a lid-driven cavity", AIChE Annual Meeting, November 16th – 21st, Philadelphia, PA, 2008

J. Abstracts (in print or accepted) and Technical Presentations

# Denotes any abstract or presentation derived from the candidate's thesis
@ Denotes abstract or presentation from work done at Iowa State University
Denotes candidate's post-doctoral advisee
♦ Denotes candidate's graduate student advisee
■ Denotes presenter

11

1. # S. Subramaniam (■) and S. B. Pope, "Limitations of the Amplitude Mapping Closure", *45th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Tallahassee, FL (1992)

2. # S. Subramaniam (■) and S. B. Pope, "The Euclidean Minimum Spanning Tree (EMST) Model for Scalar Mixing in the PDF Approach to Turbulent Combustion", *SIAM Sixth International Conference on Numerical Combustion*, New Orleans, LA (1996)

3. S. Subramaniam (■) and D. C. Haworth, "Estimation of Mean Fields in Hybrid Particle/Finite Volume Methods on Unstructured Three–Dimensional Deforming Meshes", *49th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Syracuse, NY (1996)

4. S. Subramaniam (■), "Minimum Error Diagonal Approximation to Mass Diffusion Equations in Multicomponent Gas Mixtures", *50th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, San Francisco, CA (1997)

5. S. Subramaniam (■), "Preliminary Computations of Diesel Sprays: Convergence Issues and Implications for Modeling", *Diesel CRADA Review Meeting*, Livermore, CA (1998)

6. S. Subramaniam (■), "Progress on a Spectral Model for Primary Breakup of Round Turbulent Jets", *51st Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Philadelphia, PA (1998)

7. S. Subramaniam (■) and P. J. O'Rourke, "The KIVA Stochastic Spray Model: Convergence Issues and Implications for Modeling", *International Multidimensional Engine Modeling User's Group Meeting*, Detroit, MI (1999)

8. S. Subramaniam (■), "A Spectral Model for Primary Breakup of Round Turbulent Jets", *ILASS Americas 12th Annual Conference on Liquid Atomization and Spray Systems*, Indianapolis, IN, (1999)

9. S. Subramaniam (■), "The Validity of Multiphase DNS Initialized on the Basis of Single-Point Statistics", *52nd Annual Meeting, Division of Fluid Dynamics, American Physical Society*, New Orleans, LA (1999)

10. S. Subramaniam (■), "Statistical Representation and Modeling of Multiphase Flows", *Fluids Seminar*, Mechanical and Aerospace Engineering Department, Rutgers University, Piscataway, NJ (2000)

11. S. Subramaniam (■), "A Test Problem to Validate Statistical Models of Vaporizing Sprays", *SIAM Eighth International Conference on Numerical Combustion*, Amelia Island, FL (2000)

12. S. Subramaniam (■), "A Vaporization Model Problem to Validate Statistical Models of Sprays", *Eighth International Conference on Liquid Atomization and Sprays*, Pasadena, CA (2000)

13. S. Subramaniam (■), "Statistical Representations of Multiphase Flow", *53rd Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Washington, DC (2000)

14. S. Subramaniam (■), "Eulerian and Lagrangian Statistical Representations of Multiphase Flow", *Fourth International Conference on Multiphase Flow*, New Orleans, LA (2001)

15. S. Subramaniam (■), "Relationship between Lagrangian Statistical Spray Models and Eulerian Statistical Models of Two-phase Flow", *14th Annual Conference on Liquid Atomization and Spray Systems*, Dearborn, MI (2001)

16. S. Subramaniam (■), "Properly Constrained Interphase Momentum Transfer Models for Constant-Density Two-Phase Flow: Resolution of the Ill-posedness issue in Canonical Problems", *15th Annual Conference on Liquid Atomization and Spray Systems*, Madison, WI (2002)

17. @ S. Subramaniam (■), "Developing Consistent Models for Two-Phase Flows", *Multiphase Fluid Dynamics Research Consortium (MFDRC) Meeting*, Baltimore, MD (2002)

18. @ S. Subramaniam (■), "Modeling Turbulent Two-Phase Flows", *16th Annual Conference on Liquid Atomization and Spray Systems*, Monterey, CA (2003)

19. @ G. M. Pai (♦) (■) and S. Subramaniam, "Accurate Numerical Solution of Spray Vaporization Models using Particle Methods", *16th Annual Conference on Liquid Atomization and Spray Systems*, Monterey, CA (2003)

20. @ S. Subramaniam (■), "Mathematical Models of Turbulent Multiphase Flow", *Mathematics Department Seminar*, Iowa State University, Ames, IA (2003)

21. @ S. Subramaniam (■), "Annual Progress Report on Granular Flow and Kinetics Project", *DOE Center for Synthesis and Processing Annual Review Meeting*, Germantown, MD (2003)

22. @ S. Subramaniam (■) and D. Gao ( ), "Objective Decomposition of the Stress Tensor in Granular Flows", *57th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Seattle, WA (2004)

23. @ G. M. Pai (♦) (■) and S. Subramaniam, "Analysis of Turbulence Models in Lagrangian-Eulerian Spray Computations", *ILASS Americas 17th Annual Conference on Liquid Atomization and Spray Systems*, Washington, DC (2004)

24. @ D. Gao ( ) (■), R. Fan, S. Subramaniam, R. O. Fox, D. K. Hoffman, "Momentum Transfer between Polydisperse Particles in Granular Flow", *ASME International Mechanical Engineering Congress & Exposition IMECE 2004,* Anaheim, CA (2004)

25. @ Y. Xu (♦) (■) and S. Subramaniam, "An Improved Multiscale Model for Dilute Turbulent Gas-Particle Flows based on the Equilibration of Energy Concept", *ASME Fluids Engineering Division Summer Conference 2005,* Houston, TX (2005)

26. @ G. M. Pai (♦) (■) and S. Subramaniam, "A New Coupled Langevin Model for Dilute Droplet-Laden Turbulent Flows", *ILASS Americas 18th Annual Conference on Liquid Atomization and Spray Systems*, Irvine, CA (2005)

27. @ J. Sun (♦) (■), F. Battaglia and S. Subramaniam, "Analysis of Microstructures in a Brazil Nut Problem", *58th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Chicago, IL (2005)

28. @ S. Subramaniam (■), "The Role of Particle-Fluid Velocity Correlation in Single-Point Statistical Closures of Dispersed Turbulent Two-Phase Flows", *58th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Chicago, IL (2005)

29. @ S. Markutsya (♦) (■), S. Subramaniam, M. H. Lamm, D. Vigil, and R. O. Fox, "Assessing the Applicability of Brownian Dynamics to Simulation of Nanoparticle Clustering in Liquid Suspensions", *58th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Chicago, IL (2005)

30. @ G. M. Pai (♦) (■) and S. Subramaniam, "A New Dual-Timescale Langevin Model for Particle-Laden Turbulent Flows", *58th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Chicago, IL (2005)

31. @ Y. Xu (♦) (■) and S. Subramaniam, "Consistent Modeling of Interphase Turbulent Kinetic Energy Transfer in Particle-Laden Flows", *58th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Chicago, IL (2005)

32. @ R. Garg (♦) (■), C. Narayanan, D. Lakehal and S. Subramaniam, "Development of a Consistent Lagrangian-Eulerian Approach for Particle-Laden Flows", *58th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Chicago, IL (2005)

33. @ J. B. Lechman (■), G. S. Grest, G. M. Pai (♦) and S. Subramaniam, "Feasibility of a Coupled Discrete-Time Immersed Boundary-Discrete Element Method for Numerical Simulation of Granular Multiphase Flow", *AICHE 2006 Annual Meeting*, San Francisco, CA (2006)

34. @ S. Markutsya (♦) (■), S. Subramaniam, R. O. Fox and R. D. Vigil, "Using Brownian Dynamics to Model Nanoparticle Aggregation under Shear", *AICHE 2006 Annual Meeting*, San Francisco, CA (2006)

35. @ J. Sun (♦) (■), F. Battaglia, S. Subramaniam, "Hybrid Two-Fluid DEM Simulation of Gas-Solid Fluidized Beds", *2006 ASME International Mechanical Engineering Congress and Exposition, IMECE2006 - Fluids Engineering Division,* Chicago, IL (2006)

36. @ J. Sun (♦) (■), F. Battaglia and S. Subramaniam, "Minimum Spanning Tree Analysis of Force Networks in Granular Media", *59th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Tampa, FL (2006)

37. @ Y. Xu (♦) (■), M. G. Pai (♦), and S. Subramaniam, "The Effects of Upstream Turbulence on Flow through Random Arrangements of Spheres", *59th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Tampa, FL (2006)

38. @ M. G. Pai (♦) (■), R. Garg (♦) and S. Subramaniam, "Relative Acceleration of Particle Pairs in Flows past Random Arrays of Spheres", *59th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Tampa, FL (2006)

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39. @ R. Garg (♦) (■) and S. Subramaniam, "Accurate Spray Simulations using the Lagrangian-Eulerian Method", *ILASS Americas 20th Annual Conference on Liquid Atomization and Spray Systems*, Chicago, IL (2007)

40. @ M. G. Pai (♦) (■) and S. Subramaniam, "Second-order transport due to fluctuations in clustering particle systems", *60th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Salt Lake City, UT (2007)

41. @ W. Wang (■), S. Subramaniam, R. H. Pletcher, Y. Xu (♦), R. Garg (♦) and M. G. Pai (♦), "A priori test of particle clustering effect on subgrid modeling", *60th Annual Meeting, Division of Fluid Dynamics, American Physical Society*, Salt Lake City, UT (2007)

42. @ S. Markutsya (♦), S. Subramaniam, and R. O. Fox, "Improved potential of mean force for Brownian dynamics simulation of nanoparticle aggregation", 61st Annual Meeting, Division of Fluid Dynamics, American Physical Society, San Antonio, TX, 2008

43. @ R. Garg (♦), S. Tenneti (♦), M. G. Pai and S. Subramaniam, "Heat transfer in ordered and random arrays of spheres at low Reynolds number", 61st Annual Meeting, Division of Fluid Dynamics, American Physical Society, San Antonio, TX, 2008

44. @ S. Tenneti (♦), R. Garg (♦), R. O. Fox and S. Subramaniam, "Effect of hydrodynamic forces on particle velocity fluctuations in suspensions at moderate Reynolds number", 61st Annual Meeting, Division of Fluid Dynamics, American Physical Society, San Antonio, TX, 2008

45. @ Subramaniam, S., "Fluctuations in number and volume fraction in granular and multiphase flows: implications for theory and modeling", 62nd Annual Meeting of the American Physical Society, Division of Fluid Dynamics, 2009

46. @ Vidyapati, V. (♦), Langrudi, M. K., Tardos, G., Sun, J., Sundaresan, S. and Subramaniam, S., "DEM simulation of granular flow in a Couette device", 62nd Annual Meeting of the American Physical Society, Division of Fluid Dynamics, 2009

47. @ Markutsya, S. (♦), Fox, R. O., Vigil, R. D., and Subramaniam, S., "Understanding the structural properties of clusters in sheared aggregating systems using Brownian dynamics simulation", 62nd Annual Meeting of the American Physical Society, Division of Fluid Dynamics, 2009

48. @ Tenneti, S. (♦), Garg, R. (♦), Hrenya, C. M., Fox, R. O. and Subramaniam, S., "Particle acceleration model for gas--solid suspensions at moderate Reynolds numbers", 62nd Annual Meeting of the American Physical Society, Division of Fluid Dynamics, 2009

49. @ Qin, Z. ( ), Pletcher, R. H., Fox, R. O., and Subramaniam, S., "A flow intensification model for granular filter applications", 62nd Annual Meeting of the American Physical Society, Division of Fluid Dynamics, 2009

50. @ Subramaniam, S. "Particle-Resolved Simulation of Turbulence Modification by Particle Clusters" at the ASME-Fluids Engineering Division Summer Meeting (August 2010), Montreal, CA

51. @ Tenneti, S. (♦), Fox, R.O. and Subramaniam, S., "Instantaneous particle acceleration model for gas-solid systems at moderate Reynolds numbers", International Conference on Multiphase Flow 2010, Tampa, Florida.

52. @ Subramaniam, S., "Fluctuations in number and volume fraction in granular and multiphase flows: implications for theory and modeling", International Conference on Multiphase Flow 2010, Tampa, Florida.

53. @ Vidyapati, V. (♦) and Subramaniam, S., "Refined order parameter model and its performance in homogenous shear flows", 47th Annual Technical Meeting, Society of Engineering Science, 2010.
54. @ Murphy, E. (♦), Kolakaluri, R. (♦), Subramaniam, S. "A model of the granular filtration of polydisperse particles", 47th Annual Technical Meeting, Society of Engineering Science, 2010.
55. @ Garg, R. (♦), Sun, B. (♦), Tenneti, S. (♦), and Subramaniam, S. "Improved Correlations for Gas-Solid Heat transfer using Particle-Resolved Direct Numerical Simulation", Multiphase Flow Science Workshop May 4-6, 2010.
56. @ Kolakaluri, R. (♦), Fox, R.O. and Subramaniam, S., "A model for efficiency of granular filtration based on granule-resolved direct numerical simulation of particle trapping", Multiphase Flow Science Workshop May 4-6, 2010.
57. Tenneti, S. (♦), Garg, R. (♦), and Subramaniam, S., "Quantification of gas-phase velocity fluctuations in statistically homogeneous gas-solid flow using particle-resolved direct numerical simulation", at the *48th Annual Technical Conference of Society of Engineering Sciences* (October 2011), Minneapolis, MN
58. Tenneti, S. (♦), Garg, R. (♦), and Subramaniam, S., "Quantification of gas-phase velocity fluctuations in statistically homogeneous gas-solid flow using particle-resolved direct numerical simulation", at the AIChE *2011 Annual Meeting* (October 2011), Minneapolis, MN
59. Sun, B. (♦), Tenneti, S. (♦) and Subramaniam, S. "The Study of Heat Transfer in Gas-Solid Flow Using Particle-Resolved DNS of Steady Flow Past Fixed Particle Assemblies" at the *AICHE Annual Meeting* (October 2011), Minneapolis, MN
60. Sun, B. (♦), Tenneti, S. (♦) and Subramaniam, S. "Heat Transfer in Gas-Solid Flow Using Particle-Resolved DNS of Steady Flow Past Fixed Particle Assemblies" at the *48th Annual Technical Conference of Society of Engineering Sciences* (October 2011), Evanston, IL
61. Shankar Subramaniam, "Multiphase Flow Physics from Direct Simulation for Model Development", *2011 Workshop on Multiphase Flow,* National Energy Technology Laboratory, Pittsburgh, PA, August 16-18 2011
62. Kolakaluri, R. (♦), Murphy, E. (♦), and Subramaniam, S. "A Model for Filtration of Polydisperse Particulates in Gas-Solid Flow Using Particle-Resolved Direct Numerical Simulation" at the *48th Annual Technical Conference of Society of Engineering Sciences* (October 2011), Evanston, IL

K. <u>Book and Paper Reviews (in print or accepted)</u>

None

L. <u>Patents, Disclosures and Technology Transfer Activities</u>

None

M. <u>Consulting Activities</u>

None

N. <u>Other</u>

None

O. Publications and Creative Works Submitted but Not Accepted

> # Denotes any abstract or presentation derived from the candidate's thesis.
> * Denotes abstract or presentation that has undergone stringent editorial review by peers.
> + Denotes abstract or presentation that was invited and carries special prestige and recognition.
> @ Denotes abstract or presentation from work done at Iowa State University
>   Denotes candidate's post-doctoral advisee
> ♦ Denotes candidate's graduate student advisee

- @ ♦ S. Tenneti, ♦R. Garg and S. Subramaniam, "Quantification of gas-phase velocity fluctuations in statistically homogeneous gas-solid flow using particle-resolved direct numerical simulation", *Physics of Fluids,* In Review following revisions
- V. Garzo, ♦ S. Tenneti, S. Subramaniam, and C. M. Hrenya, "Enskog kinetic theory for monodisperse gas-solid flows", *Journal of Fluid Mechanics,* In Review

III. INSTRUCTION AND SUPERVISION

A. Instruction for ISU

1. Spring 2008
   Class Title: Fluid Flow
   Rubric: ME 335
   Undergraduate class
   Number of Credit Hours: 4
   Laboratory: Yes, fluids laboratory is integrated with course
   Number of students in class: 8
   TA: Only for laboratory supervision and lab report grading; theory section homework and tests and finals are graded by the instructor
2. Spring 2008
   Class Title: Fluid Flow
   Rubric: ME 690-O Multiscale Simulation of Complex Flow
   New advanced graduate class
   Number of Credit Hours: 3
   Laboratory: No
   Number of students in class: 12 (including enrollment from CBE and CCEE)
3. Spring 2009
   Class Title: Multiphase Flow
   Rubric: ME 632 Multiphase Flow
   Advanced graduate class
   Number of Credit Hours: 3
   Laboratory: No
   Number of students in class: 11 (including enrollment from CBE and CCEE)
4. Fall 2009
   Class Title: Independent Study
   Rubric: ME 590
   Advanced graduate class
   Number of Credit Hours: 3

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Laboratory: No
Number of students in class: 8

5. Fall 2010
    Class Title: Heat Transfer
    Rubric: ME 436
    Undergraduate class
    Number of Credit Hours: 4
    Laboratory: Yes, heat transfer laboratory is integrated with course
    Number of students in class: 110
    3 TAs: 2 TAs for laboratory supervision and lab report grading; 1 TA for theory section to conduct recitation sessions and grade quizzes, homeworks graded by grader

6. Fall 2010
    Class Title: Independent Study
    Rubric: ME 590
    Advanced graduate class
    Number of Credit Hours: 3
    Laboratory: No
    Number of students in class: 2

7. Spring 2011
    Class Title: Multiphase Flow
    Rubric: ME 632
    Advanced graduate class
    Number of Credit Hours: 3
    Laboratory: No
    Number of students in class: 11

8. Fall 2011
    Class Title: Fluid Flow
    Rubric: ME 335
    Undergraduate class
    Number of Credit Hours: 4
    Laboratory: Yes
    Number of students in class: 115

B. <u>Non-ISU Instruction (including Short Courses, Workshops, Training)</u>

Indo-US Science and Technology Forum's *Frontiers of Liquid Atomization* Workshop, Dec 19-20, 2011

Complex Fluid Systems Workshop, Oct 7, 2009

C. <u>Curricular Development Activity</u>

*   Developed a new advanced graduate course ME 690-O on Multiscale Simulation of Complex Flow. Introduced statistical mechanics and kinetic theory to engineering graduate students and integrated tutorials on molecular dynamics, Brownian dynamics, dissipative particle dynamics and stochastic rotation dynamics into the course project assignments.

D. <u>Supervision of Graduate Student Research for Which Candidate is Primary Advisor or Co-Advisor</u>

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Doctoral Students (graduated)

1.   Dr. Rahul Garg, April 2009, "Modeling and Simulation of Two-Phase Flows", currently employed as a postdoctoral researcher at the National Energy Technology Laboratory, Morgantown, WV
2.   Dr. Ying Xu, May 2008, "Modeling and Direct Numerical Simulation of Particle-laden Turbulent Flows", currently employed at the Shanghai Supercomputing Institute
3.   Sergiy Markutsya, May 2010, "Modeling and simulation of nanoparticle aggregation in colloidal systems", postdoctoral researcher in Chemical Engineering at ISU

Masters Students (graduated)

1.   Christopher Schmitz, MS, Oct 2011, "A turbulence-based model for the primary breakup of pressure atomized liquid jets"
2.   Sergiy Markutsya, MS, Aug 2004, "Implementation of Brownian dynamics for modeling aggregation in colloidal systems", continuing on for a Ph.D. at ISU with same major professor
3.   Vidyapati, MS, Oct 2010, "Discrete element simulations and constitutive modeling of dense granular flows", continuing on for a Ph.D. at ISU with same major professor

Doctoral Students (currently in program)

1.   Vidyapati, Aug 2007-present, degree expected 2012

2.   Sudheer Tenneti, Aug 2007-present, degree expected 2012

3.   Ravi Kolakaluri, July 2009-present, degree expected 2014

4.   Bo Sun, Aug 2009-present, degree expected 2014

5.   Eric Murphy, Aug 2010-present, degree expected 2015

Masters Students (currently in program)

1.   Mohammad Mehrabadi, Aug 2009-present, degree expected 2012

2.   Karthikeyan Devendran, Aug 2009-present, degree expected 2012

E. Service on Thesis Committees Other than Own Advisees

Within ME Department

1.   Chengzhi Tang (Ph.D.)
2.   Bo Kong (Ph.D.)
3.   Nicholus Clinkinbeard (Ph.D.)
4.   Anup Gokarn (Ph.D.)
5.   Nan Xie (Ph.D.)
6.   Joshua Drake (Ph.D.)
7.   Vishwanath Somasekhar (Ph.D.)
8.   Rajeev Madhavannair (Ph.D.)
9.   Yuanhong Li (Ph.D.)

10. Wen Wang (Ph.D.)
11. Norman Keller (Ph.D.)
12. Joseph Miller (Ph.D.)
13. David Escudero (Ph.D.)
14. Enes Kadic (Ph.D.)

Outside ME Department

1. Mothivel Mummudi (ChemE, Ph.D.)
2. Sarah Monahan (ChemE, Ph.D.)
3. Sean Smith (ChemE, Ph.D.)
4. Gaurav Pranami (ChemE. Ph.D.)
5. Chetan Hazaree (CCEE, M.S.)
6. Chung-yin Cheng (CBE, Ph.D.)
7. Gilson Lomboy (CCEE, Ph.D.)
8. Yanxiang Shi (CBE)

F. Supervision of Post-Doctoral Students and Professional Staff

Dr. Donghong Gao, Postdoctoral Associate, responsible for coupling DEM granular code to Navier-Stokes flow solver for Granular Flow and Kinetics project, July 2003-July 2004, current position unknown.

G. Supervision of Undergraduate Research and Independent Study

Undergraduate Research Assistants

1. Cassandra Jo Reichter, 2002
2. Carol Aplin, 2003, 2004
3. Nathan Delzell, 2003
4. Sam Stineman, 2004
5. Brian Langstraat (Science Undergraduate Laboratory Intern through Ames Lab), 2006
6. Jeff Boger, 2008
7. Eric Murphy, 2008, 2009

Undergraduate Independent Study

1. Nathan Delzell
2. Kenny Kopecky
3. Dustin Bremner

H. Other Contributions to Instructional Programs
(e.g., undergraduate advising, student chapter advising)

- Faculty Mentor for *Engineering Leadership Program*, 2006

IV. SERVICE (PUBLIC, PROFESSIONAL/DISCIPLINARY, AND UNIVERSITY)

A. Public Service

B. Service to Disciplinary and Professional Societies or Associations

Leadership Activities:

- Editorial Board Member: *International Journal of Spray and Combustion Dynamics*:2008-present

- Symposium Organizer, *Society for Engineering Science*, Annual Meetings 2010 and 2011

- Editorial Board Member: *Atomization and Sprays,* April 2004-2008

- Technical Program Chair, Institute for Liquid Atomization and Spray Systems (ILASS Americas), 2005-present

- Co-Chair, Technical Committee on Computational Modeling, Institute for Liquid Atomization and Spray Systems (ILASS Americas), 2002-2005

- Chair, Honors and Awards Committee, Institute for Liquid Atomization and Spray Systems (ILASS Americas), 2002-2005

- Chair (2003-2004) and Member (2004-2005), Executive Committee, DOE Project *Granular Flow and Kinetics*

- Organizer, Second Workshop on Granular Flow and Kinetics, Argonne National Laboratory, 2004

- Session Chair "General Fluid Dynamics", American Physical Society-Division of Fluid Dynamics (1997)

- Session Chair for Institute of Liquid Atomization and Spray Systems (ILASS Americas) (8 times)

Reviewing Activities:

Journals

- o Journal of Fluid Mechanics
- o Physics of Fluids
- o International Journal of Multiphase Flow
- o AIAA Journal
- o Journal of Computational Physics
- o ASME Journal of Fluids Engineering
- o Atomization and Sprays
- o International Combustion Symposium
- o Combustion Science and Technology
- o Energy and Fuels
- o Combustion and Flame
- o Communications in Computational Physics

Funding Agencies

- o National Science Foundation
- o Department of Energy
- o German-Israeli Foundation

Membership:

- o Member, American Society of Mechanical Engineers (ASME)
- o Member, American Physical Society
- o Member, Institute for Liquid Atomization and Spray Systems
- o Ames Laboratory Associate

C. University/Campus Service

1. Preparing Future Faculty Mentor for Joseph D. Miller
2. Organized *Workshop on Complex Fluid Systems*, Oct 2009
3. Organizer, *Impact Academy 2007*, Summer 2007
4. Panelist for *Preparing Future Faculty* Program, February 2004, October 2006
5. Faculty Mentor for *Engineering Leadership Program*, 2006

D. Other Service

College Committees

1. College Honors and Awards Committee (2005-2006)

Departmental Committees

1. Faculty Search Committee (Chair) 2008-2009
2. Faculty Coordinator, Women in Mechanical Engineering Program, 2008- April 2009
3. Member P&T Committee for Eliot Winer
4. Program Director for Complex Fluid Systems Research Program: Organized Workshop in Oct 2009
5. Chair's Faculty Roundtable Participant
6. Reorganized ME computational group efforts under the new *Center for Computational Thermo-Fluids Research*
7. Faculty Search Committee (Chair) 2011-2012