

# Umesh Madanan

Assistant Professor, Department of Mechanical Engineering  
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## RESEARCH INTERESTS

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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; eco-friendly means of augmenting pool boiling heat transfer; porous-media convection

## EDUCATION

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|------|---|
| 2019 | <b>Ph.D.   Mechanical Engineering</b><br>UNIVERSITY OF MINNESOTA TWIN CITIES, USA <ul style="list-style-type: none"><li>&gt; Areas of specialization: Heat Transfer, Fluid Mechanics</li><li>&gt; Dissertation: High-Rayleigh-Number Thermal Convection of Compressed Gases in Inclined Rectangular Enclosures of Varied Aspect Ratios</li><li>&gt; Advisor: Richard J. Goldstein</li></ul> |
| 2012 | <b>M.Tech.   Mechanical Engineering</b><br>INDIAN INSTITUTE OF TECHNOLOGY MADRAS, INDIA <ul style="list-style-type: none"><li>&gt; Area of specialization: Thermal Engineering</li><li>&gt; Project: Experimental Investigation on Two-Phase Flow in a Set of Parallel Minichannels</li><li>&gt; Advisor(s): Sarit K. Das and Dhiman Chatterjee</li></ul>                                   |
| 2007 | <b>B.Tech. (Hons.)   Mechanical Engineering</b><br>UNIVERSITY OF CALICUT, INDIA   |

## PROFESSIONAL EXPERIENCE

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|----------------|--|
| 2020 - Present | <b>Assistant Professor   Department of Mechanical Engineering</b><br>INDIAN INSTITUTE OF TECHNOLOGY KANPUR, INDIA<br>Kanpur, India             |
| 2019           | <b>Post-doctoral Researcher   Heat Transfer Laboratory</b><br>Department of Mechanical Engineering<br>UNIVERSITY OF MINNESOTA TWIN CITIES, USA |
| 2012 - 2014    | <b>Edison Engineer   Advanced Technology Operations</b><br>GE POWER & WATER, JOHN F. WELCH TECHNOLOGY CENTRE<br>Bengaluru, India               |
| 2007 - 2009    | <b>Assistant Manager   Product Development</b><br>MAHINDRA & MAHINDRA AUTOMOTIVE LTD<br>Nashik, India  |

## SPONSORED PROJECTS

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“Eco-friendly Techniques for Pool Boiling Enhancement in Water on Textured Surfaces” (PI| Initiation Grant, IIT Kanpur | 2021-23)

“Fine-grained Porous Media Convection at High Rayleigh Numbers” (PI | DST-SERB SRG | 2021-23)

“Microchannel Condenser Design and Development” (co-PI| Consultancy| Godrej & Boyce Appliances | 2022-24)

## PUBLICATIONS & PRESENTATIONS

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### INVITED BOOK CHAPTERS

Goldstein, R. J. and **Madanan, U.**, 2022. Thermal convection studies at the University of Minnesota. *Advances in Heat Transfer - Volume 54* [forthcoming, June 2022]

### INTERNATIONAL JOURNAL ARTICLES

[14] Srinivasan, V., **Madanan, U.** and Goldstein, R. J., 2022. Turbulent Rayleigh-Bénard convection of compressed gas: effect of sidewall conductance. *International Journal of Heat and Mass Transfer*, Vol. 182 (p.121965)

[13] 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)

[12] **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)

[11] **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)

[10] 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)

[9] **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)

[8] **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)

[7] **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)

[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)

## OTHER PEER-REVIEWED ARTICLES

**Madanan, U.**, 2021. A step-by-step guide for precision thermocouple calibration. *Resonance - Journal of Science Education: Indian Academy of Sciences*, Vol. 26 (10) (pp.1451-1463)

## CONFERENCE PROCEEDINGS & PRESENTATIONS

[7] Alam, P. and **Madanan, U.**, Numerical Investigation into Effect of Sidewall Thermal Conductance in Darcy-Bénard Convection, *Proceedings of the 1st International Conference in Fluid Thermal and Energy Systems*, June 9-11, 2022, NIT Calicut, Kerala, India [accepted]

[6] Sudheer, A. P. and **Madanan, U.**, Numerical Study on Heat Transfer Augmentation in a Square Minichannel Heat Sink using Butterfly Inserts, *Proceedings of the 1st International Conference in Fluid Thermal and Energy Systems*, June 9-11, 2022, NIT Calicut, Kerala, India [accepted]

[5] Sen, N., Pisharody, A. S. and **Madanan, U.**, Empirical and Machine Learning Approaches for Turbulent Thermal Convection in Rectangular Enclosures Tilted at Acute Angles, *Proceedings of the 1st International Conference in Fluid Thermal and Energy Systems*, June 9-11, 2022, NIT Calicut, Kerala, India [accepted]

[4] **Madanan, U.** and Prajapati, S. (December 2021). Computational study on jet breakup behavior of a high-density liquid jet entering a quiescent immiscible liquid pool, *Proceedings of the 26th National and 4th International ISHMT-ASTFE Heat and Mass Transfer Conference*, Chennai, Tamil Nadu, India

[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 *16<sup>th</sup> 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. *2<sup>nd</sup> Thermal and Fluids Engineering Conference*, Las Vegas, USA

## TEACHING EXPERIENCE

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2020 - Present	<b>Instructor   Department of Mechanical Engineering</b> INDIAN INSTITUTE OF TECHNOLOGY KANPUR, INDIA 2021-22 - Even ME642A (Convective Heat and Mass Transfer) 2021-22 - Odd ME340A (Introduction to Refrigeration and Air Conditioning) 2020-21 - Even ME642A (Convective Heat and Mass Transfer)
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2020 - Present	<b>Tutor   Department of Mechanical Engineering</b> INDIAN INSTITUTE OF TECHNOLOGY KANPUR, INDIA 2021-22 - Odd ESO204A (Fluid Mechanics and Rate Processes) 2020-21 - Odd ESO204A (Fluid Mechanics and Rate Processes)
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2019	<b>Teaching Fellow   Department of Mechanical Engineering</b> UNIVERSITY OF MINNESOTA TWIN CITIES, USA Spring 2019 Heat Transfer
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2015 - 2018	<b>Teaching Assistant   Department of Mechanical Engineering</b> UNIVERSITY OF MINNESOTA TWIN CITIES, USA
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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

## STUDENT SUPERVISION

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<b>Ph.D.</b>	Parvez Alam (Joined April 2021) Gyanesh Kumar (Joined April 2021)
<b>M.Tech.</b>	Nabeel Aahmad (Joined November 2020) Adithya P. Sudheer (Joined November 2020) Rahul Pandey (Joined October 2021)
<b>SURGE-2022 Intern</b>	Aritri Halder (Jadavpur University)
<b>Intern</b>	Niloy Sen (Jadavpur University)

## SERVICE

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**Member**, NIT B.Tech. Direct Ph.D. Admissions Committee (Department of Mechanical Engineering), Indian Institute of Technology Kanpur

**Review Editor**, Frontiers in Thermal Engineering (Heat Transfer and Thermal Power)

**Faculty Coordinator**, Heat Transfer Laboratory (Department of Mechanical Engineering), Indian Institute of Technology Kanpur

**Member**, M.S. and Ph.D. Admissions Committee (Department of Mechanical Engineering), Indian Institute of Technology Kanpur

**Panelist**, The Senate Scholarships and Prizes Committee, Indian Institute of Technology Kanpur

**Institute Representative**, IIT JEE (Advanced) 2020

**Member**, Teaching Assistant Affairs Committee, Department of Mechanical Engineering, Indian Institute of Technology Kanpur

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

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

**Session Chair**, 2<sup>nd</sup> Thermal and Fluids Engineering Conference, Las Vegas

**Peer Reviewer**: Heat and Mass Transfer, Proceedings of the Institution of Mechanical Engineers, Part E: Journal of Process Mechanical Engineering, International Journal of Thermophysics

## CERTIFICATIONS

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- 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

## AWARDS AND HONORS

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- 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, University of Minnesota Twin Cities, USA
- 2016-17
- 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<sup>st</sup> rank in the Department of Mechanical Engineering, Indian Institute of Technology Madras, India
- 2011 Prof. N. Venkatarayulu Memorial Prize and Institute Medal, 1<sup>st</sup> rank in the Thermal Engineering Stream, Indian Institute of Technology Madras, India
- 2011 Ramanan Ramamurthy Memorial Prize and Institute Medal, 1<sup>st</sup> rank in the Department of Mechanical Engineering, Indian Institute of Technology Madras, India

## SKILLS

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

## PROFESSIONAL AFFILIATIONS

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- Member, The Institution of Engineers (India)
- Member, The American Society of Mechanical Engineers
- Life Member, Indian Society for Heat and Mass Transfer
- Life Member, National Society for Fluid Mechanics and Fluid Power

Last updated on 15th May 2022