Umesh Madanan

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Research Interests

Buoyancy-driven convection at high Rayleigh numbers; heat and mass transfer analogies; optical techniques in thermo-fluids; gas turbine heat transfer; two-phase flows in micro- and mini-tubes; pool boiling of dilute emulsions; porous-media convection

Education

2019 | **Ph.D. | Mechanical Engineering**
University of Minnesota Twin Cities, USA
- Areas of specialization : Heat Transfer, Fluid Mechanics
- Dissertation : High-Rayleigh-Number Thermal Convection of Compressed Gases in Inclined Rectangular Enclosures of Varied Aspect Ratios
- Advisor : Richard J. Goldstein

2012 | **M.Tech. | Mechanical Engineering**
Indian Institute of Technology Madras, India
- Area of specialization : Thermal Engineering
- Project : Experimental Investigation on Two-Phase Flow in a Set of Parallel Minichannels
- Advisor(s) : Sarit K. Das and Dhiman Chatterjee

2007 | **B.Tech. (Hons.) | Mechanical Engineering**
University of Calicut, India

Professional Experience

2020 - Present | **Assistant Professor | Department of Mechanical Engineering**
Indian Institute of Technology Kanpur, India
Kanpur, India

2019 | **Post-doctoral Researcher | Heat Transfer Laboratory**
Department of Mechanical Engineering
University of Minnesota Twin Cities, USA

2012 - 2014 | **Edison Engineer | Advanced Technology Operations**
GE Power & Water, John F. Welch Technology Centre
Bengaluru, India

2007 - 2009 | **Assistant Manager | Product Development**
Mahindra & Mahindra Automotive Ltd
Nashik, India

Publications & Presentations

Book Chapters

Goldstein, R. J. and **Madanan, U.**, 2021. Thermal convection studies at the University of Minnesota. *Advances in Heat Transfer - Volume 53* [under preparation]

Peer-reviewed Articles

[15] Srinivasan, V., **Madanan, U.** and Goldstein, R. J., 2020. Turbulent Rayleigh-Bénard convection of compressed gases : effect of sidewall conductance. *International Journal of Heat and Mass Transfer* [under preparation]

[14] Kulkarni, K. S., **Madanan, U.** and Goldstein, R. J., 2020. Effect of freestream turbulence on recovery factor of a thermocouple probe and its consequences. *International Journal of Heat and Mass Transfer*, Vol. 152 (p.119498)

[13] **Madanan, U.** and Goldstein and R. J., 2020. High-Rayleigh-number thermal convection of compressed gases in inclined rectangular enclosures. *Physics of Fluids*, Vol. 32(1) (p.017103)

[12] **Madanan, U.** and Goldstein, R. J., 2019. Effect of sidewall conductance on Nusselt number for Rayleigh-Bénard convection : a semi-analytical and experimental correction. *Journal of Heat Transfer*, Vol. 141(12) (p.122504)

[11] Goldstein, R. J., **Madanan, U.** and Kuehn, T. H., 2019. Simplified correlations for free convection from a horizontal isothermal cylinder. *Applied Thermal Engineering*, Vol. 161 (p.113832)

[10] **Madanan, U.** and Goldstein, R. J., 2019. Experimental investigation on very-high-Rayleigh-number thermal convection in tilted rectangular enclosures. *International Journal of Heat and Mass Transfer*, Vol. 139 (pp.121-129)

[9] **Madanan, U.** and Goldstein, R. J., 2019. Thermal convection in horizontal rectangular enclosures at moderate Rayleigh numbers : effect of sidewall conductance and aspect ratio. *International Journal of Heat and Mass Transfer*, Vol. 136 (pp.178-185)

[8] **Madanan, U.**, Chatterjee, D. and Das, S. K., 2018. A note on adiabatic two-phase flow maldistribution in a set of horizontal parallel minichannels with I-type and Z-type configurations. *Chemical Engineering and Processing : Process Intensification*, Vol. 132 (pp.34-41)

[7] **Madanan, U.** and Goldstein, R. J., 2018. Prediction and correction of sidewall conductance for natural convection in horizontal enclosures. In proceedings of the *16th International Heat Transfer Conference* (pp. 2731-2740)

[6] **Madanan, U.**, Nayak, R., Chatterjee, D. and Das, S. K., 2018. Experimental investigation on two-phase flow maldistribution in parallel minichannels with U-type configuration. *The Canadian Journal of Chemical Engineering*, Vol. 96(8) (pp.1820-1828)

[5] Kulkarni, K. S., **Madanan, U.**, Simon, T. W. and Goldstein, R. J., 2018. Experimental validation of a boundary layer convective heat flux measurement technique. *Journal of Heat Transfer*, Vol. 140(7) (p.074501)

[4] **Madanan, U.**, 2017. Prediction of two-phase mass split in mini tubes. *Chemical Engineering and Processing : Process Intensification*, Vol. 120 (pp.216-219)

[3] Mittal, R., **Madanan, U.** and Goldstein, R. J., 2017. The heat/mass transfer analogy for a backward facing step. *International Journal of Heat and Mass Transfer*, Vol. 113 (pp.411-422)

[2] Kulkarni, K. S., **Madanan, U.**, Mittal, R. and Goldstein, R. J., 2017. Experimental validation of heat/mass transfer analogy for two-dimensional laminar and turbulent boundary layers. *International Journal of Heat and Mass Transfer*, Vol. 113 (pp.84-95)

[1] Papa, F., **Madanan, U.** and Goldstein, R. J., 2017. Modeling and measurements of heat/mass transfer in a linear turbine cascade. *Journal of Turbomachinery*, Vol. 139(9) (p.091002)

Conference Presentations

[3] **Madanan, U.** and Goldstein, R. J. (July 2019). Effect of sidewall conductance on Nusselt number for Rayleigh-Bénard convection : a fin model and experimental correction. *2019 ASME Summer Heat Transfer Conference*, Seattle, USA

[2] **Madanan, U.** and Goldstein, R. J. (August 2018). Prediction and correction of sidewall conductance for natural convection in horizontal enclosures. Poster session at the *16th International Heat Transfer Conference*, Beijing, China

[1] Papa, F., **Madanan, U.** and Goldstein, R. J. (April 2017). Numerical and experimental investigation of heat/mass transfer in a linear turbine cascade. *2nd Thermal and Fluids Engineering Conference*, Las Vegas, USA

Teaching Experience

2019 | **Teaching Fellow | Department of Mechanical Engineering**
University of Minnesota Twin Cities, USA
Spring 2019 Heat Transfer

2015 - 2018 | **Teaching Assistant | Department of Mechanical Engineering**
University of Minnesota Twin Cities, USA

Fall 2018	Heat Transfer
Spring 2018	Basic Mechanical Measurements Laboratory
Fall 2017 | Fall 2016 | Fall 2015	Thermal Engineering Laboratory
Spring 2017	Heat Transfer
Spring 2016	Fluid Mechanics

Certifications

2014 **Edison Engineering B-Course Practicum and Gas Turbine Teardown School**, Energy Technical Training, General Electric, Schenectady, USA

2013 **Foundations of Leadership**, Crotonville Leadership, General Electric, Hyderabad, India

2013 **Power Plant Engineering Fundamentals**, John F. Welch Technology Centre, General Electric, Bengaluru, India

2013 **Advanced Courses in Engineering**, John F. Welch Technology Centre, General Electric, Bengaluru, India

Service

Peer Reviewer, International Journal of Thermophysics, Springer US

Reviewer, Council of Graduate Students (CoGS) Grants Review Committee, University of Minnesota Twin Cities, USA

Reviewer, OPUS 14 : General Grants, National Science Center, Government of Poland

Session Chair, 2nd Thermal and Fluids Engineering Conference, Las Vegas, USA

Skills

Experimental Techniques	Naphthalene sublimation mass transfer technique, hot-wire anemometry, flow visualization techniques (Schlieren, Shadowgraphy, Interferometry), precision temperature calibration
Analysis and Modeling Tools	ANSYS (Structural Analysis, CFX, and Workbench), FLUENT (GAMBIT), Unigraphics NX, HyperMesh, SolidWorks, CATIA, Pro/ENGINEER
Programming Languages	LabVIEW, MATLAB, C/C++

Software | Engineering Equation Solver

Awards and Honors

2018-19 Graduate Teaching Fellowship, Department of Mechanical Engineering, University of Minnesota Twin Cities, USA

2017-18 Outstanding Teaching Assistant Mention, Department of Mechanical Engineering,
2016-17 University of Minnesota Twin Cities, USA

2014-15 Graduate Student Fellowship, Department of Mechanical Engineering, University of Minnesota Twin Cities, USA

2014 Winner of ENG@GE Robotics Competition, GE Global Learning Technology, Bengaluru, India

2012 Prof. B. Sengupto Prize and Institute Medal, 1^{st} rank in the Department of Mechanical Engineering, Indian Institute of Technology Madras, India

2011 Prof. N. Venkatarayulu Memorial Prize and Institute Medal, 1^{st} rank in the Thermal Engineering Stream, Indian Institute of Technology Madras, India

2011 Ramanan Ramamurthy Memorial Prize and Institute Medal, 1^{st} rank in the Department of Mechanical Engineering, Indian Institute of Technology Madras, India

Professional Affiliations

Indian Society for Heat and Mass Transfer

The American Institute of Aeronautics and Astronautics