

AMITABH NARAIN

PERSONAL INFORMATION

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EDUCATION

Ph. D. AEROSPACE ENGINEERING AND MECHANICS, 1983
University of Minnesota, Minneapolis, MN, USA

M.S. AEROSPACE ENGINEERING AND MECHANICS, 1980
University of Minnesota, Minneapolis, MN, USA

B.Tech. AEROSPACE ENGINEERING, 1978
Indian Institute of Technology, Kharagpur, India

WORK EXPERIENCE

Michigan Technological University, Houghton, MI, USA

PROFESSOR WITH TENURE (2006–PRESENT)

ASSOCIATE PROFESSOR WITH TENURE (1990–2006)

ASSISTANT PROFESSOR (1983-1990)

University of Minnesota, Minneapolis, MN, USA

VISITING ASSISTANT PROFESSOR (1988)

RESEARCH / TEACHING ASSOCIATE, DEPARTMENT OF AEROSPACE ENGINEERING AND MECHANICS
(1978–1983)

CURRENT RESEARCH

Long-term and current research deals with fundamentals and applications of phase-change flows for innovative millimeter-scale flow-boiler and flow-condenser operations discovered in our laboratory. **Applications include addressing cooling requirements of next generation supercomputers, data centers, laser weapons, and many other new systems.** The first innovative principle deals with these operations' flow-control strategy. It involves setting up a controlled and passive recirculating vapor flow in a way that it results in annular liquid flows – of desired micrometer-scale thicknesses – over the entire heated/cooled surface of the devices. The second innovation imposes resonant pulsations on vapor and liquid flows in a way that large amplitude standing waves – with the help of enabling acoustics – form the

annular flow's interface. As a result, when the troughs of these large amplitude standing interfacial waves come sufficiently close (within, say, 10 μm) to a wetting (or hydrophilic) boiling-surface, contact line flow-physics arise to create dynamic heat-flux enhancements that lead to desired time-averaged enhancements (by a factor of 4 – 20) over the corresponding steady non-pulsatile values.

For macro or cm-scale flow-boilers and condensers used in the energy sector, the research focuses on significant air-side heat-transfer enhancements without pressure-drop penalties. Innovative fins, dielectric barrier discharge (DBD) flows, humidity-controlled condensation and evaporation on the finned surfaces, etc. are being explored to propose breakthroughs in dry-cooling/dry-heating approaches for technological innovation of heat recovery steam generators (HRSGs), air-cooled condensers, etc. for next generation power plants. Some innovations for gravity-insensitive mode of HVAC operations (such as those for aircrafts or uses in zero/microgravity space environments) are among other possible applications.

The following existing and evolving tools support the above mentioned research: two modern state-of-the-art electronically-controlled flow-loops (with extensive electronic-sensing) for testing and developing innovative boiler and condenser operations (for mm-scale devices), testing and fabrication of 3-D printed innovative passive designs for air-heated/air-cooled fins (for significant reductions in gas-side thermal resistances encountered in the operation of industrial cm-scale devices), and synthesis of experimental results with our state-of-the-art scientific and engineering simulation tools (some of them are based on our own breakthrough algorithms).

CAREER HIGHLIGHTS/SYNERGISTIC ACTIVITIES

- PI on external grants totaling approximately \$2 million. Total external grants as PI and Co-PI: about \$3.3 million.
- Core research has received continuous funding from NSF or NASA - since 2000 to 2018. Research accomplishments highlighted by NSF in 2012 and Research.Gov in 2013. Recent work is initiating several new projects (for 2016 and beyond) in the Energy and Thermal Management area.
- Fellow of ASME.
- Associate Editor, *ASME Journal of Heat Transfer*, 2015-2018.
- Member: American Society of Mechanical Engineers, American Academy of Mechanics, American Physical Society - Division of Fluid Dynamics, American Association for the Advancement of Science, The American Society for Gravitational and Space Research.
- National-level Committee Memberships/Leaderships in ASME: HTD-K8 (Vice-Chair and Chair designate, 2015-20), JHT Editorial Board (2015-2018), HTD-K13, FED-Multi Phase Flow Committee, and AMD-Fluid Mechanics (Past Chair and Vice-Chair). Lead organizer for several symposia over the past two decades. More recently, *Topic or Track Chair* for topics (in Heat Transfer and Thermal Engineering) covering several sessions at ASME IMECE 2014, 2015, and 2016.
- Current department-level Committee Memberships/Leaderships at MTU: Member Executive Committee, Area Director Energy-Thermo-Fluids Area, Chair Faculty Recruitment Committee.
- Review Committee Member for Several NSF Panels: NSF panels 2010, 2011, 2012, and 2013.
- Reviewer for International Journals (more than 90 journal papers): *International Journal of Heat and Mass Transfer*, *Journal of Heat Transfer*, *Journal of Applied Mechanics*, *Journal of Fluids Engineering*, *International Journal of Multi-phase Flows*, *Journal of Enhanced Heat Transfer*, *International Journal of Thermal Sciences*, *Computational Mechanics*, *Journal of Micromechanics and Micro-engineering*,

Journal of Rheology, International Journal of Non-Linear Mechanics and Analysis, Journal of Manufacturing Science and Engineering, Theoretical and Computational Fluid Mechanics, Chemical Engineering Communications. More than 100 papers/abstracts for several ASME Conference Proceedings and Conferences on Interdisciplinary Transport Phenomena.

- Author of over 36 refereed journal publications and 85 peer-reviewed articles - Google Scholar H-index: 12 and i10-index: 16. Citations: On Google-Scholar, 510, ResearchGate: a total of 1595 publication views on and 192 citations.

AWARDS, HONORS, AND LEADERSHIP

2006 - Present	Fellow of American Society of Mechanical Engineers (ASME)
2015 – 2018	Associate Editor, ASME <i>Journal of Heat Transfer</i> , 2015-2018
1978	Indian Institute of Technology-Kharagpur Silver Medal for First Rank in B. Tech (Aerospace Engineering). Also awarded First Rank prize for each of the five years (1973-'78) in the B. Tech (Aerospace Engineering) program
1990 - Present	Marquis Who's Who in America, Science and Engineering, and American Education. Who's Who in Thermal-Fluids (www.thermalfluidscentral.org/who/)
1990 - Present	Two Keynote Lectures, One ASME-HTD Invited Lecture, Several Invited Lectures, and Invited Membership on several Panels
1990 - Present	Topic Chairs, Symposia Chair/Organizer, and Chair of Several Technical Sessions at various conferences (ASME emphasis).
2013	Best Paper Award, <i>COMSOL Conference</i> 2013, Boston, MA, USA, October 2013.

EXTERNAL RESEARCH SUPPORT

As PI

2014–2017	Fundamental Investigations for Very High Heat-flux Innovative Operations of Millimeter Scale Flow Boilers. National Science Foundation Grant CBET-1402702. Total NSF Funding: <u>\$305,781</u>
2010–2014	Flow Prediction and Fluctuation-Sensitivity Investigations for Quasi-steady Shear Driven Condensing Flows in Millimeter to Micrometer Scale Two-Phase Systems. National Science Foundation Grant CBET-1033591. Total NSF Funding: <u>\$354,947</u>
2010-2013	Original 3-year: \$297,288.
2011–2012	NSF REU supplement: \$6,000
2012	CBET conference supplement: \$2,000

2013-2014	Flow boiling supplement:	\$49,659
2010–2012	Ground-based Experimental and Computational Investigations of Shear Driven Internal Condensing/Boiling Flows for Flight Experiments and Space-Based Two-Phase Systems. NASA Grant NNX10AJ59G.	Total Funded Amount: \$100,000
2004–2009	Direct Computational Simulations and Experiments for Internal Condensing Flows System-Instabilities/Dynamics in Micro-gravity and Terrestrial Environments. NASA Grant NNC04GB52G.	Co-Is for 2004-'06: Evenson, H.A., Co-Investigator; Van Karsen, C., Co-Investogator. Total Funded Amount: \$686,963 (with cost-share: \$712,163)
2005–2006	Flow Simulations for Optimized Performance of Displacement Pumps. Engineered Machine Products (EMP) Inc., Escanaba, MI, USA.	Total Funded Amount: \$67,748
2001–2005	Prediction and Attainment Capability for Steady Internal Condensing Flows — An Integrated Experimental/Computational Approach. National Science Foundation Grant CTS-0086988.	Co-PIs: Kim, N., (Chem-Eng); Evensen, H.A., (ME-EM); Sweger, P.O., (ME-EM). Total Funded Amount: \$213,189 (with cost-share: \$323,399) 2001-2002 REU supplement: \$12,000 2002-2003 REU supplement: \$10,000
2003–2005	Investigation of flow and heat exchange capabilities for Ferncool Box-Cooler Heat Exchangers. R. W. Fernstrum & Co., Menominee, MI, USA. Co-PI: Arici, O.	Total Funded Amount: \$80,982
2003	Exploratory Research in the Development of Automotive Mirror and Window Products. Donnelly Corporation, Holland, MI, USA. (for MSME student Amit Barve)	Total Funded Amount: \$3,000
1988–1989	Visiting Research Grant NSF/DMS - 8504323 from the Institute for Mathematics and its Applications at the University of Minnesota, Minneapolis, MN, USA.	Total Funded Amount: \$10,000
<i>As Co-PI</i>		
1999–2003	Static Pressure Measurements on the Suction Side of the Stator Blade in an Automotive Torque Converters. General Motors, Powertrain Group, Ypsilanti, MI, USA. Anderson, C.L., Principal Investigator	Total Funded Amount: \$285,651

- 2000–2001 **Noise Measurements in an Automotive Torque Converter. General Motors, Powertrain Group, Ypsilanti, MI, USA.** Anderson, C.L., Principal Investigator; Sweger, P., Evensen, H.A., Blough, J., Other Co-PIs
Total Funded Amount: \$98,700
- 2000–2001 **Turbine Blade Measurement. General Motors, Powertrain Group, Ypsilanti, MI, USA.** Anderson, C.L., Principal Investigator; Sweger, P., Evensen, H.A., Blough, J., Other Co-PIs
Total Funded Amount: \$78,000
- 1997–2000 **Cavitation Signatures in Torque Converters. General Motors, Powertrain Group, Ypsilanti, MI, USA.** Anderson, C.L., Principal Investigator
Total Funded Amount: \$277,135
- 1999–2000 **High Performance Connections to the Internet via Merit Network, Inc. in cooperation with Central Michigan University, Michigan Technological University, and Northern Michigan University.** Aupperle, E., Principal Investigator; Ogden, J., Co-Principal Investigator; Bornhorst, T., Brown, R., Cross, J., Helminen, B., Huang, X., Hyslop, M., Johnson, D., Laemmrich, S., Maclean, A., McNinch, T., Murthy, P., Rafert, J.B, Riehl, J., Rose, W., Other Co-PIs
Total Funded Amount: \$350,000
- 1998–1999 **Conference on Integral Method in Science and Engineering 98. National Science Foundation Grant NSF-9800673.** Bertram, B., Principal Investigator, Other Co-PIs: Sikarskie, D., Struthers, A., Vable, M.,
Total Funded Amount: \$28,177 (with cost share \$45,926), NSF amount: \$7,782
- 1986–1989 **Film Condensation under Microgravity Conditions. NASA- Lewis grant NAG 3-711.** Suryanarayana, N.V., Principal Investigator
Total Funded Amount: \$209,273

PEER-REVIEWED PUBLICATIONS

Journal Articles

1. Naik., R., **Narain, A.**, and Mitra, S., “Steady and Unsteady Simulations for Annular Internal Condensing Flows, Part I: Algorithm and its Accuracy.” *Numerical Heat Transfer, Part B: Fundamentals*. 2016, **69**(6), pp. 473-494. [Read More](#)
2. Naik, R., and **Narain, A.**, “Steady and Unsteady Simulations for Annular Internal Condensing Flows, Part II: Instability and Flow Regime Transitions.” *Numerical Heat Transfer, Part B: Fundamentals*. 2016, **69**(6), pp. 495-510. [Read More](#)
3. Ranga Prasad, H., **Narain, A.**, Bhasme S., and Naik, R., “Shear-driven Annular Flow-boiling in Millimeter-scale channels: Direct Numerical Simulations for Convective Component of the Overall Heat Transfer Coefficient.” Accepted: *International Journal of Transport Phenomena*. 2017. Invited paper, final version submitted Nov. 2, 2016. [Read More](#)

4. **Narain, A.**, Ranga Prasad, H., and Koca, A., “Internal Annular Flow-boiling and Flow-condensation: Context, Results, and Recommendations.” *Handbook of Thermal Science and Engineering*. Francis A. Kulacki. Springer. Invited. Final draft submitted on Nov 1, 2016. [Read More](#)
5. **Narain, A.**, Naik, R.R., Ravikumar, S., and Bhasme, S.S., “Fundamental assessments and new enabling proposals for heat transfer correlations and flow regime maps for shear driven condensers in the annular/stratified regime.” *Journal of Thermal Engineering*. 2015, **1**(4), pp. 307-321. [Read More](#)
6. Kivisalu, M. T., Gorgitrattanagul, P., and **Narain, A.**, “Results for High Heat-Flux Flow Realizations in Innovative Operations of Milli-Meter Scale Condensers and Boilers.” *International Journal of Heat and Mass Transfer*. 2014, **75**, pp. 381-398. [Read More](#)
7. Kivisalu, M.T., Gorgitrattanagul, N., **Narain, A.**, Naik. R., and Hasan, M., “Sensitivity of Shear-Driven Internal Condensing Flows to Pressure Fluctuations and its Utilization for Heat Flux Enhancements.” *International Journal of Heat and Mass Transfer*. 2013, **56**(1-2), pp. 758-774. [Read More](#)
8. **Narain, A.**, Ajotikar, N., Kivisalu, M.T., Rice, A.F., Zhao, M. and Shankar, N., “Obtaining Time-Varying Pulsatile Gas Flow Rates with the Help of Dynamic Pressure Difference and Other Measurements for an Orifice-Plate Meter.” *Journal of Fluids Engineering*. 2013,**135**(4), p.041101. [Read More](#)
9. Mitra, S., **Narain, A.**, Naik, R., and Kulkarni, S. D., “A Quasi One-Dimensional Simulation Method and its Results for Steady Annular/Stratified Shear and Gravity Driven Condensing Flows.” *International Journal of Heat and Mass Transfer*. 2011, **54**(15), pp. 3761-3776. [Read More](#)
10. **Narain, A.**, Liang, Q., Yu, G., and Wang, X., “Direct Computational Simulations for Internal Condensing Flows and Results on Attainability/Stability of Steady Solutions, their Intrinsic Waviness, and their Noise-Sensitivity.” *Journal of Applied Mechanics*. 2004, **71**(1), pp. 69-88. [Read More](#)
11. Kurita, J. H., Kivisalu, M., Mitra, S., Naik, R., and **Narain, A.**, “Experimental Results on Gravity Driven Condensing Flows in Vertical Tubes, their Agreement with Theory, and their Differences with Shear Driven Flows’ Boundary Condition Sensitivities.” *International Journal of Heat and Mass Transfer*. 2011, **54**(13), pp. 2932-2951. [Read More](#)
12. **Narain, A.**, and Joseph, D. D., “Linearized Dynamics for Step Jumps of Velocity and Displacement of Shearing Flows of a Simple Fluid.” *Rheologica Acta*. 1983, **21**(3), pp. 228-250. [Read More](#)
13. Joseph, D.D., **Narain, A.**, and Riccius, O., “Shear Wave Speeds and Elastic Modulii for Different Liquids. Part 1. Theory.” *Journal of Fluid Mechanics*. 1986, **171**, pp.289-308. [Read More](#)
14. **Narain, A.**, Yu, G., and Liu, Q., “Interfacial Shear Models and Their Required Asymptotic Form for Annular Film Condensation Flows in Inclined Channels and Vertical Pipes.” *International Journal of Heat and Mass Transfer*. 1997, **40**(15), pp. 3559 - 3575. [Read More](#)
15. **Narain, A.**, and Joseph, D.D., “Remarks about the Interpretation of Impulse Experiments in Shear Flows of Viscoelastic Liquids.” *Rheologica Acta*. 1983, **22**(6), pp. 528-538. [Read More](#)
16. Liang, Q., Wang, X., and **Narain, A.**, “Effect of Gravity, Shear and Surface Tension in Internal Condensing Flows - Results from Direct Computational Simulations.” *ASME Journal of Heat Transfer*. 2004, **126**(5), pp. 676-686. [Read More](#)
17. Phan, L., Wang, X. and **Narain, A.**, “Exit Condition, Gravity, and Surface-Tension Effects on Stability and Noise-sensitivity Issues for Steady Condensing Flows inside Tubes and Channels.” *International Journal of Heat and Mass Transfer*. 2006, **49**(13), pp. 2058-2076. [Read More](#)
18. Phan, L. and **Narain, A.**, “Non-linear Stability of the Classical Nusselt Problem of Film Condensation and Wave-Effects.” *ASME Journal of Applied Mechanics*. 2007, **74**(2), pp. 279-290. [Read More](#)

19. Ng, T. W., **Narain, A.**, and Kivisalu, M., T., “Fluorescence and Fiber-Optics Based Real-Time Thickness Sensor for Dynamic Liquid Films.” *ASME Journal of Heat Transfer*. 2010, **132**(3), pp. 1-12. [Read More](#)
20. Kulkarni, S. D., **Narain, A.**, Kivisalu, M., Mitra, S., and Hasan M. M., “Condenser performance, Control, and Heat Transfer Enhancement Issues Resulting from Elliptic-Sensitivity of Shear Internal Condensing Flows.” *International Journal of Transport Phenomena*. 2012, **1**(13), pp. 15-57. [Read More](#)
21. Kivisalu, M., Gorgitrattanagul, N., Mitra, S., Naik, R., and **Narain, A.**, “Prediction and Control of Internal Condensing Flows in the Experimental Context of their Inlet Sensitivities.” *Microgravity Science and Technology*. 2012, **24**(3), pp. 147-155. [Read More](#)
22. Geng, X., Patel, P., **Narain, A.**, and Meng D. D., “A Self-Adaptive Thermal Switch Array for Rapid Temperature Stabilization under Various Thermal Power Inputs.” *Journal of Micromechanics and Micro engineering*. 2011, **21**(8). [Read More](#)
23. Kulkarni, S. D., **Narain, A.**, and Mitra, S., “Forced Flow of Vapor Condensing over a Horizontal Plate (Problem of Cess and Koh) - Steady and Unsteady Solutions of the Full 2D Governing Equations.” *Journal of Heat Transfer*. 2010, **132** (10), pp. 1-18. [Read More](#)
24. **Narain, A.**, Kurita, J. H., Kivisalu, M., Kulkarni, S. D., Siemionko, A., Ng, T. W., Kim, N. and Phan, L., “Internal Condensing Flows Inside a Vertical Pipe – Experimental/Computational Investigations of the Effects of Specified and Unspecified (Free) Conditions at Exit.” *ASME Journal of Heat Transfer*. 2007, **129**(10), pp. 1352-1372. [Read More](#)
25. **Narain, A.**, Kulkarni, S. D., Mitra, S., Kurita, J. H., and Kivisalu, M., “Computational and Ground-based Experimental Investigations of the Effects of Specified and Unspecified (Free) Conditions at Exit for Condensing Flows in Terrestrial and Micro-gravity Environments.” *Annals of New York Academy of Sciences, Interdisciplinary Transport Phenomena in Space Sciences*. 2009, **1161**(1), pp. 321-360. [Read More](#)
26. **Narain, A.**, Phan, L., Wang, X., Kurita, J. H., Siemionko, A., Ng, T. W., and Kulkarni, S. D., “Direct Computational Simulations and Experiments for Film Condensation inside Tubes and Channels.” *Annals of New York Academy of Sciences, Interdisciplinary Transport Phenomena in Space Sciences*. 2006, **1077**(1), pp. 471-507. [Read More](#)
27. Anderson, C. L., Zeng, L., Sweger, P., **Narain, A.**, and Blough, J. R., “Experimental Investigation of Cavitation Signatures in an Automotive Torque Converter Using a Microwave Telemetry Technique.” *International Journal of Rotating Machinery*. 2003, **9**(6), pp. 403-410. [Read More](#)
28. **Narain, A.**, “Modeling of Interfacial Shear for Gas Liquid Flows in Annular Film Condensation.” *Journal of Applied Mechanics (Transactions of America Society of Mechanical Engineering)*. 1996, **63**(2), pp. 529-538. [Read More](#)
29. **Narain, A.**, and Kizilyalli, Y., “Pressure driven flow of pure vapor undergoing laminar film condensation between parallel plates.” *International Journal of Non-Linear Mechanics*. 1991, **26**(5), pp. 501-520. [Read More](#)
30. Gu, X. M., Sethna, P. R., and **Narain, A.**, “On Three-Dimensional Nonlinear Subharmonic Resonant Surface Waves in a Fluid. Part I. Theory.” *Journal of Applied Mechanics (Transactions of America Society of Mechanical Engineering)*. 1988, **55**(1), pp. 213-239. [Read More](#)
31. **Narain, A.**, “On K-BKZ and other visco-elastic models as continuum generalizations of the classical spring-dashpot models.” *Rheologica Acta*. 1986, **25**(1), pp. 1-14. [Read More](#)

32. **Narain, A.**, and Joseph, D. D, “Classification of Linear Viscoelastic Solids based on a Failure Criterion.” *Journal of Elasticity*. 1984, **14**(1), pp.19-26. [Read More](#)
33. **Narain, A.**, and Joseph, D.D, “Corrigendum to Linearized Dynamics for Step Jumps of Velocity and Displacement of Shearing Flows of a Simple Fluid.” *Rheologica Acta*. 1983, **22**(5), p. 519. [Read More](#)
34. **Narain, A.**, and Joseph, D. D., “Linearized Dynamics of Shearing Deformation Perturbing Rest in Viscoelastic Materials.” 1983, in: H. Knobloch and K. Schmitt (Editors). *Equadiff 82*, Lecture Notes in Mathematics, Springer Verlag, 1983. Also in: Trans. *28th Conference of Army Mathematicians*, ARO Report 83-1, 1017, pp. 476-507. [Read More](#)
35. Dixit, P.M., **Narain, A.**, and Joseph, D.D., “Free Surface Problems Induced by Motions Perturbing the Natural State of Simple Solids.” *Arch. Rational Mech. Anal.* 1981, **77**(3), pp. 199-261. [Read More](#)
36. Rivlin, R.S., Robert Gilbert, Robert, **Narain, A.**, and D. D., Joseph, “Spin-up in Couette flow.” *Applicable Analysis (Gordon and Breach Science Publishers Ltd.)*. 1983, **15**(1), pp. 227-228. [Read More](#)

Refereed Articles in Conference Proceedings / Symposia/IMA Pre-prints

37. Naik, R. R., **Narain, A.**, and Mitra, S., “Steady and Unsteady Computational Simulations for Annular Internal Condensing Flows in a Channel.” *Proceedings of 2014 ASME International Mechanical Engineering Congress and Exposition*, Montreal, Canada, 2014. Paper No. IMECE2014-38445.
38. Kivisalu, M., **Narain, A.**, Gorgitrattanagul, P., and Naik, R., “Innovative Realizations of High Heat-Flux Boiling and Condensing Flows for Milli-meter and Micro-meter Scale Applications.” *Proceedings of 2014 ASME International Mechanical Engineering Congress and Exposition*, Montreal, Canada. Paper No. IMECE2014-37319.
39. **Narain A.**, Kivisalu M., Gorgitrattanagul P., Naik R., and Shankar N., “Results for High Heat-flux Realizations in Innovative Operations of Milli-meter Scale Condensers and Boilers.” *Electronic Proceedings of the 22th National and 11th International ISHMT-ASME Heat and Mass Transfer Conference*, IIT Kharagpur, India, December 28 – 31, 2013. Paper number: HMTTC 1300183.
40. Naik, R., Mitra, S., **Narain, A.**, and Shankar, N., “Steady and Unsteady Computational Results of Full Two Dimensional Governing Equations for Annular Internal Condensing Flow.” *Fluid Dynamics, COMSOL Conference*, Boston, MA, October 9-11, 2013.
41. **Narain, A.**, “High Effectiveness Microscale Condensers and Boilers for Terrestrial and Space Applications.” *NSF 2012 CBET Grantee Conference*, Baltimore, MD, USA, 2012. Grant NSF-CBET-1033591.
42. **Narain, A.**, Kivisalu, M., Naik, R., Gorgitrattanagul, N., Mitra, S., and Hasan, M. M., “Comparative Experimental and Computational Studies for Annular Condensing and Boiling Flows in Milli-meter Scale Horizontal Ducts.” *Proceedings of ASME 2012 Summer Heat Transfer Conference*, Rio Grande, PR, USA, 2012. Paper No. HT2012-58602, pp. 563-574, doi: 10.1115/HT2012-58602.
43. Kivisalu, M., Gorgitrattanagul, N., Mitra, S., Naik, R., and **Narain, A.**, “Shear/Pressure Driven Internal Condensing Flows and their Sensitivity to Inlet Pressure Fluctuations.” *Proceedings of 2011 ASME International Mechanical Engineering Congress and Exposition*, Denver, CO, USA, 2011. Paper No. IMECE2011-63281, pp. 487-498, doi: 10.1115/IMECE2011-63281.
44. Kivisalu, M., Gorgitrattanagul, N., Mitra, S., Naik, R., and **Narain, A.**, “Prediction and Control of Internal Condensing Flows in the Experimental Context of their Sensitivities.” *EUROTHERM Seminar on Gravitational Effects on Liquid-Vapour Phase Change. Presqu’ile de Giens – Hyeres*, France, April 17-21, 2011.

45. Mitra, S., Naik, R. R., and **Narain, A.**, “Numerical Simulation of Exact Two-Dimensional Governing Equations for Internal Condensing Flows.” *COMSOL Conference*, Boston, MA, USA, 2010.
46. Mitra, S., **Narain, A.**, Kulkarni, S. D., Kurita J., Kivisalu, M., and Hasan, M. M., “Shear Driven and Gravity Driven Annular/Stratified Internal Condensing Flows.” *Proceedings of International Transport Phenomena VI: Fluid, Thermal, Biological, Materials and Space Sciences*, Volterra, Italy, 2009. Paper Number ITP-09-75.
47. Mitra, S., **Narain, A.**, Kulkarni, S. D., Naik, R., and Kurita, J. H., “Annular /Stratified Internal Condensing Flows in Millimeter to Micrometer Scale Ducts.” *Proceedings of ASME 2nd Micro/Nanoscale Heat & Mass Transfer International Conference*, Shanghai, China, December 18–21, 2009. Paper No. MNHMT2009-18507, pp. 155-170, doi: 10.1115/MNHMT2009-18507.
48. **Narain, A.**, Kulkarni, S., Kivisalu, M., Kurita, J. H., and Mitra, S., “New Experimental and Computational Results for Macro- and Micro-scale Internal Condensing Flows.” *Proceedings of Engineering Conference International Heat Transfer and Fluid Flow in Microscale III*, Whistler, BC, Canada, September 21-26, 2008.
49. **Narain, A.**, Kulkarni, S. D., Mitra, S., Kurita, J. H., and Kivisalu, M., “Internal Condensing Flows in Terrestrial and Micro-gravity Environments – Computational and Ground-based Experimental Investigations of the Effects of Specified and Unspecified (Free) Conditions at Exit.” *Proceedings of Interdisciplinary Transport Phenomena V: Fluid, Thermal, Biological, Materials and Space Sciences*, Bansko, Bulgaria, 2007.
50. **Narain, A.**, Kivisalu, M. T., Siemionko, A., and Kulkarni, S. D., “Internal Condensing Flows inside a Vertical Pipe – Experimental/Computational Investigations of the Effects of Specified and Unspecified (Free) Conditions at Exit.” *Proceedings of 2007 ASME International Mechanical Engineering Congress and Exposition*, Seattle, WA, USA, 2007. Paper No. IMECE2007-41306, pp. 1529-1541; 13 pages, doi: 10.1115/IMECE2007-41306.
51. Ng, T. W. and **Narain, A.**, “Fluorescence and Fiber-Optics Based Real-Time Thickness Sensor for Dynamic Liquid Films.” *Proceedings of 2007 ASME International Mechanical Engineering Congress and Exposition*, Seattle, WA, USA, 2007. Paper No. IMECE2007-41304, pp. 1517-1528; 12 pages, doi: 10.1115/IMECE2007-41304.
52. Kulkarni, S. D., **Narain, A.**, and Mitra, S., “Steady Attractors for Forced Flow of Vapor Condensing over a Horizontal Plate (Problem of Cess and Koh) and their Unsteady Responses to Initial Disturbances and Noise.” *Proceedings of 2007 ASME International Mechanical Engineering Congress and Exposition*, Seattle, WA, USA, 2007. Paper No. IMECE2007-41311, pp. 1543-1555; 13 pages, doi: 10.1115/IMECE2007-41311.
53. Phan, L., X., Wang, Kulkarni S., and **Narain, A.**, “Direct computational simulations for film condensation inside tubes and channels.” *Fluids Engineering, Proceedings of 2005 ASME International Mechanical Engineering Congress and Exposition*, Orlando, FL, USA, 2006. Paper No. IMECE2005-80445 pp. 391-402; 12 pages, doi: 10.1115/IMECE2005-80445. Also see: *Proceedings of 18th National & 7th ISHMT-ASME Heat and Mass Transfer Conference*, IIT Guwahati, India.
54. Phan, L., S. L. Post, and **Narain, A.**, “Direct Computational Simulations that Yield Stability and Wave-Effects for the Classical Nusselt Problem of Film Condensation.” *Proceedings of 2005 ASME International Mechanical Engineering Congress and Exposition*, Orlando, FL, USA, 2005. Paper No. IMECE2005-80221, Applied Mechanics, pp. 317-325; 9 pages, doi: 10.1115/IMECE2005-80221.
55. **Narain, A.**, Siemionko, A., Ng, T. W., Kurita, J. H., Kim, N., Opella, K., and Sweger, P. O., “Internal Condensing Flows Inside a Vertical Pipe – Experimental/Computational Investigations of Effects of

- Constrained and Natural Exit Conditions.” *Heat Transfer Part B, Proceedings of 2005 ASME International Mechanical Engineering Congress and Exposition*, Orlando, FL, USA, 2005. Paper No. IMECE2005-80441, pp. 543-553; 11 pages, doi: 10.1115/IMECE2005-80441.
56. **Narain, A.**, Wang, X., Phan, L., Siemionko, A., Ng, T., and Kurita, J. H., “Film Condensation inside Tubes and Channels-Direct Computational Simulations and Experiments.” *Proceedings of International Conference on Computational & Experimental Engineering and Sciences*, Chennai/Jaipur, India, 2005.
 57. Mekkes, J., Anderson, C. L., and **Narain, A.**, “Static Pressure Measurements and Cavitation Signatures on the Nose of a Torque Converter’s Stator Blades.” *Proceedings of the 10th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery*, Honolulu, HI, USA, 2004. Paper number: ISROMAC10-2004-035.
 58. **Narain, A.**, Liang, Q., Yu, G., and Wang, X., “Direct computational simulations for internal condensing flows.” *ASME Proceedings (CD-ROM) for Summer Heat Transfer*, Las Vegas, NV, USA, 2003. Paper number HT2003-40472.
 59. Anderson, C. L., Zeng, L., Sweger, P., **Narain, A.**, and Blough, J. R., “Experimental Investigation of Cavitation Signatures in an Automotive Torque Converter Using a Microwave Telemetry Technique.” *Proceedings of the 9th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery*, Honolulu, HI, USA, 2002.
 60. **Narain, A.**, Liang, Q., and Barve, A. S., “Free Surface Tracking and Steady/Unsteady Computational Simulations for Internal Condensing Flows in Fluid-Physics and Heat Transfer For Macro- And Micro-Scale Gas-Liquid And Phase-Change Flows.” *ASME Proceedings*, Vol. 3. ASME, 2001. IMECE01; Book Number I00526.
 61. **Narain, A.**, Yu, G., and Liu, Q., “Computational Simulation and Flow Physics for Stratified/ Annular Condensing Flows.” Begell House, Inc., ISBN 1-56700-146-5, *Proceedings of Engineering Foundation Conference on Microgravity Fluid Physics and Heat Transfer*, Oahu, HI, USA, 2000. pp. 46 – 54.
 62. Yu, G., and **Narain, A.**, “Computational simulations and flow domain classification for laminar/laminar annular/stratified condensing flows.” *Proceedings of Integral Methods in Science and Engineering*, Houghton, MI, USA. CRC Press, 1999.
 63. Liu, Q., and **Narain, A.**, “Computational simulation and interfacial shear models for downward annular wavy-interface condensing flow in a vertical pipe.” *Proceedings of Integral Methods in Science and Engineering*, Houghton, MI, USA. CRC Press, 1999.
 64. Yu, G., and **Narain, A.**, “Computational Flow Simulation and Interfacial Shear for Annular/Stratified Condensing flows.” *Proceedings of the American Society of Mechanical Engineers-Fluids Engineering Division*, Dallas, TX, USA, 1997. FED-Vol. 244, Symposium on Gas-Liquid Flows in Fluid Mechanics and Heat Transfer, pp. 53-61.
 65. **Narain, A.**, Yu, G., and Liu, Q., “On Integrability, Interfacial Shear, and Flow Predictions for a Class of Internal Gas Liquid Flows in Annular Film Condensation.” *Proceedings of the Society of Engineering Science 32nd Annual Technical Meeting*, New Orleans, LA, USA, 1996. Hui, D., Michaelidis, S., Eds., College of Engineering-University of New Orleans and School of Engineering-Tulane University, pp. 393-394.
 66. **Narain, A.**, “Modeling of Interfacial Shear for Gas Liquid Flows in Annular Film Condensation in Two Fluid Flows-With or Without Phase Change.” *1994 ASME Winter Annual Meeting*, 1994. ASME AMD - Vol. 184, pp. 41-54.

67. **Narain, A.**, “Modeling of Interfacial shear and Heat Transfer Predictions for Internal Flows with Film Condensation in Fundamentals of Phase Change-Boiling and Condensation.” *1994 ASME Winter Annual Meeting*, 1994. *ASME HTD* - Vol. 273, pp. 29-40.
68. **Narain, A.**, “Interfacial Shear Modeling and Heat Transfer Predictions for Internal Flows with Film Condensation, Proceedings of Engineering Foundation Conference on Condensation and Condenser Design.” *Engineering Foundation Conference*, St. Augustine, Florida, 1993. Publisher: United Engineering Trustees, ISBN No. 0-7918-0693-6, pp. 105 - 121.
69. **Narain, A.**, “Interfacial Shear Modeling and Flow Predictions for Internal Film Condensation Flows, in Fluid Mechanics Phenomena in Microgravity.” *AMD*-Vol. 154 and *FED*- Vol. 142, 1992. pp. 23-39.
70. **Narain, A.**, “Condensing vapor flows and the case of flow between parallel plates,” in Recent Advances in Mechanics of Structured Continua.” *ASME-AMD* - Vol. 117, 1991. pp. 47-53.
71. **Narain, A.**, and Kamath, R., “Internal flows of vapor undergoing film condensation,” Proceedings of the *Twenty-Second Midwestern Mechanics Conference*, Rolla, Missouri, 1991. Developments in Mechanics, University of Missouri-Rolla, Vol.16, Edited by R.C. Batra and B.F. Armaly, pp. 411-412.
72. **Narain, A.**, “Flow of vapor undergoing laminar film condensation between parallel plates” in *Proceedings of CSME Mechanical Engineering Forum 1990*, University of Toronto, Toronto, Canada. Vol. 1, 1990, pp. 379-389.
73. **Narain, A.**, “Impulse Dynamics of Viscoelastic Fluids and Some Solutions by Integral Transforms.” *Integral Methods in Science and Engineering*, Arlington, Texas, 1986. In: *Integral Methods in Science and Engineering*, Payne FR, Corduneanu CC, Haji-Sheikh A, Tseng Huang (Editors), Hemisphere Publishers, pp. 114-129.
74. **Narain, A.**, “Interfacial Shear Modeling and Flow Predictions for Internal Flows of Pure Vapor Experiencing Film Condensation.” *Institute for Mathematics and its Applications*, University of Minnesota, Minneapolis, MN, USA, 1993. IMA Preprint Series #1103, pp 1-60.
75. **Narain, A.**, “Interfacial Shear Modeling and Flow Predictions for Internal Flows of Pure Vapor Experiencing Film Condensation.” *Institute for Mathematics and its Applications*, University of Minnesota, Minneapolis, MN, USA, 1993. IMA Preprint Series #1103, pp 1-60.
76. **Narain, A.**, “Pressure driven flow of pure vapor undergoing film condensation between parallel plates.” *Institute for Mathematics and its Applications*, University of Minnesota, Minneapolis, MN, USA, 1989. IMA Preprint #542. Also submitted as technical report to NASA - Lewis on the grant NAG 3-711. Times Cited: 1
77. **Narain, A.**, and Kizilyalli, A., “The flow of pure vapor undergoing film condensation between parallel plates.” *Institute for Mathematics and its Applications*, University of Minnesota, Minneapolis, MN, USA, 1989. IMA Preprint #502.
78. **Narain, A.**, and Joseph, D.D., “Note on the Balance of Energy at a phase-change interface.” *Institute for Mathematics and its Applications*, University of Minnesota, Minneapolis, MN, USA, 1989. IMA Preprint #518.
79. **Narain, A.**, “On K-BKZ and Other Viscoelastic Models as Continuum Generalizations of the Classical Spring-Dashpot Models.” University of Wisconsin, Madison, WI, USA, 1985. MRC Report #2895.

Research Reports Submitted to Federal Agencies

80. **Narain, A.**, “Prediction and Attainment Capability for Steady Internal Condensing Flows — An Integrated Experimental/Computational Approach.” Final and several annual reports submitted on NSF Fastlane’s report website for CTS-0086988, 2001–2005.

81. **Narain, A.**, “Direct Computational Simulations and Experiments for Internal Condensing Flows’ System-Instabilities/Dynamics in Micro-gravity and Terrestrial Environments.” Final and several annual reports submitted on NASA Task book website for NASA Grant NNC04GB52G, 2004–2009.
82. **Narain, A.**, “Flow Prediction and Fluctuation-Sensitivity Investigations for Quasi-Steady Shear Driven Condensing Flows in Millimeter to Micrometer Two-Phase Systems.” Annual report submitted on NSF Fastlane’s report website for CBET-1033591 and, in 2013, on Research.Gov, 2010–2013.
83. **Narain, A.**, “Flow Prediction and Fluctuation-Sensitivity Investigations for Quasi-Steady Shear Driven Condensing Flows in Millimeter to Micrometer Two-Phase Systems.” Annual report submitted on NSF Fastlane’s report website for CBET-1033591 and, in September 2014, on Research, 2013–2014.
84. **Narain, A.**, “Fundamental Investigations for Very High Heat-Flux Innovative Operations of Millimeter Scale Flow Boilers for CBET-1402702.” Annual report submitted on Research.gov website, June 2014–May 2015.
85. **Narain, A.**, “Fundamental Investigations for Very High Heat-Flux Innovative Operations of Millimeter Scale Flow Boilers for CBET-1402702.” Annual report submitted on Research.gov website, June 2015–May 2016.

EDITED BOOKS/VOLUMES/BOOK CHAPTERS

1. **Narain, A.**, Ranga Prasad, H., and Koca, A., “Internal Annular Flow-boiling and Flow-condensation: Context, Results, and Recommendations.” *Handbook of Thermal Science and Engineering*. Francis A. Kulacki. Springer. Invited. Draft August 31, 2016 submission being revised for final submission on Oct 31, 2016.
2. **Narain, A.**, Liang, Q., Yu, G., and Wang, X., “Fluid-Physics and Heat Transfer for Macro- and Micro-Scale Gas-Liquid and Phase-Change Flows.” *ASME Bound Volume Proceedings for IMECE01*. ASME Publications, New York, NY, USA, 2001. Book Number: I00526, HTD-Vol. 369-3, Vol. 3.
3. **Narain, A.**, “Gas Liquid Flows in Fluid Mechanics and Heat Transfer.” *Proceedings of the ASME Fluids Engineering Division*. ASME Publications, New York, NY, USA, 1997. ISBN No. 0-7918-1838-1, FED -Vol. 244.
4. **Narain, A.**, Siginer, D.A., and Kelkar, K.M., “Two Fluid Flows With or Without Phase Change.” *ASME Winter Annual Meeting (International Mechanical Engineering Congress and Exposition) Bound Volume Proceedings*. ASME Publications, New York, NY, USA, 1994. ISBN No. 0-7918-1405-X, ASME-AMD Vol. 184

STUDENT ADVISING

NOTABLE MENTORING OUTCOMES

- R. R. Naik: Won MTU’s Graduate School *Finishing Fellowship* in May 2014; Won MTU’s GSG 2014 Exceptional Student Scholar Award; Won Best Paper Award for *COMSOL Conference 2013*, Boston, MA, USA; and Won MTU Outstanding TA Award, 2011.
- M. Kivisalu: Won MTU’s Graduate School *Finishing Fellowship* in Nov. 2012.
- Guang Yu, Q. Liu, Q. Liang, L. Phan, and S. Kulkarni - all won MEEM’s prestigious Winnikow Fellowship awards.
- Minority undergraduate student researcher Charles Ferreira was mentored through MICUP program.

GRADUATE STUDENTS

Ph.D. Students

12 graduated students (principal advisor for 10 students and co-principal advisor for 2):

- Ranjeeth R. Naik from MTU. “Development of Unsteady Two-dimensional Computational Simulation Tools for Annular Internal Condensing Flows – and their Use for Results on Heat-transfer rates, Flow physics, Flow stability, and Flow sensitivity.” (2015)
- Michael T. Kivisalu from MTU. “Experimental Investigations of Certain Internal Condensing and Boiling Flows: Their Sensitivity to Pressure Pulsations and Heat Transfer Enhancements.” (2015)
- Soumya Mitra from MTU. “Development of one-dimensional and two-dimensional computational tools to simulate steady internal condensing flows in terrestrial and zero-gravity environments.” (2012)
- Jorge H. Kurita from MTU. “Experimental results on gravity driven fully condensing flows in vertical tubes, their agreement with theory, and their differences with shear driven flows’ boundary-condition sensitivities.” (2011)
- Shantanu Kulkarni from MTU. “Computational Study of Internal and External Condensing Flows and Experimental Synthesis to Investigate their Attainability and Stability in Ground-Based and Space-Based Environments.” (2010)
- Lucas Phan from MTU. “Flow Simulations, Code Developments and Comparisons with Experiments for Internal/External Condensing Flows.” (2007)
- Tian W. Ng from MTU. “Development and Calibration of a Fluorescence and Fiber-Optics Based Real-Time Thickness Sensor for Dynamic Liquid Films.” (2006)
- Anna Siemionko, Ph.D. from MTU, ChemE (with Nam Kim as Advisor). “Design, Fabrication, and Operation of a System to Control FC-72 Condensation inside a Vertical Tube.” (2006)
- Q. Liang, Ph. D. from MTU. “Unsteady Computational Simulations and Code Development for a Study of Internal Film Condensation Flows Stability, Noise-sensitivity, and Waviness,” (2003)
- G. Yu, Ph. D. from MTU. “Development of a CFD Code for Computational Simulations and Flow Physics of Annular/Stratified Film Condensation Flows.” (1999)
- Q. Liu, Ph. D. from MTU. “Computational Simulation and Interfacial Shear Models for Wavy Interface Annular Downward Flows in Vertical Pipes: Turbulent Vapor/Laminar Condensate Situations.” (1999)
- Q. Lu, Ph. D. from MTU (with N. V. Suryanarayana). “An Experimental Investigation of Heat Transfer with Condensation in a Horizontal Rectangular Duct.” (1992)

Current Ph.D. students:

- Patcharapol Gorgitrattanakul, Ph. D. from MTU. “Experimental Investigations of Steady and Pulsatile Annular Flow Boiling of FC-72 in Millimeter-scale Horizontal Duct of Rectangular Cross-section. Ph. D. Thesis.” (expected Spring 2017).
- Soroush Sepahyar, Ph. D. from MTU. “Experimental Investigations of Steady and Pulsatile Annular Flow Boiling of Water in Millimeter-scale Horizontal Duct of Rectangular Cross-section. Ph. D. Thesis.” (expected Spring 2018).

M. S. Students

29 graduated students (principal advisor for 25 students and co-principal advisor for 4)

- Sharayu Bhasme, MSME from MTU. “Development of and Simulation Results from: a CFD code for Steady Annular (Suppressed Nucleation) Flow Boiling.” (Summer 2016).
- Timothy Frasier, MSME from MTU. “Non-pulsatile shear driven annular flow boiling investigations.” (Fall 2015)
- Siddhartha Ravikumar, MSME from MTU. “Elementary Assessment and Simulations Based Proposals for New Heat Transfer Correlation and Flow Regime Maps for Annular/Stratified Regime of Shear Driven Internal Condensing Flows.” (Fall 2015)
- Nikhil Shankar, MSME from MTU. “An assessment of flow regime maps and numerical simulations assisted heat-transfer correlation for the annular/stratified regime of shear driven internal condensing flows.” (Summer 2014)
- Andrew F. Rice, MSME from MTU. “Assessments and Computational Simulations for a Time-Varying Pulsatile Gas Flow Measurement Technique.” (Fall 2013)
- Patcharapol Gorgitrattagul, MSME from MTU. “The length of the Annular Regime for Condensing Flows inside a Horizontal Channel – The Experimental Determination of Its Values and its Trends.” (Fall 2012)
- Nikhil Ajotikar, MSME from MTU. “Obtaining Time-Varying Flow-Rates for Pulsatile Gas Flows - with Assistance from Dynamic Pressure-Difference and Mean Mass Flow-Rate Measurements.” (Fall 2012)
- Rohan Gumaste, MSME from MTU. “Computational Simulations of Latent Heat Energy Storage Systems – With First-Principles Based Simulations for the Melting Processes Within the System.” (Fall 2012)
- Sunil Khilnani, MSME (Report) from MTU. “Differences in Behavior between Metallic and Non-Metallic Vapors for Internal Condensing Flows.” (Fall 2010)
- Akshay Tonape, MSME (Report) from MTU. “A Simple 1-D Model for Gravity Dominated 1-D Flows.” (Fall 2010)
- Zhipeng Qin, MSME (Report) from MTU. “A Three-dimensional Heat Conduction Simulation Model for Assistance in the Use of a Heat-Flux Meter.” (Summer 2010)
- Sandeep S. Sikarwar, MSME from MTU. “Recalibration and Modification of a Real Time Optical Fiber and Fluorescence based Liquid Film Thickness Sensor.” (2008)
- Jorge H. Kurita, MSME from MTU. “Experimental Investigation of Fully Condensing Downward Vapor Flows in a Vertical Tube - Unspecified (Free) Exit Condition Cases.” (Mar 2007)
- Jordan Bilyeu, MSME from MTU. “Flow Simulations for Optimized Performance of Displacement Pumps Manufactured By Engineered Machined Products.” (Aug 2006)
- Hector O. Degadillo Rocha, MSME from MTU. “Measurement and Modeling of Film Thickness Variations for Annular In-Tube Flows Through Design and Development of a Flow-Loop Test Apparatus.” (Sep 2006)
- Chichester, MSME from MTU. “Heat-Exchanger Performance and External Water (Coolant) Flow for a Heat-Exchanger at the Hull of a Ship.” (Nov 2005)
- X. Wang, MSME from MTU. “Direct Computational Simulations of Internal Condensing Flows and Effects of Gravity, Shear, and Surface Tension on Interfacial Waves and Heat Transfer Rates.” (Apr 2004)

- J. T. Mekkes, MSME from MTU, 2003 (with C. L. Anderson). “Static Pressure Measurements on the Nose of a Torque Converter Stator during Cavitation.” (2003)
- S. Barve, MSME from MTU. “A Comparative Study of Internal Condensing Flows in Converging and Parallel Channels.” (2002)
- L. Zeng, MSME from MTU (with C. L. Anderson). “Experimental Investigation of Cavitation Signatures in an Automotive Transmission Torque Converter.” (2000)
- T. A. Cross, MSME from MTU (with C. L. Anderson). “Cavitation Signatures in an Automotive Torque Converter.” (1998)
- R. M. Kamath, MSME from MTU. “Internal Flows of Vapor Undergoing Film Condensation.” (1991)
- Y. Kizilyalli, MSME from MTU. “Computations (Integral Formulation) for the Flow of Pure Vapor Undergoing Condensation between Parallel Plates.” (1989)
- K. Lee, MSME from MTU. “A Computational Study of Film Condensation over a Horizontal Plate.” (1988)
- Christodoulou, MSME from MTU (with N. V. Suryanarayana). “Condensation in a Horizontal Rectangular Duct – An Experimental Study.” (1987)

Current MS students

- Hrishikesh Prasad Ranga Prasad.
- Nikhil Shinde
- Amit Dev Vojini

Special-topics or Courses-only MS students

- Prathamesh Jadhav, 1cr, MEEM 5990, Special Topics, Summer 2015
- Chirag Bangera, 3 cr, MEEM 5990, Special Topics, Spring 2016
- Kaustubh Kale, 1cr, MEEM 5990, Special Topics, Summer 2015
- Menghan Zhao, MEEM 5990, Special Topics, Spring 2013
- Jun Zheng, MEEM 5990, Special Topics, Spring 2012
- Sushant More, MEEM 5990, Special Topics, Summer 2011
- Ranjeeth Naik, courses only, Fall 2010

UNDERGRADUATE STUDENTS (>26)

- ME-EM senior (2016-2017) Stuart M. Liburd Jr. on NSF grant
- ME-EM senior (2015-2016) Tristan Slabaugh on NSF grant
- ME-EM sophomore (2015-2016) Nicholas Silvestri on NSF grant
- ME-EM senior (2015-2016) Michael Kostic (GPA 4.0) on NSF grant and Senior Design Project (MMEM 4901 and 4911).
- ME-EM senior (2015-2016) Jonah Kimmes on NSF grant and Senior Design Project (MMEM 4901 and 4911).
- ME-EM senior (2015-2016) Taylor Hoensheid on their Senior Design Project (MMEM 4901 and 4911) and 1 cr Special Topics.
- ME-EM senior (2015-2016) Cory Jokela on Senior Design Project (MMEM 4901 and 4911).
- ME-EM senior (2015-2016) Jessica Liubakka on Senior Design Project (MMEM 4901 and 4911).
- ME-EM senior (2015-2016) John Ware on Senior Design Project (MMEM 4901 and 4911).

- ME-EM senior (2013-2014) Tim Frasier (GPA 3.4) on NSF REU and NSF grant.
- ME-EM senior (2012) Daniel Leppek (GPA 3.6) on NSF REU grant.
- ME-EM senior (2010-2011) Andrew F. Rice (GPA 3.7) on NSF REU grant.
- Charles Ferreira, MICUP program, summer of 2009.
- ME-EM senior Michael Kivisalu (GPA 3.7) over summer '06 and fall '06 as an undergraduate researcher on NASA grant.
- Three seniors: Alan Chichester (GPA 3.7) and Lucas Phan (GPA 3.85) over spring '03 and Jordan Bilyeau over fall '04.
- ME-EM seniors Justin Keske (GPA 3.8) and James Whitmarsh (GPA 3.6) over the summer of 2003. Supported through NSF's REU grant.
- ME-EM seniors Ted Hanes (GPA 3.88) and Vince F. Jones (GPA 3.9) over the summer of 2002. Supported through NSF's REU grant.
- Sponsored and advised Matthew Himes, Matt McQueen, Jason Skiera, Nick Verhagen, and S. Daiyouga over Spring 04 and Fall 04 on a senior design project related to research.
- Advised undergraduates Rodney Worthing, Celeste Mazur, Brian Kleinfeld, etc. on individualized undergraduate projects, 1995-1998.

VISITING FACULTY/POSTDOCS

- Prof. Balaram Kundu, Visiting Professor, Jadavpur University, Kolkata (1 week, March, 2016)
- Dr. Alihsan Koca, Visiting Post-doc, Scholar, TUBITAK, Turkey (May 2016 - June 2017)
- Prof. Dr. Zhe Zhang, Department of Refrigeration and Cryogenics Engineering, Tianjin University of Commerce, Tianjin, China (March - August 2013)

INVENTIONS

- Kivisalu, M. T., Gorgitrattanagul, P., and **Narain, A.**, 2014. "Methods and Results for High Heat-Flux Flow Realizations in Innovative Operations of Milli-Meter Scale Condensers and Boilers." Principles-descriptions same as in *International Journal of Heat and Mass Transfer*. 2014, **75**, pp. 381-398.
- Ajotikar, N., Kivisalu, M., Rice, A., and **Narain, A.**, 2012. "Obtaining Time-Varying Pulsatile Gas Flow-Rates with the Help of Dynamic Pressure-Difference and Other Measurements for an Orifice-Plate Meter." 2012. Invention Reported to NASA. Principles-descriptions as in *Journal of Fluids Engineering*. 2013, **135**(4), p.041101.
- Ng, T. W., **Narain, A.**, and Kivisalu, M., 2010. "Fluorescence and Fiber-Optics Based Real-Time Thickness Sensor for Dynamic Liquid Films." Principles-descriptions as in *ASME Journal of Heat Transfer*. 2010, **132**(3), pp. 1-12.

EDITORIAL BOARD ACTIVITIES

- Associate Editor, *ASME Journal of Heat Transfer*, 2015-2018.
- Member, Editorial Board of *Open Access Journal of Conference Papers in Engineering*, Hindawi Publishing Corporation, 2013-2015.

ORAL PRESENTATIONS AT CONFERENCES/WORKSHOPS/INSTITUTIONAL - WITH PUBLISHED ABSTRACTS

Keynote Presentations

- Keynote Presentation at “International Conference on Advances in Mechanical Engineering – ICAME 2016,” May 10-13, 2016, Istanbul, Turkey
- Keynote Presentation at “Energy Technologies Conference,” December 22-24, 2014, Istanbul, Turkey
- Keynote Presentation at US-India Short-term Course, “Advanced Energy and Thermal Systems,” (sponsored by NSF and IIT-Delhi), January 2-7, 2014, DCRUST, Murthal, Sonapat-131039, Haryana, India
- Invited (by ASME HTD Executive Committee) Presentation at ASME International Mechanical Engineering Congress and Exposition 2014, November 14-21, 2014, Montreal, Canada
- Keynote Presentation at *International Transport Phenomena VI: Fluid, Thermal, Biological, Materials and Space Sciences*, 2009, Volterra, Italy

Professional-level and Invited International Short-Courses Taught

- GIAN 161004G05 : BOILING AND CONDENSATION: THEORY AND APPLICATIONS
Institute Name : Indian Institute of Technology, Kanpur
Foreign Faculty : Amitabh Narain, Professor, United States of America
Host Faculty : Dr. P. S. Ghoshdastidar
Duration : September 6, 2016 to September 15, 2016

Invited and/or Funded Presentations

- Invited Visit and Seminar, Department of Mechanical Engineering, Sept. 16, 2016, *Indian Institute of Technology – Kharagpur, India*
- Invited Visit and Seminar, Department of Mechanical Engineering, Jan. 6, 2016, *Indian Institute of Technology – Kanpur, India*
- Invited Visit and Seminar, Department of Mechanical Engineering, Jan. 14-15, 2016, *Indian Institute of Technology – Guwahati, India*
- Invited Visit and Seminar, Department of Mechanical Engineering, Jan. 12-14, 2016, *Jadavpur University, Kolkata, India*
- Invited Industry Presentation and Seminar (with Vice-President Research and his team) at *Thermax India Limited*, Dec. 29, 2015, Pune, India
- Invited Presentation at *Fluid Physics, the American Society for Gravitational and Space Research Meeting*, Nov. 12, 2015, Westin Alexandria, Alexandria, VA. USA.
- Invited Visit and Seminar, Department of Mechanical Engineering, Nov. 28, 2013, *Indian Institute of Technology – Kanpur, India*
- Invited Visit and Seminar, Department of Mechanical Engineering, Dec. 3, 2013, *Indian Institute of Science – Bangalore, India*
- Invited Visit and Seminar, Department of Mechanical Engineering, Dec. 16, 2013, *Indian Institute of Technology – Patna, India*
- Invited Presentation at US-India “*Multi-Phase Workshop*” (sponsored by NSF and IIT-Mumbai), Dec. 26-27, 2013, Indian Institute of Technology – Bombay.

- *Fluid Physics, the American Society for Gravitational and Space Research Meeting.*, Nov. 28- Dec. 2, 2012, Westin New Orleans Canal Place, New Orleans, LA. USA.
- *NSF 2012 CBET Grantee Conference*, Jun. 6-8, 2012, Baltimore Convention Center, Baltimore, MD, USA.
- *IMECE 2009-13385, ASME International Mechanical Engineering Congress and Exposition, Symposium on Gas Liquid and Phase-Change Flows at Macro- and Micro Scales*, Nov. 13-19, 2009, Orlando, FL, USA.
- *MNHMT 2009-18507, ASME 2nd Micro/Nanoscale Heat & Mass Transfer International Conference*, Dec. 18-22, 2009, Shanghai, China.
- *Symposium on Complex Fluid Flows. Technical Lecture. NSF Sponsored. University of Minnesota*, May 2-3, 2009, Minneapolis, MN, USA.
- *Conference: International Transport Phenomena VI: Fluid, Thermal, Biological, Materials and Space Sciences*, Oct. 4-9, 2009, Volterra, Italy.
- *65th Annual Meeting of the APS Division of Fluid Dynamics*, Nov. 18-20, 2012, San Diego, CA, USA.
- *NASA-GRC Fluid Physics Group Seminar Series*, Jul. 25, 2011.
- *Gravitational Effects on Liquid-Vapour Phase Change (Eurotherm Seminar Number 92)*, Apr. 17-21, 2011, Presqu'île de Giens, Paris, France.
- *Symposium on Multi-Component and Multiphase Fluid Dynamics. 14th U.S. National Congress of Theoretical and Applied Mechanics*, Jun. 23–28, 2002, Blacksburg, VA, USA.
- *Microgravity Transport Processes in Fluid, Thermal, Biological and Materials Sciences II, Banff.*, Sep. 30-Oct 5, 2001, Alberta, Canada.
- *Microgravity Fluid Physics and Heat Transfer. Engineering Foundation Conference.*, Sep 19-24, 1999, Oahu, HI, USA.
- *Workshop on Multi-component Multi-phase Fluid Dynamics. NSF Sponsored. University of Pennsylvania*, Mar. 12-13, 1999, PA, USA.
- *Heat Transfer I Session. Society of Engineering Science 32nd Annual Technical Meeting.*, Oct. 30, 1995, New Orleans, LA, USA.
- *Innovations in Multiphase Flow. An International Fluid Mechanics Symposium.*, Mar. 25-27, 1994, Minneapolis, MN, USA.
- *22nd Midwestern Mechanics Conference. University of Missouri*, Oct. 6-9, 1991, Rolla, MO, USA.
- *Condensation and Condenser Design. Engineering Foundation's International Conference.*, Mar. 7-12, 1993, St. Augustine, FL, USA.

Contributed Presentations with Published Abstracts

- Presentation of Paper No. ASME SHTC 2016-7464 at *ASME 2016 Summer Heat Transfer Conference*, Washington, DC.
- Presentation of Paper No. IMECE2014-38445 at *2014 ASME International Mechanical Engineering Congress and Exposition*, Montreal, Canada.
- Presentation of Paper No. IMECE2014-37319 at *2014 ASME International Mechanical Engineering Congress and Exposition*, Montreal, Canada.
- *22nd National and 11th International ISHMT-ASME Heat and Mass Transfer Conference, HMTTC1300183 (Session: Multi-phase Transport Processes/Phase-Change/Phase-Separation)*, Dec. 29, 2013, IIT Kharagpur, India.
- *COMSOL Conference*, Oct. 9-11, 2013, Boston.

- Presentation at *ASME Summer Heat Transfer Conference*, Jul. 14-19, 2013, Minneapolis, MN, Extended Abstract (HT 2013-17307)
- Presentation at *ASME Summer Heat Transfer Conference*, Jul. 14-19, 2013, Minneapolis, MN, Extended Abstract (HT 2013-17477)
- *65th Annual Meeting of the APS Division of Fluid Dynamics*, Nov. 18-20, 2012, San Diego, CA, USA. (2012). <http://meeting.aps.org/Meeting/DFD12/Event/179473>
- Heat Transfer Photo-gallery Session 7-30-1, *K-22 Heat Transfer Visualization Committee*, IMECE2012, Nov. 9-15, 2012, Houston, TX, USA
- *COMSOL Conference*, Boston, Oct. 7-9, 2010, MA, USA.
- *ASME Summer Heat Transfer Conference*, Jul. 21-23, 2012, Rio Grande, Puerto Rico, USA.
- *ASME International Mechanical Engineering Congress and Exposition*, Nov. 11-17, 2011, Denver, Colorado, USA.
- *Next Generation Sub-Orbital Researchers Conference*. Boulder, 2009, CO, USA. Times Cited: 1
- *62nd Annual Meeting of the APS Division of Fluid Dynamics, Volume 54, Number 19.*, Minneapolis, MN, USA. (2009). <http://meetings.aps.org/link/BAPS.2009.DFD.LL.5>
- *62nd Annual Meeting of the APS Division of Fluid Dynamics, Volume 54, Number 19.*, Minneapolis, MN, USA. (2009). <http://meetings.aps.org/link/BAPS.2009.DFD.HK.3>
- *62nd Annual Meeting of the APS Division of Fluid Dynamics, Volume 54, Number 19.*, Minneapolis, MN, USA. (2009). <http://meetings.aps.org/link/BAPS.2009.DFD.HK.4>
- *62nd Annual Meeting of the APS Division of Fluid Dynamics, Volume 54, Number 19.*, Minneapolis, MN, USA. (2009). <http://meetings.aps.org/link/BAPS.2009.DFD.HK.5>
- *ECI International Conference on Heat Transfer and Fluid Flow in Micro-scale*, Sep. 21-26, 2008, Whistler.
- *Interdisciplinary Transport Phenomena V: Fluid, Thermal, Biological, Materials and Space Sciences.*, Oct. 14-19, 2007, Bansko, Bulgaria.
- *IMECE2007-41304: Symposium on Gas Liquid and Phase Change Flows*, IMECE2007, Nov. 11-16, 2007, Seattle, WA, USA.
- *IMECE2007-41306: Symposium on Gas Liquid and Phase Change Flows*, IMECE2007, Nov. 11-16, 2007, Seattle, WA, USA.
- *IMECE2007-4131: Symposium on Gas Liquid and Phase Change Flows*, IMECE2007, Nov. 11-16, 2007, Seattle, WA, USA.
- *8th National & 7th ISHMT-ASME Heat and Mass Transfer Conference*. IIT, Jan. 4-6, 2006, Guwahati, India.
- *Transport Phenomena in Microgravity and Space Sciences IV*. Engineering Conferences International, Aug. 7-12, 2005, Tomar, Portugal.
- *IMECE2005-80445: Symposium on Gas Liquid and Phase Change Flows*, Nov. 5-11, 2005, Orlando, FL, USA.
- *IMECE2005-80221: Symposium on Gas Liquid and Phase Change Flows*, Nov. 5-11, 2005, Orlando, FL, USA.
- *IMECE2005-80441: Symposium on Gas Liquid and Phase Change Flows*, Nov. 5-11, 2005, Orlando, FL, USA.
- *IMECE2005-83211: Symposium on Gas Liquid and Phase Change Flows*, Nov. 5-11, 2005, Orlando, FL, USA.

- *International Conference on Computational & Experimental Engineering and Sciences*, Dec. 8-10, 2005, Jaipur, India.
- *Microgravity Transport Processes in Fluid, Thermal, Biological and Material Sciences III*, Engineering Conferences International, Sep. 14-19, 2003, Davos, Switzerland.
- *ASME Summer Heat Transfer Conference*, Jul. 21-23, 2003, Las Vegas, NV, USA.
- *Computational Simulations for Internal Condensing Flows. Heat Transfer Seminar Series*, Feb. 23, 2003, Purdue University, West Lafayette, IN, USA.
- *Free Surface Tracking and Steady/Unsteady Computational Simulations for Internal Condensing Flows. Symposium on Fluid-Physics and Heat Transfer For Macro- And Micro-Scale Gas-Liquid and Phase-Change Flows*. International Mechanical Engineering Congress and Exposition, Nov. 11-16, 2001, New-York, NY, USA.
- Yu, G., and Narain, A., *Computational Simulations and Classification of Flow Domains for Laminar/Laminar Annular/Stratified Condensing Flow*. 5th International Conference on Integral Methods in Science and Engineering. Michigan Technological University, Aug. 10-13, 1998, Houghton, MI, USA.
- Lui, Q., and Narain, A., *Computational Simulation and Interfacial Shear for Annular Condensing Downward Flows in a Vertical Pipe for Turbulent Vapor and Laminar Condensate*. 5th International Conference on Integral Methods in Science and Engineering. Michigan Technological University, Aug. 10-13, 1998, Houghton, MI, USA.
- Narain, A., and Yu, G., *Symposium on Gas-Liquid Flows in Fluid Mechanics and Heat Transfer*, Nov. 16-21, 1997, Dallas, TX, USA.
- *Multiphase and Particle-Laden Flows*. 48th Annual Meeting of American Physical Society/ Division of Fluid Dynamics, Nov. 19-21, 1995, Irvine, CA, USA.
- *Two Fluid Flows-With or Without Phase Change*. Symposium at 1994 ASME Winter Annual Meeting, Nov. 6-11, 1994, Chicago, IL, USA.
- *Fundamentals of Phase Change —Boiling and Condensation*. AIAA/ASME Thermophysics and Heat Transfer Conference, Jun. 20-23, 1994, Colorado Springs, CO, USA.
- *Symposium at Winter Annual Meeting of ASME*. Anaheim, Aug., 1992, CA, USA.
- *Summer Annual Meeting of ASME-AMD*, Jun. 16-19, 1991, Columbus, OH, USA.
- *34th Annual Meeting of the Society for Natural Philosophy*, Apr. 6-8, 1990, Lincoln, NE, USA.
- *Canadian Society of Mechanical Engineers Forum 1990*. University of Toronto, Jun. 3-8, 1990, Toronto, Canada.
- *11th U.S. National Congress of Applied Mechanics*, May 21-25, 1990, Tucson, AZ, USA.
- *IMA Workshop on two phase flows in Fluidized Beds, Sedimentation, and Granular Flows*, University of Minnesota, Jun. 3-10, 1989, Minneapolis, MN, USA.
- *59th Annual Meeting of the Society of Rheology*, Oct. 19, 1987, Atlanta, GA, USA.
- *Mini-Symposium on Hyperbolic Phenomena in flows of Viscoelastic Fluids*, University of Minnesota, Oct. 8-10, 1986, Minneapolis, MN, USA.
- *Mini-Symposium on Hyperbolic Phenomena in flows of Viscoelastic Fluids*, University of Minnesota, Oct. 8-10, 1986, Minneapolis, MN, USA.
- *10th U.S. National Congress of Applied Mechanics*, University of Texas, Jun. 16, 1986, Austin, TX.
- *22nd Annual Meeting of the Society of Engineering Science*, Pennsylvania State University, University Park, Oct. 8, 1985, PA, USA.
- *Conference on Integral Methods in Science and Engineering*, University of Texas , Mar. 20, 1985, Arlington, TX, USA.

- 27th Annual Meeting of the Society for Natural Philosophy, University of Wisconsin-Madison, Nov. 30, 1984, WI, USA.

MEDIA HIGHLIGHTS OF RESEARCH

- *Research.gov* 2013 SEE innovation highlight article: *Adapting Boilers and Condensers for Earth and Space*.
- NSF CBET-1033591 research accomplishments highlights - Flow Condensers and flow boilers for innovative micro-scale and space-based thermal systems, 2012. Also see *Research.gov* NSF research accomplishments highlights, 2013.
- End of 2012 research accomplishments highlighted by NSF at NSF-EPRI workshop held at ASME IMECE 2012, Nov. 9-15, 2012, Houston, TX, USA.

CONSULTANCY

- Procter and Gamble, Westchester, OH, USA. (2006). *Development of a thermal design code for a chemical on a conveyor belt that moves through a chamber and is exposed to condensation*.
- Mathematics Research Center, University of Wisconsin, Madison, WI, USA. (1984). Consultant (Viscoelasticity).

NATIONAL LEADERSHIP AND SERVICE ACTIVITIES

Invited Member of Review Panels and Future Research Direction Workshops for Government Agencies

- NSF-CBET Review Panels, 2013, 2012, 2011, and 2010 (time-intensive contributions)
- NSF Workshop for Frontiers in Transport Phenomena Research and Education: Energy Systems, Biological Systems, Security, Information Technology and Nanotechnology, at the University of Connecticut in Storrs (2007)
- NASA's Office of Biological and Physical Science sponsored workshop for identifying exciting unanswered questions regarding "Multiphase Flow" and "Fluid Stability and Dynamics" in reduced gravity, especially as it relates to the design and operation of power, propulsion and thermal management systems. Hilton Garden Inn, Cleveland, OH, USA (2003)
- Army Research Office Workshop on "Constitutive Modeling". Virginia Polytechnic, Blacksburg, VA, USA (1985)

Professional Society

Leadership: Chair, Vice-Chair, Memberships

- Member: Multi-Phase Flow Committee of the ASME's Fluids Engineering Division; K-8 and K-12 committees of ASME's Heat Transfer Division; Fluid Mechanics Technical Committee ASME's Applied Mechanics Division.
- ASME Heat Transfer Division, Theory and Fundamental Research (K8 Committee), Chair (2017) and Vice-Chair (2014-2017).

- ASME Applied Mechanics Division, Fluid Mechanics Technical Committee, Chair (2000-2003) and Vice-Chair

Symposium/Conference Organization Leaderships

American Society of Mechanical Engineers

- IMECE 2016 Topic Chair/Session Organizer (Fundamentals of Boiling/Condensation including Nano-scale Effects, 10-5-1-10-5-3, lead for K-8) at ASME International Mechanical Engineering Congress and Exposition, Phoenix, Arizona (Nov. 11-17, 2016)
- ASME 2016 SHTC Topic Chair/Two sessions plus session chair Organizer (Symposium on Fundamentals of Phase-Change Heat Transfer- Boiling and Condensation, 3-5-1 and 3-5-2, lead for K-8) at ASME International Mechanical Engineering Congress and Exposition, Washington, DC (July 10-16, 2016)
- ASME 2016 Track Chair/ 3 sessions at HD/FEDSM/ICNMM conference's Interdisciplinary track (4-1 to 4-3) on: "Boiling and condensation in macro, micro, and nano systems," Washington, DC (July 10-16, 2016)
- IMECE 2015 Topic Chair/Session Organizer (Symposium on Fundamentals of Phase-Change Heat Transfer- Boiling and Condensation, 10-9-1-10-9-3, lead for K-8) at ASME International Mechanical Engineering Congress and Exposition, Houston, Texas (Nov. 13-19, 2015)
- IMECE 2014 Topic Chair/Session Organizer (10-9: Symposium on Fundamentals of Phase-Change Heat Transfer- Boiling and Condensation) at ASME International Mechanical Engineering Congress and Exposition, Montreal, Canada (Nov. 14-20, 2014)
- IMECE 2014 Topic Chair (10-11: Fundamentals of Single Phase Convection) at ASME International Mechanical Engineering Congress and Exposition, Montreal, Canada (Nov. 14-20, 2014)
- IMECE 2014 Topic Chair (10-12: Fundamentals of Radiative Transport including Nanoscale Effects) at ASME International Mechanical Engineering Congress and Exposition, Montreal, Canada (Nov. 14-20, 2014)
- IMECE 2014 Topic Chair (10-13: Advances in Interfaces and Heat Sinks including Nano-scale Conduction and Interfacial Effects) at ASME International Mechanical Engineering Congress and Exposition, Montreal, Canada (Nov. 14-20, 2014)
- IMECE 2014 Topic Chair/Session Organizer (10-14: Fundamentals of Multi-scale Modeling) at ASME International Mechanical Engineering Congress and Exposition, Montreal, Canada (Nov. 14-20, 2014)
- IMECE 2014 Topic Chair (10-15 Panel on Phonon Accumulation Function) at ASME International Mechanical Engineering Congress and Exposition, Montreal, Canada (Nov. 14-20, 2014)
- Track Chair (with significant paper review and paper selection responsibilities) for 22nd National and 11th International ISHMT-ASME Heat and Mass Transfer Conference, IIT Kharagpur, India (Dec. 30, 2013,)
- Organizer, Condensation Heat Transfer, ASME 2013 Summer Heat Transfer Conference, Minneapolis, MN, USA (Jul. 14 – 19, 2013)
- Organizer / Co-Organizer, Symposium on Fundamentals of Phase-Change Heat Transfer (seven sessions 7-3: 4, 13 to 16, 18, and 23). International Mechanical Engineering Congress and Exposition, Houston, TX, USA (Nov. 9-15, 2012)
- Organizer, Symposium on Gas Liquid and Phase Change Flows, Orlando, FL, USA (Nov. 13-19, 2009)
- Organizer, Session (13-16-1), Symposium on Gas Liquid and Phase Change Flows, Boston, MA, USA (Oct. 31-Nov 6, 2008)

- Lead Organizer, International Symposium on Gas- Liquid and Phase-Change Flows at Macro- And Micro-Scales, Seattle, WA, USA (Nov. 11-16, 2007)
- Lead Organizer, 6th Session, International Symposium on Gas- Liquid and Phase-Change Flows at Macro- and Micro-Scales, Orlando, FL, USA (Nov. 13-18, 2005)
- Lead Organizer, 8th Session, International Symposium on Fluid-Physics and Heat Transfer for Macro- and Micro-Scale Gas-Liquid and Phase-Change Flows, New York, NY, USA (Nov. 11-16, 2001)
- Lead Organizer, 4th Session, International Symposium on Gas Liquid Flows in Fluid Mechanics and Heat Transfer (Winter Annual Meeting), Dallas, TX, USA (Nov. 16-21, 1997)
- Lead Organizer, Symposium on Two Fluid Flows with or without Phase Change, ASME Winter Annual Meeting (International Mechanical Engineering Congress and Exposition), Chicago, IL, USA (Nov. 6-11, 1994)

Society of Engineering Science

- Organizer, Symposium on Heat Transfer I for the Society of Engineering Science 32nd Annual Technical Meeting, New Orleans, LA, USA (Oct. 29-Nov. 2, 1995)

Integral Methods in Science and Engineering

- Co-Organizer (with Bertram, B., Organizer; Sikarskie, D., Struthers, A., and Vable, M.) for Integral Methods in Science and Engineering, Michigan Technological University (1998)

Session-Chair/Co-chair at Professional Meetings

- Session Chair (Multi-phase Transport Processes/Phase-Change/Phase-Separation, 10:00 – 11:30 am) 22nd National and 11th International ISHMT-ASME Heat and Mass Transfer Conference, IIT Kharagpur, India (Dec. 30, 2013)
- Session Chair (Energy, 12:00 – 1:30 pm) 22nd National and 11th International ISHMT-ASME Heat and Mass Transfer Conference, IIT Kharagpur, India (Dec. 30, 2013)
- Session Chair (Multi-phase Transport Processes/Phase-Change/Phase-Separation, 5:00 – 6:30 pm) 22nd National and 11th International ISHMT-ASME Heat and Mass Transfer Conference, IIT Kharagpur, India (Dec. 30, 2013)
- Session Chair (3.3.2, Flow Boiling and Condensation) at ASME Summer Heat Transfer Conference, Minneapolis, MN (Jul. 14-19, 2013)
- Session Chair (3.3.4, Condensation) at ASME Summer Heat Transfer Conference, Minneapolis, MN (Jul. 14-19, 2013)
- Chair (1 session) / Co-Chair (6 sessions), Symposium on Fundamentals of Phase-Change Heat Transfer, International Mechanical Engineering Congress and Exposition. Houston, TX, USA (Nov. 9-15, 2012)
- Chair, Interdisciplinary Transport Phenomena VI: Fluid, Thermal, Biological, Materials and Space Sciences, Session, Volterra, Italy (Oct. 4-9, 2009)
- Chair, Symposium on Gas Liquid and Phase Change Flows, ASME IMECE, Orlando, FL, USA (Nov. 13-19, 2009)
- Chair, Symposium on Gas Liquid and Phase Change Flows Session (13-16-1), ASME IMECE, Boston, MA, (2009) (Oct. 31-Nov. 6, 2008)
- Co-chair, Symposium on Gas Liquid and Phase Change Flows (Two Sessions), ASME IMECE, Seattle, WA, USA (Nov. 11-16, 2007)

- Chair, Interdisciplinary Transport Phenomena V: Fluid, Thermal, Biological, Materials and Space Sciences, Bansko, Bulgaria (Oct. 14-9, 2007)
- Co-chair / Chair, Symposium on Gas Liquid and Phase Change Flows (Four Sessions), ASME IMECE, Orlando, FL, USA (Nov. 5-11, 2005)
- Chair, Transport Phenomena in Microgravity and Space Sciences IV, Engineering Conferences International, Tomar, Portugal (Aug. 7-12, 2005)
- Co-chair / Chair, Symposium on Gas-Liquid Flows in Fluid Mechanics and Heat Transfer, ASME IMECE, Dallas, TX, USA (Nov. 16-21, 1997)
- Chair, “Heat Transfer I” Session, Society of Engineering Science 32nd Annual Technical Meeting, New Orleans, LA, USA (Oct. 30, 1995)

OTHER SERVICE ACTIVITIES

Michigan Technological University

- Member, ME-EM Department Executive Committee, (2015--Present)
- Member, ME-EM Department Curriculum Committee, (2013-Present)
- Chair, ME-EM Department Computer Committee, Annual Budget: \$740,000 (2007–2010)
- Mentor (Chair-Designated), ME-EM Assistant Professor Dr. Jeffrey Allen (2004–2008) and Dr. A. Mukherjee (2006–2007)
- Member, ME-EM Faculty Recruitment Committee (2000–2006)
- University Library Liaison Committee, (Mechanical Engineering representative) yearly acquisition of books by the University Library System (1990-2010)
- Member, ME-EM Graduate Seminar Committee (2003)
- Mechanical Engineering Computer Committee (1997–2002)
- Chair, ME-EM Department Chair Evaluation Committee (1999)
- Member, ME-EM Faculty Development (Promotion and Tenure) Committee (1990-1992, 1992-1994 and 1994–1996)
- Chair/Member, 20-plus Mechanical Engineering Ph. D. Committees (Written and Oral) for Energy/Thermo-Fluids and Mathematics Exams
- Course Coordinator, MEEM 3210, 3230 (past), 5210, 5280 and 6240

Public Services

- Voluntary contributions to IIT-Patna’s curriculum development (2013-2014)
- Working with three universities (IIT-P has expressed interest) in India for initiating graduate school co-operation with MEEM at MTU
- Initiated meetings (over 2013-2014) with US-India Multinationals, GoI, and US Government Agencies to advance research in the Energy sector (emphasis on clean and efficient energy generation that advances global energy security).
- Several visits and experiment demonstrations to laboratory; 2004 “fly-in” group of prospective college freshmen considering engineering, industry/university visitors to MEEM
- Judge, Ice-Sculptors during 2004 Winter Carnival (for Blue Key)
- Faculty Advisor, India Students Association, Michigan Technological University (1999–2000)
- Judge, Michigan Technological University Graduate Students Council’s Research Poster Competitions (1996, 1997, and 1998)

- United Way, ME-EM Representative, (1985)
- ME-EM Michigan Tech Fund Representative (1984)

TEACHING

Courses Taught

Graduate (Michigan Technological University)

- Advanced Fluid Mechanics (MEEM 5210/EM531, regularly 1985 - present)
- Advanced Heat Transfer (MEEM 5230, regularly 2000 - present)
- Two Phase Flow and Heat Transfer (MEEM 5280)
- Advanced Fluid Mechanics II (EM632)

Undergraduate (Michigan Technological University)

- Heat Transfer (ME328/MEEM3230, ME327, Regularly 1995–Present)
- Fluid Mechanics (EM431, EM332/MEEM3210, Regularly 1983–Present)
- Thermodynamics (ME223, ME320)
- Dynamics (EM212)

Undergraduate (University of Minnesota, 1988–1989)

- Incompressible Boundary Layer Theory (Senior Level, AEM 5202)
- Honors Mechanics I (Statics & Strength of Materials, AEM 3816H)
- Dynamics (Junior Level, AEM 3036)