SEAN C. GARRICK

University of Minnesota
111 Church Street S.E.
Department of Mechanical Engineering
Minneapolis, MN 55455-0111

m: (612) 730-7660
w: (612) 624-5741
sgarrick@umn.edu

EDUCATION

Ph.D., Mechanical Engineering, "Large eddy simulation of turbulent reacting jets," State University of New York at Buffalo, September 1998.

M.S., Mechanical Engineering,"Affordable computations of turbulent reacting flows," State University of New York at Buffalo, September 1994.

B.S., Mechanical Engineering, State University of New York at Buffalo, June 1992.

AWARDS AND HONORS

- Fullbright Scholar, 2016.
- Finnish Distinguished Professorship nomination, June 2013.
- Visualization Society of Japan - Silicon Graphics Inc. 2004 Award for *Excellent Visualized Image*.
- *DoD Success Story 2002*, Research on nanoparticles selected as among top Department of Defense funded research.
- *Award of Dedication,* University of Minnesota Chapter, National Society of Black Engineers, April, 2001.
- *Faculty Member of the Year,* University of Minnesota Chapter, National Society of Black Engineers, April, 2000.
- *First Prize Winner,* National Society of Black Engineers Graduate Student Paper Competition, Northeast Region, "Parallel Implementation of Navier-Stokes Solver," January, 1998.
- *Future Faculty Fellowship,* Office of Naval Research, 1995 - 1997.
- *First Prize Winner,* AIAA Technical Paper Competition, Northeast Regional Student Conference held at Clarkson University, Potsdam, NY, April 1994. Title of paper: Large Eddy Simulation of a Turbulent Reacting Mixing Layer.
- Schomburg Graduate Fellowship, State University of New York, 1993-94.

EXPERIENCE

Professor, Dept. of Mechanical Engineering, University of Minnesota 2013 – present.

Associate Professor, Dept. of Mechanical Engineering, University of Minnesota 2004 – 2013.

Nelson Assistant Professor, Dept. of Mechanical Engineering, 1998 – 2004.

Visiting Professor*,* Dept of Mechanical Engineering, Eidgenössische Technische Hochschule (ETH) Zürich, Zurich Switzerland Jan. 2006 - Jun. 2006

Visiting Professor, Technical Research Center of Finland, Helsinki, Finland Jul. 2006 - Aug. 2006.

State University of New York at Buffalo

Graduate Research Assistant Sept. 1994 - July 1998
Sponsored by the Office of Naval Research. Investigating the use of deterministic and stochastic methods in providing closures for theoretical description of turbulent reacting flows .

Graduate Research Assistant June 1992 - Aug. 1994
Sponsored by the National Science Foundation and SUNY-Buffalo. Implementation of simple but reliable closures for sub-grid scale modeling in large eddy simulations of non-homogeneous turbulent combustion systems.

Instructor Summer 1993, 1994, 1995, 1996
Buffalo-area Engineering Awareness for Minorities/School of Engineering and Applied Science (SEAS). Instructed engineering bound high school students in pre-Calculus and Calculus Mathematics, Physics and Mathematical and Scientific programming of microcomputers. Responsibilities included development of class syllabus, grading, and performance assessment.

School of Engineering and Applied Sciences Tutor Aug. 1992 - May 1993
School of Engineering and Applied Science. Tutored sophomore engineering students in Engineering Physics, Solid Mechanics, and Classical Thermodynamics.

Undergraduate Research Aide Sept. 1991 - Jun. 1992
Performed direct numerical simulations of dump combustor. Sponsored by the American Chemical Society and the NASA Langley Research Center.

MANUSCRIPTS IN PREPARATION

1. S.C. Garrick and J. Liu, "Rapid cooling as a strategy for nanoparticle synthesis" for ACS Nano.
2. S.C. Garrick and M.B. Buhlmann, "Large-scale modeling of mercury capture in turbulent flows," for Springer Briefs in Applied Sciences and Technology.
3. J. Liu and S.C. Garrick, "The effects of size-dependent surface tension on the nucleation of metal nanoparticles" Journal of Aerosol Science (in revision).

MANUSCRIPTS UNDER REVIEW

4. P.J. Bruggeman1, M.J. Kushner, B.R. Locke, J.G.E. Gardeniers, W.G. Graham, D.B. Graves, R.C. Hofman-Caris, D. Maric J.P. Reid, E. Ceriani, D. Fernandez Rivas, J. E. Foster11, S.C. Garrick, Y. Gorbanev1, S. Hamaguchi, F. Iza, J. Kolb, F. Krcma, P. Lukes, Z. Machala, I. Marinov, D. Mariotti, S. Mededovic Thagard, D. Minakata, E. Neyts, J. Pawlat, Z.Lj. Petrovic, R. Pfieger, S. Reuter15, D.C. Schram, S. Schroter, M. Shiraiwa, B. Tarabová, H. Tresp, P. Tsai, J. Verlet, T. von Woedtke, E. Vyhnankova, K.R. Wilson, K. Yasui, G. Zvereva, "Plasma-Liquid Interactions: A Review and Roadmap", Plasma Sources Science and Technology
5. J. Liu and S.C. Garrick, "The effect of heat release on nanoparticle nucleation in laminar and

turbulent jets", Aerosol Science and Technology (submitted).

6. E. Wenzel, W-J. Liu, Ramalingam, S.K, Cloeter, M. and S.C. Garrick, "Lagrangian VOF approach for the simulation of turbulent multi-phase flows" Journal of Computational Physics (submitted).

JOURNAL PUBLICATIONS

9. Garrick, S. C. "A comparison of nanoparticle thermophoretic and diffusive transport in a turbulent jet", Journal of Aerosol Science (accepted).
10. Garrick, S. C., "Growth Mechanisms of Nanostructured Titania in Turbulent Reacting Flows", Journal of Nanotechnology, 6242014 (2015).
11. E. Wenzel, S.C. Garrick, and F. Kulacki, "Modeling and simulation of liquid-liquid droplet heating in a shear flow", International Journal of Multiphase Flow (in press).
12. S.C. Garrick, "Book Review: Experiments and Numerical Simulations of Diluted Spray Turbulent Combustion", AIAA Journal, 52 (1), 221-222 (2014).
13. N. J. Murfield, J. Pyykonen, J. Jokiniemi, and S.C. Garrick, "The structure of nanoparticle nucleation in turbulent jets," Journal of Aerosol Science, 62: 1-14 (2013).
14. N. J. Murfield and S.C. Garrick, "The effects of unresolved fluctuations on nanoparticle nucleation", Aerosol Science and Technology, Aerosol Science & Technology, 47:806-817 (2013).
15. N. J. Murfield and S.C. Garrick, "Large eddy simulation of nanoparticle nucleation in turbulent wakes," for Journal of Aerosol Science, Journal of Aerosol Science, 60: 21-33 (2013).
16. A. Fager and S.C. Garrick, Metal Particle Formation in a Turbulent Jet: Visualization of scalar mixing and nucleation, Journal of Visualization, 16 (4): 297-302 (2013).
17. A. Fager, J. Liu and S.C. Garrick, "Hybrid DNS-LES of metal particle formation: A posteriori analysis of unresolved scalar interactions on nanoparticle nucleation", Physics of Fluids 24, 075110 (2012).
18. J. Liu and Garrick, S.C., "Metal nanoparticle nucleation in laminar jets", Physics of Fluids 24, 073304 (2012).
19. Garrick, S.C., "Effects of Turbulent Fluctuations on Nanoparticle Coagulation in Shear Flows", Aerosol Science and Technology 45 (10):1272-1285 (2011).
20. Loeffler, J., Das, S., and Garrick, S.C., "Large Eddy Simulation of Titanium Dioxide Nanoparticle Formation and Growth in Turbulent Jets", Aerosol Science and Technology, 45: 616-628 (2011).
21. Garrick, S.C. and Wang, G., "Modeling and simulation of titanium dioxide nanoparticle synthesis with finite-rate sintering in planar jets", Journal of Nanoparticle Research, 13:973–984 (2010).
22. Liu, J. and Garrick, S.C., "On the evaluation of surface tension and Tolman length as a function of droplet radius from experimental nucleation rate and supersaturation ratio: Metal vapor homogeneous nucleation", Journal of Chemical Physics, 133, 047101 (2010).
23. Das, S. and Garrick, S.C., "The effects of turbulence on nanoparticle growth in turbulent

reacting jets", Physics of Fluids, 22, 103303 (2010).

24. Garrick, S.C., "Introduction to the 27th Annual Gallery of Fluid Motion", Physics of Fluids, 22, 091101 (2010).
25. N. Settumba, S.C. Garrick, "Modeling and Simulation of Nano-aluminum Synthesis in a Plasma Reactor," in Advancement in Energetic Materials & Chemical Propulsion, Begell House Press, *2007*.
26. G. Wang, S.C. Garrick, "Modeling and simulation of TiO2 formation and growth in temporal mixing layers," *Journal of Aerosol Science* 37, 4, 431-451 2006.
27. S.C. Garrick, K.E.J. Lehtinen, and M.R. Zachariah, "Nanoparticle coagulation via a Navier-Stokes/Nodal methodology: Evolution of the particle field," *Journal of Aerosol Science* 37, 5, 555-576 2006.
28. G. Wang, S.C. Garrick, "Modeling and simulation of TiO2 synthesis in methane-air diffusion flames,"Journal of Nanoparticle Research, 7, 621-632, 2005.
29. P.C. Saunders, V. Interrante, and S.C. Garrick, "Pointillist and Glyph-based Visualization of Nanoparticles in Formation", IEEE-Eurovis Symposium on Visualization (*Publication Cover*), June 2005.
30. S.C. Garrick and M. Khakpour, "The effect of size-dependent diffusion in nanoparticle coagulation," *Aerosol Science & Technology,* 38, 851-860, 2004.
31. P.C. Saunders, S. C. Garrick, and V. Interrante, "Visualization of Nanoparticle Formation in Turbulent Flows," 15th IEEE Visualization Conference, October, 2004.
32. N. Settumba and S.C. Garrick, "A comparison of diffusion transport in moment method formulations for nanoparticle coagulation," *Journal of Aerosol Science*, 35, 1, 93-101, 2004.
33. S. Miller, S.C. Garrick, "Nanoparticle coagulation in a planar jet," *Aerosol Science & Technology*, 38, 1, 79-89, 2004.
34. N. Settumba and S.C. Garrick, "Direct numerical simulation of nanoparticle coagulation in a temporal mixing layer via a moment method," *Journal of Aerosol Science*, 34, 2, 149-167, 2003.
35. S. Modem and S.C. Garrick, "Nanoparticle coagulation in a temporal Mixing Layer: Mean and size-selected images," *Journal of Visualization*, 6, 30, 293-302, 2003.
36. S. Modem, S.C. Garrick, M.R. Zachariah and K.E.J. Lehtinen, "Direct numerical simulation of nanoparticle coagulation in temporal mixing layers," *Proceedings of 29th Symposium (Int.) on Combustion*, The Combustion Institute, 2002.

POPULAR PRESS

"The Interaction of Fire," **Computer Graphics World** magazine, Pennant Publishers, November 2000. http://www.cgw.com

Appearance on **DragonFly TV**, PBS-Kids science program, Episode 406, Fall 2005.

http://pbskids.org/dragonflytv

INVITED REVIEWS

1. E.R.G. Eckert, R.J. Goldstein, W.E. Ibele, S.V. Patankar, T.W. Simon, T.H. Kuehn, P.J. Strykowski, K.K. Tamma, A. Bar-Cohen, J.V.R. Heberlein, J.H. Davidson, J. Bischof, F. Kulacki, U. Kortshagen and S.C. Garrick, "Heat Transfer - A Review of 1997 Literature," (2000) Int. J Heat Mass Transfer, Vol. 43, pp. 2431-2528, (1999)
2. R.J. Goldstein, E.R.G. Eckert, W.E. Ibele, S.V. Patankar, T.W. Simon, T.H. Kuehn, P.J. Strykowski, K.K. Tamma, A. Bar-Cohen, J.V.R. Heberlein, J.H. Davidson, J. Bischof, F. Kulacki, U. Kortshagen and S.C. Garrick, (2000) "Heat Transfer - A Review of 1998 Literature," Int. J Heat Mass Transfer, Vol. 44, pp. 253-366.
3. R. J. Goldstein, E.R.G. Eckert, W.E. Ibele, S.V. Patankar, T.W. Simon, T.H. Kuehn,P. J. 4. Strykowski, K.K. Tamma, A. Bar-Cohen, J.V.R. Heberlein, J.H. Davidson, J. Bischof, and F. Kulacki, U. Kortshagen and S.C. Garrick (2001)"Heat Transfer - A Review of 1999 literature," Int. J Heat Mass Transfer, Vol. 44 (19), pp. 3579-3699.
4. R.J. Goldstein, E.R.G. Eckert, W.E. Ibele, S.V. Patankar, T.W. Simon, T.H. Kuehn, P.J. Strykowski, K.K. Tamma, A. Bar-Cohen, J.V.R. Heberlein, J.H. Davidson, J. Bischof, F.A. Kulacki, U. Kortshagen, S.C. Garrick (2002) ""Heat Transfer - A Review of 2000 literature," Int. J Heat Mass Transfer, Vol. 45 (14), pp. 2853-2957.
5. "Heat Transfer - A Review of the 2001 literature," R.J. Goldstein, E.R.G. Eckert, W.E. Ibele, S.V. Patankar, T.W. Simon, T.H. Kuehn, P.J. Strykowski, K.K. Tamma, A. Bar-Cohen, J.V.R. Heberlein, J.H. Davidson, J. Bischof, F.A. Kulacki, U. Kortshagen, S.C. Garrick, V. Srinivasan, Int. J Heat Mass Transfer, 46, 1887, (2003)
6. "Heat Transfer - A Review of the 2002 literature," R.J. Goldstein, E.R.G. Eckert, W.E. Ibele, S.V. Patankar, T.W. Simon, T.H. Kuehn, P.J. Strykowski, K.K. Tamma, A. Bar-Cohen, J.V.R. Heberlein, J.H. Davidson, J. Bischof, F.A. Kulacki, U. Kortshagen, S.C. Garrick, V. Srinivasan, Int. J Heat Mass Transfer, 48, 819, (2005)
7. "Heat Transfer - A Review of the 2003 literature," R.J. Goldstein, E.R.G. Eckert, W.E. Ibele, S.V. Patankar, T.W. Simon, T.H. Kuehn, P.J. Strykowski, K.K. Tamma, A. Bar-Cohen, J.V.R. Heberlein, J.H. Davidson, J. Bischof, F.A. Kulacki, U. Kortshagen, S.C. Garrick, V. Srinivasan Int. J Heat Mass Transfer, 49, 451, (2006)

CONFERENCE PAPERS

1. Liu, W-J. and Garrick, S.C., "Simulation of sprays via a Lagrangian filtered density function approach", Proceedings of the 66th Annual Meeting of the American Physical Society - Division of Fluid Dynamics, Pittsburgh, PA, Nov. 2013.
2. Liu, W-J. and Garrick, S.C., "A Lagrangian volume-of-fluid approach for the simulation of turbulent multiphase flows", Proceedings of the Fall Eastern Sectional Meeting of the American Mathematical Society - Special Session on Meshfree, Particle, and Characteristic Methods for Partial Differential Equations, Philadelphia, PA, Oct., 2013.
3. Liu, W-J., Cloeter, M. and Garrick, S.C. "A priori and a posteriori Analysis of Turbulent Sprays" ILASS-Americas 24th Annual Conference on Liquid Atomization and Spray Systems, San Antonio, TX, May 2012.
4. Liu, W-J., Cloeter, M. and Garrick, S.C., "Analysis of liquid-gas flows for the large-eddy

simulation of turbulent sprays", Proceedings of the 2011 meeting of the American Institute of Chemical Engineers, Minneapolis, MN, October 2011.

5. Fager, A. and Garrick, S. C. "Hybrid DNS-LES of Nanoparticle Nucleation: The effects of small-scale fluctuations on metal nucleation", Proceedings of the 2011 meeting of the American Institute of Chemical Engineers, Minneapolis, MN, October 2011.
6. Liu, J. and Garrick, S. C. "Metal Nanoparticle Nucleation in Turbulent Flows", Proceedings of the 2011 meeting of the American Institute of Chemical Engineers, Minneapolis, MN, October 2011
7. Liu, J., Murfield, N. J. and Garrick, S.C. "The Effects of Fluid Turbulence on Nanoparticle Nucleation in Shear Flows", International Aerosol Conference, Helsinki Finland, July, 2010.
8. Liu, J. and Garrick, S.C., "Direct numerical simulation of Zinc nanoparticle nucleation in 3D turbulent jets", International Aerosol Conference, Helsinki Finland, July, 2010.
9. Pyykönen, J., Jokiniemi, J. and Garrick, S.C., "Some observations of nucleation during turbulent mixing", International Aerosol Conference, Helsinki Finland, July, 2010.
10. M. Buhlmann and S.C. Garrick, "Modelling and simulation of gas-to-particle mass-transfer in turbulent flows", 2008 European Aerosol Conference, Thessaloniki, Greece, September, 2008.
11. M.C. Heine, B. Buesser, S.C. Garrick and S.E. Pratsinis, "Primary Particle Dynamics During Aerosol Synthesis of Nanoparticles," PARTEC 2007, Nürnberg, Germany, March 2007.
12. S. Jathar and S.C. Garrick "Direct Numerical Simulation of Nanoparticle Coagulation via a Quadrature Method of Moments," PARTEC 2007, Nürnberg, Germany, March 2007.
13. N. Settumba and S.C. Garrick, "Large-eddy Simulation of Nanoparticle Growth in Turbulent Flows," PARTEC 2007, Nürnberg, Germany, March 2007.
14. J. Weier and S.C. Garrick, "Large-eddy simulation of nanoparticle coagulation in temporal mixing layers," Complex Effects in Large Eddy Simulations Six, University of Cyprus, Cyprus, Oct. 3-8, 2005.
15. G. Wang and S.C. Garrick, "Direct Numerical Simulation of TiO2 Formation and Growth in Reacting Shear Flows," PARTEC 2004, Nürnberg, Germany, March 2004.
16. P. C. Saunders, S. C. Garrick, and V. Interrante, "Visualization of Nanoparticle Formation in Turbulent Flows," 15th IEEE Visualization Conference, October, 2004.
17. M. Khakpour and S.C. Garrick, "Effects of differential diffusion on nanoparticle coagulation and growth," Joint U.S. Sections Meeting of the Combustion Institute, Chicago, IL, March 16-19, 2003.
18. G. Wang and S.C. Garrick, "Modeling and simulation of titania formation and growth in temporal mixing layers," Joint U.S. Sections Meeting of the Combustion Institute, Chicago, IL, March 16-19, 2003.
19. S.C. Garrick, M. R. Zachariah, and K. E. J. Lehtinen, "Modeling and simulation of nanoparticle coagulation in high Reynolds number incompressible flows," Proceedings of the Joint U.S. Sections Meeting of the Combustion Institute, Oakland, CA, March, 2001.
20. S.C. Garrick and V. Interrante, "Stochastic modeling and simulation of turbulent reacting flows," 9th International Symposium on Flow Visualization, Edinburgh Scotland, August,

2000.

21. S.C. Garrick, "Large eddy simulation of turbulent reacting jets," Proceedings of the 2000 Technical Meeting of the Combustion Institute, Central States Section, in Combustion Fundamentals and Applications, pp. 441- 446, Indianapolis, IN, April 16-18, 2000.
22. S.C. Garrick, "Large Eddy Simulation of a Turbulent Reacting Mixing Layer," AIAA Paper 95-0010, Aerospace Sciences Meeting and Exhibit, Reno, Nevada, January 10, 1995.
23. S.C. Garrick, R.S. Miller, and P. Givi, "Large Eddy Simulations of Reacting Turbulent Flows," Proceedings of the 1994 Fall Technical Meeting of the Eastern States Section of the Combustion Institute, Clearwater Beach, FL, December 5-7, 1994.

BOOK CHAPTERS

1. S. C. Garrick, S. Modem, M. R. Zachariah, and K. E. J. Lehtinen, "Simulation of particle coagulation in temporally developing mixing layers," chapter in Proceedings of the Third AFOSR Conference on DNS and LES, Greyden Press, 2001.
2. S. C. Garrick, F. A. Jaberi, and P. Givi, "Large eddy simulation of scalar transport in a turbulent jet flow," in Recent Advances in Direct Numerical Simulation and Large Eddy Simulation, Kluwer Academic Press, 1999.

INVITED SEMINARS

1. "A Lagrangian volume-of-fluid approach for the large-eddy simulation of turbulent multiphase flows", Aerospace Engineering and Mechanics, University of Minnesota, September, 2014.
2. "Advanced modeling and simulation of reacting multiphase flows", Gas/Plasma-Liquid Interface: Transport, Chemistry and Fundamental Data, Lorentz Center, Leiden, Netherlands, August, 2014.
3. "Strategies for the modeling & simulation of turbulent reacting multiphase flows", Cargill Corportation, October, 2013.
4. "A Lagrangian volume-of-fluid approach for the simulation of turbulent multiphase flows: Towards the reduction of spray drift", Dow AgroSciences, October, 2013.
5. "Advanced modeling particle formation in turbulent flows", Clemson University, December 2011.
6. "Towards the large eddy simulation of turbulent sprays", Sandia National Laboratory, July 2011.
7. "Strategies for the modeling of turbulent reacting flows", Dow Chemical Company, April 2011.
8. "The Formation & Growth of Particles from Vapor: Multiphase flows for energy and the environment", Arizona State University, February, 2011.
9. "Turbulent, reacting, multiphase flows for energy and the environment", Aerospace Engineering and Mechanics, University of Minnesota, November, 2010

10. “Turbulent Multi-phase Flows: Modeling and Simulation for Energy and the Environment” University of Iowa, Department of Mechanical Engineering, October, 2010.
11. “Modeling and Simulation of Mass Transfer in Multiphase Flows Mercury, Coal, and Virtual Sorbent Beds”, Saint Anthony Falls Laboratory, University of Minnesota, April, 2009.
12. “Multi-scale Modeling and Simulation of Turbulent, Reacting, Multiphase Flows,” Ohio State University, April 2008.
13. “Zinc Nanoparticles for Solar Thermal Synthesis of Hydrogen”, University of Turabo, Puerto Rico, April 2008.
14. “How to Succeed in Graduate School”, University of Turabo, Puerto Rico, April 2008.
15. “Multi-scale Modeling and Simulation of Particle Formation and Growth in Turbulent Reacting Flows,” State University of New York at Buffalo, March, 2008.
16. “Multi-scale Modeling and Simulation of Particle Formation and Growth in Turbulent Reacting Flows,” Illinois Institute of Technology, Chicago, IL, May 2007.
17. “Modeling of Finite-rate Sintering during the Flame Synthesis of Nano-structured Titanium Dioxide,” University of Kuopio, Kuopio, Finland, August 2006.
18. “Stochastic and Deterministic Modeling for Simulation of Nano-structured Materials Synthesis,” Institute for Pure and Applied Mathematics, University of California - Los Angeles, June 2005.
19. “Modeling and Simulation of Nanoparticle Synthesis in Turbulent Reacting Flows,” Department of Mechanical Engineering, University of Maryland, April 2005.
20. “Nanoparticles from the vapor-phase: Applications, Science & Engineering,” Department of Mechanical & Aerospace Engineering, Princeton University, February 2005.
21. “The effects of turbulence on nanoparticle growth,” European Centre for Research and Advanced Training in Scientific Computation, Toulouse, France, March 2004.
22. “Nanoparticle synthesis in turbulent reacting flows,” Department of Electrical Engineering, Florida State University, Tallahassee, Fl, April 2003.
23. “Why go to graduate school,” Florida A&M University – Undergraduate Program, Tallahassee Fl, April 2003.
24. “The effects of turbulence on nanoparticle growth,” Department of Mechanical and Aerospace Engineering, Cornell University, Ithaca, NY, October 2002.
25. “The effects of turbulence on nanoparticle growth,” Department of Mechanical and Nuclear Engineering, Rensselaer Polytechnic Institute, Troy, NY, September 2002
26. “The effects of turbulence on nanoparticle coagulation,” Nanosimulation Workshop, Digital Technology Center, University of Minnesota, Minneapolis, MN, December 2002.
27. “The effects of turbulence on nanoparticle growth,” Department of Aerospace Engineering and Mechanics, University of Minnesota, Minneapolis, MN, August 2002.
28. “The effect of subgrid-scale interactions in turbulent coagulating flows,” Finnish Aerosol Symposium, Helsinki, Finland, August, 2001.
29. “Modeling and simulation of internal fluid-structure-chemistry interactions,” Army Research Lab, Adelphi, MD, October 2001.

30. “Data Mining and Dynamic Feature Extraction of Turbulent Reacting Flows,” Workshop on Mining Scientific Datasets, Army High Performance Computing Research Center, Minneapolis, MN, September 1999.
31. “The future of large eddy simulations,” Second International AFOSR Conference on DNS and LES, June 1999.
32. “Stochastic modeling and simulation of turbulent reacting flows,” Canadian National Research Council, Ottawa, Canada, October, 1998.
33. “Large eddy simulations of turbulent shear flows,” John D. Miles Engineering Lecture Series, University of Notre Dame, Notre Dame, IN, February 19, 1997.
34. “Large eddy simulation of a turbulent reacting mixing layer,” AIAA 33rd Aerospace Sciences Meeting and Exhibit, Reno, Nevada, January 10, 1995.
35. “Large eddy simulation of a turbulent reacting mixing layer,” AIAA Northeast Regional Student Conference, Potsdam, NY, April 21, 1994.

SHORT COURSES

1. Modeling of Turbulent Reacting Flows, University of Helsinki, Helsinki, Finland, August, 2001.
2. Numerical Simulation of Aerosol Formation and Growth in Turbulent Flows, VTT Technical Institute of Finland, August, 2001.
3. Advanced Computation of Turbulent Multiphase Flows, American Association for Aerosol Research (2005-2007, 2009).
4. Effective Strategies for Success in Funded Research, Office for Diversity in Graduate Education, UM (2011, 2012, 2014).

ACADEMIC SERVICES AND PROFESSIONAL SOCIETIES

Member: American Physical Society, Combustion Institute, National Society of Black Engineers, American Association for Aerosol Research. American Institute of Chemical Engineers.

EDUCATIONAL-OUTREACH ACTIVITY PARTNERS

- NSF LSAMP North Star Stem Alliance, University of Minnesota.
- Twin Cities Public Television (PBS) – Dragonfly TV
- Minnesota Science Museum
- National Society of Black Engineers
- Society of Women Engineers
- Florida A&M University
- Army High Performance Computing Research Center Summer Institute

EDUCATION AND RESEARCH IN SERVICE

1. I am an active member of an interdisciplinary group of scientists at the University of Minnesota whose research is related to multi-scale phenomena. Multi-scale expresses the fact that in order to correctly describe the behavior of the system it is necessary to resolve macroscopic and microscopic processes simultaneously. A "Multi-scale Science and Engineering" group was created with students, scientists and faculty recruited from diverse science, mathematics, and engineering fields. I have developed computational tools and models to describe non-equilibrium thermodynamics, physics and chemistry coupled with macroscopic transport processes.

2. I have served as the Faculty Advisor to the Minnesota-wide North Star STEM Alliance (NSSA) for the past 5 years. The mission of the NSF-funded NSSA is to broaden the participation and increase the graduation rates of students traditionally underrepresented in STEM fields. This state-wide effort an includes 17 institutions and is part of the NSF's LSAMP aimed at increasing the quality and quantity of students successfully completing STEM degree programs. Within the first two years, many of the indicators that point to positive outcomes were in place: (1) The number of bachelors degrees granted to underrepresented students STEM disciplines by 16% (compared to 4% for all students); (2) The GPAs of students participating in the program improved at all levels; (3) The number of students with GPAs greater than 3.0 went from 44% to 55% and the number of students with GPAs less than 2.0 went from 18% to 5%. Graduation rates were doubled by year 5. I recruited three additional faculty (from chemistry, electrical engineering and industrial engineering) to participate in the student interactions to increase throughput/capacity.

3. In Fall 2008, I began participating in the Student Excellence in Academics and Multiculturalism (SEAM) at UM. SEAM is a rewarding way for first-year students in the College of Liberal Arts, College of Biological Sciences, and College of Food, Agricultural, and Natural Resource Sciences to start at the UofM. SEAM seminars are for first-year students who share similar interests or goals and a desire to study in a multicultural environment. I have co-taught (with an instructor from the office of Residential Life) four semesters of the SEAM Freshman Seminar - Introduction to Engineering. (This teaching was above my normal teaching load.) SEAM helped them transition socially and academically into university life. Students explained that the social relationships they developed through SEAM were important to them for many social and academic reasons. Seventy five (75) students have participated in the Introduction to Engineering seminar. In Fall 2009, the students were so complimentary of the experience that word reached the CSE Dean's Office and I was asked to teach a similar course within the college. In Fall 2013 the class became a regular offering and 6 CSE faculty led 120 students in their own freshman seminar.

4. I am also involved with activities that serve to bring high-school students who are interested in majoring in STEM disciplines to the UM. One such activity is Experience Minnesota. Experience Minnesota is an open house for multicultural high school students and their families held each Fall. Prospective students and families are invited to campus for a day for a special introduction to the UM campus. In addition to a campus tour, families learn about the wide variety of majors available at the UM, attend resource fairs, visit residence halls, the Multicultural Center for Academic Excellence, student-run cultural organizations and attend panel presentations. The main feature is visiting departments and programs of interest and

meeting faculty and multicultural undergraduate students in those colleges. I lead discussion on how engineers and scientists use imagination, science, and math to improve technology around the world.

5. I am a member of the Region 11 Math and Science Teaching Academy Partnership that acts to ensure that K-12 teachers can make the connections between science, mathematics, and engineering and can do so in a way that engages the students in their classrooms. Engineering has become part of the Science Standard as specified by the Minnesota Department of Education. The partnership provides instructional strategies that aid secondary school teachers in implementing STEM contexts into their mathematics classrooms and increases their understanding of the connections between mathematics and the other areas of STEM. Participants become familiar with engineering, science, and technology as contexts in which to teach secondary school mathematics and map STEM context activities to both state and national standards. I work with K-12 teachers, school administrators & school districts, and professional learning communities to ensure that the teachers are well prepared to enter post-secondary education. Leadership Forums were created and are scheduled throughout the year to provide opportunities for building principals, curriculum leaders, and math specialists to receive support to extend and refine teacher learning. I have led 80 teachers and school administrators through the program.
6. I am working with the Sandia National Laboratories and the Institute for Liquid Atomization and Spray Systems to establish Industry-University benchmarks —experiments, procedures, and data — for the development of computational tools and mathematical models for use in spray modeling simulation. This database is being used by investigators around the world to improve the atomization and spray characterization and performance.
7. I have developed a short course work aimed at integrating computational fluid dynamics and particle dynamics from the nano scale to the micro scale. This integration has enabled scientists to use first-principles approaches and phenomenological models to perform robust high level simulations of real-world processes. The course has been given at the University of MN, the annual meeting of the Finnish Aerosol Society, and the annual meeting of the American Association for Aerosol Research. More than 150 scientists from Asia, Europe and the US have participated in the course.