

MR. AVINASH UPADHYAY

Date of Birth: 31st August, 1996

Research Scholar

Thermal and Fluid Transport Laboratory (TFTL)

Indian Institute of Technology Patna, India

[Google Scholar](#) | [LinkedIn](#) | [ResearchGate](#) | [ORCiD](#)

✉ avinash_2121me24@iitp.ac.in

☎ +91-7017550285

Address: TFTL, Block III, IIT Patna,
Bihta, Bihar-801103, India

Research Interests

Thermal Management, Colloids and Interfaces, Bubble Acoustics, Machine Learning, Multiphase Simulations

Software Skills

Microsoft Office, ANSYS Fluent, MATLAB, C, Origin, Image J, SOLIDWORKS, AutoCAD, LabVIEW

Instrument Operation

High-Speed Camera (Phantom-v 7.3, V410L, V640L), Infrared Camera (Flir-SC7000), Micro Goniometer (Kyowa-MCA3), Hydrophone (B&K-8103), Data Acquisition Unit (Agilent, NI and B&K), DC Power Supply (Agilent)

Education

Degree	Institute	Duration	C.P.I./%
Ph.D. (Mechanical)	Indian Institute of Technology Patna	July 2021 - Present	9.50
M.Tech. (Mechanical)	Indian Institute of Technology Patna	July 2019 - June 2021	9.71
B.Tech. (Mechanical)	I E T Mahatma Jyotiba Phule Rohilkhand University, Bareilly (U.P.), India	August 2014 - June 2018	82.30 %

Professional Experiences

Teaching/Industrial	Role	Duration
Teaching Assistant at IIT Patna	➤ Undergraduate Course: Engineering Mechanics (ME 1102); Instructor: Dr. Rishi Raj and Dr. Sunil Kumar Singh; No. of Students: 375	August 2024 – Present
	➤ Undergraduate Course: Engineering Mechanics (ME 102); Instructor: Dr. Rishi Raj and Dr. Sunil Kumar Singh; No. of Students: 685	January 2024 – April 2024
	➤ Postgraduate Course: Advanced Engineering Mathematics (MH 681); Instructor: Dr. Rishi Raj; No. of Students: 57	August 2023 – December 2023
	➤ Undergraduate Course: Heat and Mass Transfer (ME 315); Instructor: Dr. Rishi Raj; No. of Students: 72	August 2020 – December 2020
	➤ Postgraduate Course: Advanced Heat Transfer (ME 522); Instructor: Dr. Deepu P; No. of Students: 18	January 2021 – March 2021
Industrial Trainee at BHEL-CFP Rudrapur	➤ Regular industrial visits to understand the fabrication process of the “Aluminium bus duct”	June 2017 - July 2017

Projects

Ph.D. Project: Development of an integrated system that combines boiling acoustic emissions (for CHF prediction) with submerged liquid-jet impingement to facilitate on-demand CHF enhancement regarding boiler safety; **Mentor:** Dr. Rishi Raj (October 2023 – Present); **Funding Agency:** Swarnjayanti Fellowship Scheme, SERB and DST (Project No. SB/SJF/2021-22/15)

Ph.D. Project: Ionic Liquid as a Cosurfactant for Critical Heat Flux (CHF) Enhancement during Boiling with Aqueous Surfactant Solutions; **Mentor:** Dr. Rishi Raj (August 2022 – March 2024); **Funding Agency:** Core Research Grant, SERB (Project No. CRG/2019/001410)

Ph.D. Project: Simultaneous enhancements in critical heat flux (CHF) and heat transfer coefficient (HTC) during boiling with aqueous solution of imidazolium-based ionic liquids; **Mentor:** Dr. Rishi Raj (July 2021 – February 2023); **Funding Agency:** *Core Research Grant*, SERB (Project No. CRG/2019/001410)

Other Ph.D. Project: Development of a wickless boiling-based heat spreader designed for microgravity experiments in the upcoming Gaganyaan mission conducted by the Indian Space and Research Organization (ISRO); **Mentor:** Dr. Rishi Raj (July 2021 – Present); **Funding Agency:** *Human Space Flight Centre*, ISRO

Other Ph.D. Project: Numerical and experimental investigation of acoustic signature associated with air bubbles injected through a nozzle; **Mentor:** Dr. Rishi Raj (August 2022 – Present); **Funding Agency:** *Swarnjayanti Fellowship Scheme*, SERB and DST (Project No. SB/SJF/2021-22/15)

Other Ph.D. Project: Numerical and experimental investigation of acoustic signature associated with single vapor bubble during boiling; **Mentor:** Dr. Rishi Raj (July 2023 – Present); **Funding Agency:** *Swarnjayanti Fellowship Scheme*, SERB and DST (Project No. SB/SJF/2021-22/15)

M.Tech. Project: Numerical simulation of bubble behavior in surfactant aided pool boiling; **Mentor:** Dr. Rishi Raj (August 2020 – June 2021); **Funding Agency:** *Core Research Grant*, SERB (Project No. CRG/2019/001410)

B.Tech. Project: Finite Element Analysis of Friction Parameters on Aluminium Alloys AA6082 in Impression Die Cold Forging Process; **Mentor:** Dr. T. U. Siddiqui (August 2017 – June 2018)

Peer-Reviewed Journal

- [1] Upadhyay, A., Kumar, B., & Raj, R. (2024). "Ionic Liquid as a Cosurfactant for Critical Heat Flux Enhancement during Boiling with Aqueous Surfactant Solutions", *Applied Thermal Engineering*, 122962. [Link](#)
- [2] Upadhyay, A., Hazra, S. K., Assam, A., & Raj, R. (2023). "Review of the Current Status and the Potential of Machine Learning Tools in Boiling Heat Transfer", *Numerical Heat Transfer, Part B: Fundamentals*, 1-44. [Link](#)
- [3] Upadhyay, A., Kumar, B., Kumar, N., & Raj, R. (2023). "Simultaneous Enhancement of Critical Heat Flux and Heat Transfer Coefficient via In-Situ Deposition of Ionic Liquids during Pool Boiling", *International Journal of Heat and Mass Transfer*, 208, 124066. [Link](#)
- [4] Alam, M. Q., Upadhyay, A., Assam, A., and Raj, R., "The Sound of Bubbles: Mechanism, Modeling, and Insights". (**Communicated shortly**)

Peer-Reviewed Conference Proceedings

- [1] Suriyaprasaad, B., Upadhyay, A.*, Assam, A., and Raj, R., "Boiling Regime Classification via Principal Component Analysis on Bubble Images and Acoustics," Proceedings of the 27th National and 5th International ISHMT-ASTFE Heat and Mass Transfer Conference, IIT Patna, Patna-801103, India, December 14-17, 2023. (**Poster**)
- [2] Alam, M. Q.*, Upadhyay, A., Assam, A., and Raj, R., "Improving Acoustic Emission Modeling of Underwater Bubble Detachment by Accounting for Compressibility Effects," Proceedings of the 27th National and 5th International ISHMT-ASTFE Heat and Mass Transfer Conference, IIT Patna, Patna-801103, India, December 14-17, 2023. (**Oral**)
- [3] Upadhyay, A.*, Kumar, N., Pathak, M., and Raj, R., "Numerical Simulation of Bubble Behavior during Pool Boiling with Foaming Solutions," Proceedings of the 26th National and 4th International ISHMT-ASTFE Heat and Mass Transfer Conference, IIT Madras, Chennai, India, December 17-20, 2021. (**Oral**)

Conference Presentations

- [1] Upadhyay, A.* and Raj, R., "Enhancing Boiling Performance in Adverse Gravity Conditions with Imidazolium-Based Ionic Liquid Additives," 14th Asian Microgravity Symposium 2024, IIT Madras, Chennai, India, December 1 – 6, 2024. (**Accepted**)
- [2] Alam, M. Q.*, Upadhyay, A., Assam, A., and Raj, R., "Investigation of Bubble Acoustics via Experimental, Analytical, and Computational Fluid Dynamics Approaches," Proceedings of the Annual AeSI CFD Symposium 2024, Birla Institute of Technology Mesra, Ranchi, August 11 – 13, 2024. (**Oral**)
- [3] Shukla, A.*, Upadhyay, A., Qadeer, M., Thakur, A. D., and Raj, R., "Advancing Two-Phase Energy Systems with Ionic Liquid-Based Coating Technologies," *International Conference on Advancement in Thermal-Spray (ICOAT) 2024*, Indian Institute of Technology Patna, July 18 – 21, 2024. (**Oral**)

- [4] Upadhyay, A.*, Kumar, B., and Raj, R., “Potential of Soluble Molecular Additives in Boiling-Based Thermal Management Systems,” *4th Conference on Micro Flow and Interfacial Phenomena (μFIP)*, The Hong Kong Polytechnic University, Hong Kong, June 20 – 24, 2024. **(Oral)**
- [5] Alam, M. Q., Upadhyay, A., Sinha, K. N. R., Kumar, V., Assam, A., Thakur, T., and Raj, R.*, “Acoustic Characterization of Bubbles for In-Situ Prediction and Control of Boiling Heat Transfer Regimes,” *11th International Conference on Boiling and Condensation Heat Transfer, ICBCHT-2023*, University of Edinburgh, May 15-17, 2023. **(Oral)**
- [6] Upadhyay, A.*, Kumar, B., and Raj, R., “Simultaneous Enhancement in Pool Boiling CHF and HTC with the Aqueous Solutions of Mixture of SDS and [C₂mim][Cl],” *Indian Chemical Engineering Congress & 75th Annual Session of Indian Institute of Chemical Engineers CHEMCON - 2022*, Harcourt Butler Technical University Kanpur, December 27 – 30, 2022. **(Oral)**
- [7] Kumar, B.*, Upadhyay, A., and Raj, R., “Synergistic Effect of Ionic Liquid on the Foamability of Aqueous Surfactant Solutions,” *Indian Chemical Engineering Congress & 75th Annual Session of Indian Institute of Chemical Engineers CHEMCON - 2022*, Harcourt Butler Technical University Kanpur, December 27 – 30, 2022. **(Oral)**
- [8] Alam, M. Q.*, Upadhyay, A., Assam, A., and Raj, R., “Numerical Investigation of Passive Acoustic Emissions during Bubble Departure from an Underwater Nozzle,” *Indian Chemical Engineering Congress & 75th Annual Session of Indian Institute of Chemical Engineers CHEMCON - 2022*, Harcourt Butler Technical University Kanpur, December 27 – 30, 2022. **(Oral)**
- [9] Upadhyay, A.*, Kumar, B., and Raj, R., “Understanding the Role of Counterions of Imidazolium-based Ionic Liquids on Boiling Heat Transfer,” *International Chemical Engineering Conference 2022*, Indian Institute of Technology Patna, November 12 – 13, 2022. ***Best Presentation Award (Oral)**
- [10] Upadhyay, A.*, Kumar, A., Siddiqui, T. U., Khan, M. M., and Gupta, Y., “Finite Element Analysis of Friction Parameters on Aluminium Alloys in Impression Die Cold Forging: A Review,” *3rd International Conference on Academic Research in Engineering, Management and Information Technology ICAREMIT-2018*, Faculty of Engineering and Technology, M. J. P. Rohilkhand University, Bareilly, February 17 – 19, 2018. **(Oral)**

Mentoring Experiences

- **Monisha Daimari, M.Tech. Student at IIT Patna**, August 2021 – July 2022
Research Topic: Bubble Acoustics Using Computational Fluid Dynamics Simulations
- **Brijesh Kumar, M.Tech. Student at IIT Patna**, August 2022 – June 2023
Research Topic: Boiling Heat Transfer using Ionic Liquid as a Co-surfactant in an Aqueous Surfactant Solution: Interplay between Foamability and Wettability
- **Ansh Saxena and Manav Agrawal, B.Tech. Students at IIT Patna**, August 2023 – July 2024
Research Topic: In-Situ Critical Heat Flux Enhancement of Boiling-Based Systems via Submerged Liquid Jet Impingement
- **Dave Martin, Intern Student at IIT Patna**, November 2022 – December 2022
Research Topic: Boiling Heat Transfer with the Aqueous Solutions of Imidazolium-based Ionic liquids
- **Suriyaprasaad B, Intern Student at IIT Patna**, May 2023 – July 2023
Research Topic: Boiling Regime Classification via Principal Component Analysis on Bubble Images and Acoustics
- **Prahlad Kumar, Intern Student at IIT Patna**, May 2024 – June 2024
Research Topic: Thermal and Acoustic Characterization of Pool Boiling Heat Transfer

Workshop/Course/Training Details

- | |
|--|
| ➤ Participated in a two-day workshop on “ <i>Thermal Management Techniques: Innovations and Insights</i> ” organized by the Department of Mechanical Engineering, Indian Institute of Technology Madras from January 10 – 11, 2024 Link |
| ➤ Participated in the 8 th National Workshop on Research Methodology in Fluid Mechanics on the theme “ <i>Visualization of Fluid Flow and Temperature Distribution</i> ” organized by the Department of Mechanical Engineering, Indian Institute of Technology Jodhpur from July 12 – 15, 2023 Link |
| ➤ Completed online “ <i>30-hours hands-on training on CFD with OpenFOAM</i> ” under Paanduv Applications Advanced Academic Program in April, 2023 Link |

➤ Completed online one-week short-term course on “ <i>Experimental and Numerical Approaches to Two-Phase Heat Transfer (ENTPHT – 2021)</i> ” organized by the Department of Mechanical Engineering NITK, Surathkal from December 27, 2021 to December 31, 2021 Link
➤ Achieved Coursera certification on courses ‘Material Science’ Link and ‘Python’ Link

Other Activities

Reviewer	<ul style="list-style-type: none"> ➤ International Communications in Heat and Mass Transfer ➤ Numerical Heat Transfer, Part B: Fundamentals
Membership	<ul style="list-style-type: none"> ➤ American Society of Mechanical Engineers: NY, US (Student Member, ID: 103789807) ➤ International Society for Heat and Mass Transfer: India (Student Member, ID: 1642) ➤ Indian Society of Outer Space Utilization (Lifetime Member, ID: LM-24031) ➤ National Society of Fluid Mechanics and Fluid Power: Mumbai, India (Lifetime Member, ID: LM871)
Extra-curricular	<ul style="list-style-type: none"> ➤ Acted as Student Organizer of the “<i>27th National and 5th International ISHMT – ASTFE Heat and Mass Transfer Conference</i>”, IHMTC – 2023, organized by the Department of Mechanical Engineering, Indian Institute of Technology Patna from December 14, 2023 to December 17, 2023 Link ➤ Acting Technical Head of IIT Patna Student Chapter of American Society of Mechanical Engineers (ASME) ➤ Acted as Event Coordinator of IIT Patna Student Chapter of American Society of Mechanical Engineers (ASME) (Year 2023) ➤ Acted as Student Coordinator in a SERB-sponsored online workshop on “<i>Emerging Trends in Liquid-Vapor Phase Change Heat Transfer</i>” organized by the Department of Mechanical Engineering, IIT Patna from July 17 to July 19, 2023 Link ➤ Acted as Secretary, Hostel Affairs Council (Masters) at IIT Patna (February 2021 - June 2021) ➤ Acted as M.Tech. Representative in Departmental Academic Program Committee of Mechanical Engineering at IIT Patna (August 2020 - June 2021)

Academic Achievements

- Recipient of Ministry of Human Resource Development (MHRD) Fellowship from 2021–Present (Ph.D.)
- Recipient of Ministry of Human Resource Development (MHRD) Fellowship from 2019–2021 (M.Tech.)
- IIT Patna silver medalist (in 8th convocation) for securing the highest CPI in the Department and second highest CPI among 140 master’s students (including M.Tech. and M.Sc.)