

CURRICULUM VITAE

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Institution: Indian Institute of Technology, Kharagpur

Academic Qualification (Undergraduate Onwards)

Degree	Year	Subject	University/Institution
B. Tech. (Hons)	1997	Mechanical Engineering	Indian Institute of Technology (IIT), Kharagpur
Master of Science	1999	Mechanical Engineering	University of Colorado at Boulder, USA
Ph.D.	2001	Thermal and Fluids Sciences	University of Colorado at Boulder, USA

Specialization and Expertise

Specialization: Thermal & Fluids Engineering

Research areas: Electronic Packaging and Cooling, Microscale Transport Phenomena, Flow in Porous Media, Energy Engineering, Thermal Management of Li-ion batteries

Professional experience (in reverse chronological order)

- Associate Professor, Mechanical Engineering Dept, IIT Kharagpur (July 2015 – present)
 - Involved in teaching and research
- Associate Dean, International Relations, IIT Kharagpur (July 2018 – Dec 2021)
 - Setting the strategy for international and external outreach of the Institute
- Co Prof-in-charge, Academy of Classical and Folk Arts, IIT Kharagpur (September 2019 – present)
 - Setting up of the academy in IIT Kharagpur including academic programs, infrastructure and activities
 - Programme Officer of NCA Vocal Music
- Visiting Scholar, Waterloo Institute of Nanotechnology, Univ. of Waterloo (Summer 2018)
 - Microfluidics research in the domain of Energy Engineering

- Senior Engineer at GE Global Research Center, India (July 2012 – July 2015)
 - Led projects with business funding levels of \$500-700k per year in Energy Management, Oil & Gas, Aviation and Healthcare
 - Started new area on System Level Thermal Management across different GE businesses
- Senior Researcher at General Motors R&D - India Science Lab (August 2010 – June 2012)
 - Senior Technologist in CFD group working on Thermal Management of Electric Drives and Power Electronics
- Staff Mechanical Engineer at Intel Technology India Pvt. Ltd. (July 2005 – August 2010)
 - Technology Lead for Thermal Technology Development team for mobile platforms
 - Member of the global IP committee, Mentored several university collaborations
- Assistant Professor (Mechanical Engineering) at IIT Bombay (December 2003 – July 2005)
 - Teaching and research guidance
 - Founding member of Suman Mashruwala Microsystems Lab
- Senior Mechanical Engineer at Intel Corporation, Chandler, AZ, USA (March 2002 – Nov 2003)
 - Packaging and Thermal Management of microprocessors, packages and systems
 - Mentor for university collaboration

Professional Recognition/ Award/ Prize/ Certificate, Fellowship

Sl. #	Name of Award	Awarding Agency	Year
1.	Faculty Excellence Award for outstanding contributions in teaching, research and institutional development	IIT Kharagpur	2021
2.	Fulbright-Nehru International Education Administrators Seminar (IEAS) Award	Fulbright House	2020
3.	Shastri Indo-Canadian Institute (SICI) Short Mobility Program Fellowship	Shastri Indo-Canadian Institute (SICI)	2020
4.	University of Waterloo – Visiting Scholar	Waterloo Institute for Nanotechnology, Univ of Waterloo	2018
5.	GE GRC Organizational Citizen Award	GE Global Research Center, India	2015

Sl. #	Name of Award	Awarding Agency	Year
6.	GE Inventor Award – medallion	GE Global Research Center, India	2015
8.	INAE – Young Engineer Award	Indian National Academy of Engineering (INAE)	2009
9.	MPG Achievement Award – second highest technical award at Intel	Intel Corporation	2009
10.	MG-India Idol Innovation award	Intel Corporation	2009
11.	Team Excellence Award – Client Platform Engineering	Intel Corporation	2009
12.	Inclusion in America’s Registry of Outstanding Professionals	America’s Registry of Outstanding Professionals	2003
13.	Enrolment Enhancement Fellowship	Dean, School of Engineering, University of Colorado at Boulder	2001
14.	IBM Cooperative Fellowship	International Business Machines (IBM)	1998, 1999
15.	Engineering Excellence Fund and Award	School of Engineering, University of Colorado at Boulder	1998
16.	Amlan Sen Memorial Award – best sessional work in Mechanical Engineering	IIT Kharagpur	1997
17.	Medury Bhanumurthy Memorial Award – best graduating student for extra-academic excellence	IIT Kharagpur	1997
18.	Best Outgoing Student in Mechanical Engineering – for academic excellence and contribution to the department	Mechanical Engineering Society, IIT Kharagpur	1997
19.	Institute Blue (Order of Merit) for Music and Dramatics	IIT Kharagpur	1997

TECHNOLOGY DEVELOPMENT AND TRANSFER

1. **Grooved busbar:** New busbar design for Electrical power equipments that enable more than 20% material (copper) savings in busbars with no penalty in rating; technology implemented in GE motor control centers.
2. **Laminar Wall Jets:** a technology inspired by film cooling of gas turbine blades, whereby through an intelligent louver design, the entrained cooling airflow is redirected along the bottom side of the notebook chassis thereby guiding the flow to precisely where it is needed. The technology was adopted by multiple computer manufacturers (Dell, HP, Acer, Lenovo) and can be found in several commercially launched systems today.
3. **Honeywell PCM 45F:** Involved in co-developing and characterizing the Thermal Interface Material (TIM) Honeywell PCM 45F that went on to be adopted by multiple computer manufacturers; also developed reliability models that are widely used in the industry today for prediction of TIM performance degradation.
4. **Chimney effect:** Developed flow channelization technology to enable fanless desktop computing systems; concept and design are seen in various embodiments in the several All-In-One (AIO) desktop systems that have come out in the last 3 years.
5. Initiated and investigated several new ideas including delta wing vortex generators, miniature piezoelectric fans, synthetic jets, new thermal interface materials (TIM), porous skins and transient cooling through PCMs. Some of these technologies are in various stages of licensing negotiations

SUMMARY OF RESEARCH OUTPUT (PAPERS, PATENTS, TECHNOLOGY DEVELOPMENT)

Publication in refereed journals:	39
Publications in conferences:	30
Book Chapter:	2
Patents filed/issued:	26 (17 US + 9 Indian)

STUDENT SUPERVISION

Ph.D.:	3 graduated + 10 ongoing
M.Tech/MS.:	18 graduated + 4 ongoing
B.Tech.:	23 graduated

MAJOR SPONSORED R&D PROJECTS COMPLETED/ON-GOING

- “Thermal Modelling and Cell Characterization of Batteries for Electric Vehicles”
Sponsor: The Mathworks Inc., INR 44.3 Lakh (2022-25)
- “Centre of Excellence on Energy Aware Urban Infrastructure”
Sponsor: SERB, Dept. of Science and Technology, INR 17.3 Cr. (2022-27)
- “Thermal Technology Toolkit for Smart Computing Systems for IoT Applications”
Sponsor: Intel Corporation, INR 50 Lakh (2018-23)

- “Electrohydrodynamics for Avionics Cooling”
Sponsor: GE India Industrial Pvt. Ltd., INR 20.6 Lakh (2019-23)
- “Electrothermal flows for Thermal Management of Electronics”,
Sponsor: SERB, Dept. of Science and Technology, INR 32 Lakh (2018-21)
- “Experimental Investigation of Pool Boiling and Direct Contact Condensation in High Porosity Metal Foams”
Sponsor: IIT Kharagpur seed grant, INR 27 Lakh (2016-19)
- “Two Phase Mechanically Pumped Fluid Loop (MPFL) with microchannel based evaporator for application to high power communication spacecraft, interplanetary mission and human space mission”
Sponsor: Indian Space Research Organization (ISRO), INR 30.5 Lakh (2018-21)
- “Capacity fade and prognostics of advanced Li-ion battery”
Sponsor: Samsung Research Institute Bangalore, INR 19.8 Lakh (2018-21)
- “Design and Fabrication of a Cold Plate using Friction Stir Channeling for Thermal Management of Electronic Systems and Battery Packs”,
SERB, Dept. of Science and Technology, INR 33 Lakh (2020-23)
- “Development of Scalable GaN-based Distributed Dynamic Power Management System for IoT Applications with On-Demand Dynamic Thermal Management”
Sponsor: Ministry of HR Development – IMPRINT scheme, INR 2.38 Cr. (2017-22)
- “Development of High Energy and High Power Density Lithium Ion Battery For Under Water Application”
Sponsor: Ministry of HR Development – IMPRINT scheme, INR 1.61 Cr. (2017-22)
- “Opened & Intelligent Plug-in Hybrid Electric Vehicle (PHEV) Technologies for Smart Indian Cities”
Sponsor: Ministry of HR Development – UAY scheme with TATA Motors, INR 19.9 Cr. (2016-21)
- Led R&D projects at Intel, GM and GE during 2005 – 2015 with budgets ranging from USD 300k – 700k per year
- Part of the 6-member founding team of Suman Mashruwala Microsystems Lab at IIT Bombay
Sponsor: Raj Mashruwala Endowment grant, USD 1 million (2004)
- Industry mentor university collaboration projects (GA Tech, IIT Bombay, IIT Kharagpur)

TEACHING EXPERIENCE

- IIT Kharagpur
 - UG: Heat Transfer, Fluid Mechanics, Heat Transfer Lab
 - PG: Fundamentals of Electronic Packaging, Refrigeration Systems, Energy Conservation and Waste Heat Recovery, Measurements Lab
- IIT Bombay

- UG: Heat Transfer, Fluid Mechanics and Fluid Machines
- PG: Electronic Packaging and Manufacturing, Transport in Porous Media
- NPTEL MOOCS, Govt. of India
 - Energy Conservation and Waste Heat Recovery
 - Electronic Packaging and Manufacturing
- Industry
 - GE Edison Engineering Development Program (EEDP) - Thermodynamics, Thermal and Flow Measurements
 - Intel University – Thermal Design and Analysis of Electronic Systems

OTHER ACTIVITIES

- Associate Editor of ASME Journal of Thermal Science and Engineering Applications (2021 – present)
- Associate Editor of IEEE Transactions on Components and Packaging Technologies (2008 – present)
- Joint PI at IIT Kharagpur of MoE's National Mission Project on Virtual Laboratories for Phase III Extended (2022-26)
- Assistant Warden, Meghnad Saha Hall of Residence, IIT Kharagpur (2015-2018)
- Member of MHRD - SPARC Founding Organizing team (2018-20)
- Member of Executive Committee IEEE Kharagpur Section (2016 – present)
- Member of American Society of Mechanical Engineers (ASME), 1999-present
- Chair of Technical Tracks/Sessions/Panel Discussions
 - IEEE: ITherm 2006, 2008, 2014, 2017
 - ASME: IMECE 2009, InterPACK 2010
 - ISHMT - ASME Heat and Mass Transfer Conference 2013, 2015, 2019
- Awards Committee, IEEE ITherm 2019, ASME EPPD 2021
- National Advisory Committee for ISHMT-ASME Heat and Mass Transfer Conference (2013, 2017)
- Program Committee for International Conference on Design and Reliability of Mechanical Systems (iCDRMS), 2015, 2016 (supported by IEEE CPMT)

OTHER HONORS

- TRIZ Level 2 Certification (2013)
- Regular Reviewer for variety of journals including ASME and IEEE Journals, Journal of Applied Physics, Journal of Porous Media, Institute of Physics, etc.

List of Publications and Patents

Number of International Journal publications: 39

Citation Index (as on 27 July 2022): h – index: 18; i-10 index: 31; Number of citations: 2743 (Source: Google Scholar)

A. International Journals

1. Patra Chinmaya, Das P.K., Bhattacharya A., “Mechanistic model of combined pressure drop and heat transfer for the entire growth stage of an elongated bubble in a rectangular microchannel” *accepted for publication* in International Journal of Heat and Mass Transfer, Manuscript ID: HMT-D-22-01879 (2022)
2. Pujahari Ankita, Dasgupta Sunando, Bhattacharya A., “Electro-osmosis Aided Thin-Film Evaporation from a Micropillar Wick Structure”, *Langmuir*, Vol. 38, pp. 8442–8455 (2022)
3. Mondal Kaushik, Bhattacharya A., “Bubble Dynamics and Enhancement of Pool Boiling in Presence of an Idealized Porous Medium - a Numerical Study using Lattice Boltzmann Method”, *ASME Journal of Thermal Science and Engineering Applications* Vol. 14(8) (2021) Manuscript DOI: <https://doi.org/10.1115/1.4053054>
4. Mondal Kaushik, Bhattacharya A., “Numerical modeling of adjacent bubble interactions under the influence of induced vibrations in liquid pool using lattice Boltzmann method (LBM)”, *Journal of Applied Physics*, 130(22) (2021), Manuscript DOI: 10.1063/5.0069152
5. Mondal Kaushik, Bhattacharya A., “Pool boiling enhancement through induced vibrations in the liquid pool due to moving solid bodies—A numerical study using lattice Boltzmann method (LBM)”, *Physics of Fluids*, 33 (2021), Manuscript DOI: 10.1063/5.0057637
6. Chowdhury Akash, Bhattacharya A., Bandyopadhyay P.P., “Influence of Temperature-Dependent Physical Properties on Liquid Metal Droplet Impact Dynamics” *ASME Journal of Thermal Science and Engineering Applications*, 14(5) (2021) Manuscript DOI: 10.1115/1.4051839
7. Pujahari Ankita, Dasgupta Sunando, Bhattacharya A., “Performance Evaluation of Evaporation from Micropillar Arrays with Different Pillar Topologies”, *International Journal of Thermal Sciences*, Vol. 168: 107044 (2021)
8. Ramakrishna T, Ghosh Moulic Sandipan, Bhattacharya A., “Experimental Investigation of Buoyancy-Induced Convection in High-Porosity Open-Cell Aluminum Metal Foams under Different Orientations” *ASME Journal of Thermal Science and Engineering Applications*, 13(6): 061003 (10 pages) (2021)
9. Mondal Kaushik, Bhattacharya A., “Numerical Study of Pool Boiling Heat Transfer from Surface with Protrusions using Lattice Boltzmann Method”, *ASME Journal of Heat Transfer*, 143(2): 021603 (9 pages) (2021)
10. Girhe Sanket, Cardenas Ruander, Macdonald Mark, Bhattacharya A., “Numerical Modeling and Simulation of a Volumetric Resistance Blower using Porous Rotor”, *ASME Journal of Electronic Packaging*, 143(2): 020301 (2021)
11. Das Saptarshi, Das Debasish, Mitra Arijit, Jena Sambadan, Bhattacharya A., Majumder Subhasish B, “Electrophoretic Deposition of ZnFe₂O₄–Carbonaceous Composites as Promising Anode for Lithium-ion Batteries”, *Materials Letters*, Vol. 301:130265 (2021)

12. Das Saptarshi, Das Debasish, Mitra Arijit, Jena Sambadan, Bhattacharya A, Majumder Subhasish B, "Electrophoretic deposition of nickel ferrite anode for lithium-ion half cell with superior rate performance", *Surface and Coatings Technology*, Vol. 421: 127365 (2021).
13. Venkatesh Saravanan, Kumar Amit, Pramanik S, Bhattacharya A., "Ionic Wind Review-2020: Advancement and Application in Thermal Management" *SADHANA*, Vol. 46 (3) pp. 1-27 (2021)
14. Kunti G., Dhar J., Chakraborty S., Bhattacharya A. "Alternating Current Electrothermal Flow for Cooling of Localized Hot Spots in Microelectronic Devices", *IEEE Transactions on Components, Packaging and Manufacturing Technology*, 10 (6), pp. 1020-1027 (2020)
15. Kunti G., Agarwal Tarun, Bhattacharya A., Maiti T.K., Chakraborty S., "On-Chip Concentration and Patterning of Biological Cells Using Interplay of Electrical and Thermal Fields", *Analytical Chemistry*, 92 (1) pp 838-844 (2020)
16. Kunti G., Dhar J., Bhattacharya A., Chakraborty S., "Directionally controlled open channel microfluidics", *Physics of Fluids*, 31 (2019)
17. Kunti G., Bhattacharya A., Chakraborty S., "Strong rotating flow in stationary droplets in low power budget using wire electrode configuration", *Electrophoresis*, 40 (2019)
18. Kunti G., Bhattacharya A., Chakraborty S., "Interfacial dynamics of immiscible binary fluids through ordered porous media: The interplay of thermal and electric fields", *Physics of Fluids*, 31 (2019)
19. Kunti G., Dhar J., Bhattacharya A., Chakraborty S. "Joule heating-induced particle manipulation on a microfluidic chip", *Biomicrofluidics*, 13 (2019)
20. Kunti G., Bhattacharya A., Chakraborty S. "Alteration in contact line dynamics of fluid-fluid interfaces in narrow confinements through competition between thermocapillary and electrothermal effects", *Physics of Fluids*, 30 (2018)
21. Kunti G., Bhattacharya A., Chakraborty S., "Electrothermally actuated moving contact line dynamics over chemically patterned surfaces with resistive heaters", *Physics of Fluids* 30, (2018)
22. Kunti G., Bhattacharya A., Chakraborty S., "Electro-thermally driven transport of a non-conducting fluid in a two-layer system for MEMS and biomedical applications" *Journal of Applied Physics*, 123 (2018)
23. Kunti G., Mondal P. K., Bhattacharya A., Chakraborty S. "Electrothermally modulated contact line dynamics of a binary fluid in a patterned fluidic environment", *Physics of Fluids* 30 (2018)
24. Kunti G., Dhar J., Bandyopadhyay S., Bhattacharya A., Chakraborty S., "Energy-Efficient Generation of Controlled Vortices on Low-Voltage Digital Microfluidic Platform" *Applied Physics Letters* 113 (2018)
25. Kunti, Golak, Bhattacharya, A., Chakraborty, S. "Alternating current electrothermal modulated moving contact line dynamics of immiscible binary fluids over patterned surfaces", *Soft Matter*, 13, pp. 6377-6389 (2017)
26. Kunti, Golak, Bhattacharya, A., Chakraborty, S. "Numerical investigations of electrothermally actuated moving contact line dynamics: Effect of property contrasts", *Physics of Fluids* 29, 082009 (2017).
27. Kunti, Golak, Bhattacharya, A., Chakraborty, S. "Rapid mixing with high-throughput in a semi-active semi-passive micromixer", *Electrophoresis*, 38 (9-10), pp. 1310-1317 (2017).
28. Kunti, Golak, Bhattacharya, A., Chakraborty, S. "Analysis of micromixing of non-Newtonian fluids driven by alternating current electrothermal flow", *Journal of Non-Newtonian Fluid Mechanics*, 247, pp. 123-131 (2017).

29. Kunti, Golak, Bhattacharya, A., Chakraborty, S., "A Scaling Analysis for Electro-thermo-hydrodynamic Convection with Variable Thermophysical and Electrical Properties", International Journal of Heat and Mass Transfer, 109, pp. 215-222 (2017).
30. Kavoori Nagapriya, Sinha Shashank, Prashanth R., Poonacha Samhitha, Chaudhry Gunaranjan, Bhattacharya, A., Choudhury Niloy, Mahalik Saroj, Maity Sandip, "Laser Calorimetry Spectroscopy for sub-ppm Dissolved Gas Detection and Analysis" Scientific Reports, 7, 42917; doi: 10.1038/srep42917 (2017).
31. Bhattacharya, A., R. Senthil, Varadarajan, Krishnakumar, 2016, "Phase Change Materials for Transient Cooling of a Heater Array in a High Aspect Ratio Channel in Presence of Mean Flow", ASME Journal of Thermal Science and Engineering Applications, 8, doi: 10.1115/1.4030696 (2016).
32. Sarangi, R.K., Bhattacharya A., and Prasher, R.S., "Numerical Modeling of Boiling Heat Transfer in Microchannels", Applied Thermal Engineering, 29, pp. 300-309 (2009).
33. Mongia, Rajiv, Bhattacharya A., and Pokharna, Himanshu, "Skin Cooling and Other Challenges in Future Mobile Form Factor Computing Devices", Microelectronics Journal, 39 (7), pp. 992-1000 (2008).
34. Malapure, V.P., Mitra, Sushanta K., and Bhattacharya A., "Numerical Investigation of Fluid Flow and Heat Transfer over Louvered Fins in Compact Heat Exchangers", International Journal of Thermal Sciences, 46, pp. 199-211 (2007).
35. Bhattacharya, A. and Mahajan, R.L., "Metal Foam and Finned Metal Foam Heat Sinks for Electronics Cooling in Buoyancy Induced Convection", ASME Journal of Electronic Packaging, 128, pp. 259-266 (2006).
36. Bhattacharya, A., and Mahajan, R.L., "Temperature Dependence of Thermal Conductivity of Biological Tissues", Physiological Measurement, 24, pp. 769-783 (2003).
37. Bhattacharya, A. and Mahajan, R. L., "Finned Metal Foam Heat Sinks for Electronics Cooling in Forced Convection", ASME Journal of Electronic Packaging, 124 (3), pp. 155-163 (2002).
38. Bhattacharya, A., Calmidi, V. V., and Mahajan, R.L., "Thermophysical Properties of High Porosity Metal Foams", International Journal of Heat and Mass Transfer, 45 (5), pp. 1017-1031 (2002).
39. Bhattacharya, A. and Mahajan, R.L., "Entrainment Effects in Buoyancy Induced Flows in Longitudinal Finned and Finned Metal Foam Heat Sinks", International Journal of Microelectronic Packaging, 1, pp. 253-267 (2001).

B. Book Chapters and Edited Volumes

1. Sarkar Pooja, Pal S.K., Bhattacharya A., Shollock B., "An Application from a Defect—A Friction Stir Channeling Approach", Welding Technology, Chapter 4, Springer International Publishing (2021)
2. Bhattacharya, A., Chang Je-Young, Haehn, Nicholas, "Thermal Management of Electronics using Sprays and Droplets", Applications and Paradigms of Droplet and Spray Transport: Paradigms and Applications, pp. 267-295, Springer (2018).

C. Proceedings Publication/ Conference Presentation

1. Bhowmik Mrinmay, Chatterjee Dipayan, K. Hariharan, Kapat Santanu, Bhattacharya A., "State Feedback Design Approach for Fast Recovery Digitally Current Mode Controlled Boost

Converters" *accepted for publication in IEEE 48th Annual Conference of the Industrial Electronics Society, IECON 2022, Brussels (2022)*

2. Mondal Subhadeep, Traore Philippe, Perez Alberto, Vasquez Pedro A, Bhattacharya A., "Mass Transfer Enhancement Induced by Electro-Solutic Convection within Two Parallel Electrodes Due to Unipolar Charge Injection" *Proceedings of IEEE 21st IEEE International Conference on Dielectric Liquids, ICDL 2022, Seville (2022)*
3. Pujahari Ankita, Dasgupta Sunando, Bhattacharya A., "Analysis of Evaporation from micropillar surface by Using Non-Uniform Heat Flux", *Proceedings of the 23rd Electronic Packaging Technology Conference, Singapore (2021)*
4. Dey D., Alam M., Bhattacharya A., Roy S. "Natural convection in an enclosure with a heated element for power law fluids", *Proceedings of the 25th National and 3rd International ISHMT-ASTFE Heat and Mass Transfer Conference (2019)*
5. Kunti G., Dhar J., Bhattacharya A., Chakraborty S., "Alternating Current Electrothermal Flow for Energy Efficient Thermal Management of Microprocessor Hot Spots", *Proceedings of IEEE 25th International Workshop on Thermal Investigations of ICs and Systems (THERMINIC), 2019*
6. Dash M., Kumar S., Bandyopadhyay P. P., Bhattacharya A., "A Study On Evolution Of Splat Radius And Temperature In Thermal Spray Process" *Proceedings of International Mechanical Engineering Congress and Exposition IMECE2018, 2018.*
7. Ramakrishna Tupakula, Ghosh Moulic S., and Bhattacharya, A., "Experimental Study on Buoyancy Induced Convection in Open Cell Aluminum Metal Foam", *Proceedings of ASME International Mechanical Engineering Congress and Exposition IMECE2017, 2017.*
8. Kharangate, C., Uppal, A., Prabhu, S.V., Vedula, R.P., Reddy, Anand V., Bhattacharya, A., "Delta Wing Vortex Generators For Local Heat Transfer Enhancement In High Aspect Ratio Channels In Laminar Flows", *Proceedings of the 23rd National and 1st ISHMT-ASTFE Heat and Mass Transfer Conference, ISRO Trivandrum, 2015, Paper no. IHMTTC2015-1566.*
9. Bhattacharya, A., R. Senthil, Varadarajan, Krishnakumar, "Phase Change Materials for Transient Cooling of a Heater Array in a High Aspect Ratio Channel in Presence of Mean Flow", *Proceedings of the 22nd National and 11th International ISHMT-ASME Heat and Mass Transfer Conference, IIT Kharagpur, 2013. Paper no. HMTTC 1300625.*
10. Goel, Nitin, Anoop T.K., Bhattacharya, A., Cervantes, Joe, Mongia, R.K., Machiroutu, Sridhar V., et al., "Technical Review of Characterization Methods for Thermal Interface Materials (TIM)", *Proceedings of ITherm, Orlando, FL, 2008, pp. 248-258.*
11. Bhattacharya, A., and Mongia, R.K., "Low Profile Piezoelectric Fans for Cooling in Confined Geometries", *contributed paper in A Festschrift in Honour of Professor Suhas P. Sukhatme, Research Publishing Services, Singapore, 2008, pp. 67-71.*
12. Bhattacharya, A., Vijayaraghavan Sanjay, and Chunduru Sriharsha, "Cooling Challenges for Future Generation of Laptop Computers", *Proceedings of the 19th National & 8th ISHMT ASME Heat and Mass Transfer Conference, Hyderabad, India, 2008, Paper no. EC-3.*

13. Bhattacharya, A., Mongia, Rajiv K., and Kamiya, R., "Laminar Wall Jets for Skin Cooling in Low Form Factor Electronics", Proceedings of THERMES, Thermal Challenges in Next Generation Electronic Systems -II, Santa Fe, New Mexico, 2007 pp. 291-298.
14. Mongia, Rajiv K., Macdonald, M.A., Mccune, Joshua S., Pavlova, Anna A., Trautman, Mark A. and Bhattacharya, A., "Heat Transfer Enhancement Using Synthetic Jets for Cooling in Low Form Factor Electronics in Presence of Mean Flow", Proceedings of the 9th Electronic Packaging Technology Conference, Singapore, 2007, pp. 830-835.
15. Singh, S.G., Duttagupta, S.P., Bhattacharya, A., and Meiti, N., "Fabrication and Characterization of Integrated Microchannel and Microheater", Proceedings of the 33rd National and 3rd International Conference on Fluid Mechanics and Fluid Power, Mumbai, India, 2006, Paper no. NCFMFP2006-1508.
16. Agrawal, Amit, Bhattacharya, A., and Agrawal, Abhishek, "Flow Patterns and Pressure Drop in different Microchannels and Microbends", Proceedings of the 18th National & 7th ISHMT ASME Heat and Mass Transfer Conference, Guwahati, India, 2006, pp. 2385-2392, Paper no. HMT-2006- C331.
17. Sarangi, R.K., Bhattacharya, A., Prasher, R.S., and Narasimhan, S., "Numerical Modeling of Boiling Heat Transfer in Microchannel Heat Sinks", Proceedings of 2005 ASME International Mechanical Engineering Congress and Exposition, Orlando, CA, 2005, Paper no. IMECE2005-80931.
18. Bahga, S.S., Bhattacharya, A., and Mahajan, R.L., "Numerical Modeling of Buoyancy Induced Convection in Finned Heat Sinks in Presence of Heated and Unheated Shrouds", Proceedings of 2005 ASME International Mechanical Engineering Congress and Exposition, Orlando, CA, 2005, Paper no. IMECE2005-80895.
19. Chavan, Niranjana S., Bhattacharya, A. and Iyer, Kannan, "Modeling of Two Phase Flow Instabilities in Microchannels", Proceedings of the 3rd International Conference on Microchannels and Minichannels, Toronto, Ontario, Canada, 2005, Paper no. ICMM2005-75048.
20. Malapure, V.P., Bhattacharya, A. and Mitra, Sushanta K., "Fluid Flow and Heat Transfer Analysis of Automotive Reactor using CFD Tools", Proceedings of 2005 ASME Summer Heat Transfer Conference, San Francisco, CA, 2005, Paper no. HT2005-72247.
21. Bhattacharya, A., "Analysis of Two Phase Forced Convection in Microchannels for Electronics Cooling", Proceedings of the First European Micro and Nano Systems Conference, 2004, pp. 137-141.
22. Mahalingam, R., Glezer, A., Bhattacharya, A., and Machiroutu, S.V., "Low Profile Synthetic Jet Cooling in Confined Geometries", Proceedings of 4th European Thermal Sciences Conference, Birmingham, UK, 2004, Paper no. MIC 4.
23. Bhattacharya, A., and Sorrell, J., "Mounting of MEMS Pressure Sensors on Catheter Guidewires used in Balloon Angioplasty", Advanced Biomedical and Clinical Diagnostic Systems, Proceedings of SPIE, Vol. 4958, 2003, pp. 235-241.

24. Bhattacharya, A., and Mahajan, R. L., "Numerical Modeling of Pressure Drop in High Porosity Metal Foams", Proceedings of 8th Joint AIAA/ASME Thermophysics and Heat Transfer Conference, St. Louis, MS, 2002, Paper no. 2002-3005.
25. Lohe, R.L., Bhattacharya, A. and Mahajan, R.L., "Longitudinal Finned Heat Sinks with Unheated and Heated Shrouds in Buoyancy Induced Convection", Proceedings of INTERPACK 2001 The Pacific RIM/ASME International Electronic Packaging Technical Conference and Exhibition, Kauai, Hawaii, 2001, Paper no. IPACK2001-15588.
26. Bhattacharya, A., Calmidi, V.V. and Mahajan, R.L., "Permeability and Inertial Coefficient of High Porosity Metal Foams", Proceedings of the 35th National Heat Transfer Conference, Anaheim, CA, 2001, Paper no. NHTC2001-20181.
27. Bhattacharya, A., and Mahajan, R. L., "Thermal Conductivity of Biological Tissues using Transient Hot Wire Technique", Thermal Treatment of Tissue: Energy Delivery and Assessment, Proceedings of SPIE, Vol. 4247, 2001, pp. 171-180.
28. Bhattacharya, A., and Mahajan, R. L., "Buoyancy Induced Convection in Metal Foam and Finned Metal Foam Heat Sinks", ASME Proceedings of IMECE 2000, HTD Vol. 3664, 2000, pp. 391- 98.
29. Bhattacharya, A. and Mahajan, R. L., "Finned Metal Foam Heat Sinks for Electronics Cooling in Forced Convection", Proceedings of the 34th National Heat Transfer Conference, Pittsburgh, PA, 2000, Paper no. NHTC2000-12256.
30. Bhattacharya, A., Calmidi, V. V., and Mahajan, R.L., "An Analytical Experimental Study for the Determination of the Thermal Conductivity of High Porosity Metal Foams", Application of porous media methods for engineered materials, AMD Vol. 233, 1999, pp. 13-20.

D. List of Patents Granted and/or Filed

Sl. #	Patent Title	Name of Applicant(s)	Patent / Application No.	Year	Agency, Country
1.	Enhanced heat exchanger	Himanshu Pokharna, <u>Anandaroop Bhattacharya</u>	6,958,912	2005	USPTO, USA
2.	Electronic package with thermally-enhanced lid	Anandaroop Bhattacharya, Varaprasad V. Calmidi, Sanjeev B. Sathe	7,183,642	2007	USPTO, USA
3.	Thermal management arrangement for standardized peripherals	<u>Anandaroop Bhattacharya</u> , Chia-pin Chiu, Sridhar Machiroutu	7,251,139	2007	USPTO, USA
4.	Electromagnetic interference shielding for device cooling	Rajiv Mongia, <u>Anandaroop Bhattacharya</u>	7,764,514	2010	USPTO, USA
5.	Method and apparatus for inverted vortex generator for enhanced cooling	<u>Anandaroop Bhattacharya</u> , Rajiv Mongia, Krishnakumar Varadarajan, Rajendra Vedula, Siddini V Prabhu	7,983,045	2011	USPTO, USA
6.	Chimney-based cooling mechanism for computing devices	<u>Anandaroop Bhattacharya</u> , Mark Macdonald, Sanjay Vijayaraghavan	8,451,604	2013	USPTO, USA
7.	Method, apparatus and computer system for vortex generator enhanced cooling	<u>Anandaroop Bhattacharya</u> , Rajiv Mongia, Krishnakumar Varadarajan	8,537,548	2013	USPTO, USA
8.	Current carrying systems and methods of assembling the same	Peter Greenwood, Michael Bryant, Shyam Mathure, Venkateswara Rao Polineni, <u>Anandaroop Bhattacharya</u> , Subhashish Dasgupta, Sunil Murthy	9,431,782	2016	USPTO, USA
9.	Electrical equipment and a method of manufacturing	<u>Anandaroop Bhattacharya</u> , Subhashish Dasgupta, Peter Greenwood, Steven Meiners	9,622,374	2017	USPTO, USA
10.	Current carrying systems and methods of assembling the same	Peter Greenwood, Michael Bryant, Shyam Mathure, Venkateswara Rao Polineni, <u>Anandaroop Bhattacharya</u> , Subhashish Dasgupta, Sunil Murthy	10,027,076	2018	USPTO, USA

11.	Active vents for cooling of computing devices	<u>Anandaroop Bhattacharya</u> , Bijendra Singh	20100167636	2010	USPTO, USA
12.	High performance spreader for lid cooling applications	Rajiv Mongia, Krishnakumar Varadarajan, <u>Anandaroop Bhattacharya</u>	20090323276	2009	USPTO, USA
13.	Thermal attach for electronic device cooling	Nitin Goel, <u>Anandaroop Bhattacharya</u> , Rajiv Mongia	20090127701	2009	USPTO, USA
14.	Method, apparatus and computer system for air mover lid cooling	Krishnakumar Varadarajan, <u>Anandaroop Bhattacharya</u>	20090080157	2009	USPTO, USA
15.	Winged piezo fan	<u>Anandaroop Bhattacharya</u> , Rajiv Mongia	20080218968	2008	USPTO, USA
16.	Aerodynamic memory module cover	<u>Anandaroop Bhattacharya</u> , Chia-pin Chiu	20050196904	2005	USPTO, USA
17.	Thermal management device for an integrated circuit	<u>Anandaroop Bhattacharya</u> , Ravi S. Prasher, Jerome Garcia, Suzana Prstic	20050111188	2005	USPTO, USA
18.	System for particle manipulation and aggregation	Golak Kunti, Jayabrata Dhar, <u>Anandaroop Bhattacharya</u> , Suman Chakraborty	201931022341	2019	Indian Patent Office, DPIIT
19.	A method for friction stir spiral tunneling (fsst) in pipe and a system to carry out such method	Pooja Sarkar, Surjya Kanta Pal, <u>Anandaroop Bhattacharya</u> , P. Mishra	202031010846	2020	Indian Patent Office, DPIIT
20.	Systematic distributor	Arvind Srivastav, Shailesh Joshi, Guru Sreevansh Yerragolam, <u>Anandaroop Bhattacharya</u>	201731029765	2017	Indian Patent Office, DPIIT
21.	Electrical equipment and a method of manufacturing	<u>Anandaroop Bhattacharya</u> , Subhashish Dasgupta, Peter J. Greenwood, Steven E. Meiners	3920/CHE/2014	2014	Indian Patent Office, DPIIT
22.	Active vents for cooling of computing device	Anandaroop Bhattacharya, Bijendra Singh	2946/DEL/2008	2008	Indian Patent Office, DPIIT
23.	Heat spreader plate with pulsating heat pipes	Krishnakumar Varadarajan, <u>Anandaroop</u>	1519/DEL/2008	2008	Indian Patent Office, DPIIT

		<u>Bhattacharya</u> , Rajiv Mongia			
24.	Electromagnetic interference shielding for device cooling	Rajiv Mongia, <u>Anandaroop Bhattacharya</u>	2630/DEL/2006	2006	Indian Patent Office, DPIIT
25.	Method and apparatus for enhanced cooling	<u>Anandaroop Bhattacharya</u> , Rajiv Mongia, Krishnakumar Varadarajan	2589/DEL/2006	2006	Indian Patent Office, DPIIT
26.	Method, apparatus and computer system for air mover lid cooling	Krishnakumar Varadarajan, <u>Anandaroop Bhattacharya</u>	2143/DEL/2006	2006	Indian Patent Office, DPIIT

E. Invited Industrial/ Academic Talks/ Seminars Delivered

1. *Thermal Management using High Porosity Metal Foams*, IMAPS Topical Workshop on Thermal Management for High-Performance Computing and Telecom/Wireless Applications, San Jose, April 2001
2. *Convective Transport in High Porosity Media*, Invited Lecture in Tata Research Development and Design Centre (TRDDC), Pune, June 2004
3. *Cooling Challenges in Mobile Computing*, Invited lecture in SAMEER Workshop on Electronic Packaging, Bangalore, January 2007
4. *Thermal Management of Mobile Platforms*, Keynote lecture in ASME-ISHMT Heat and Mass Transfer Conference, Hyderabad, January 2007
5. *Cooling Challenges in Low Form Factor Electronic Systems*, Invited lecture in IEEE Workshop on Thermal Management of Electronic Device, Bangalore, January 2008
6. *Cooling Challenges in Low Form Factor Electronic Systems*, Invited lecture in IISc Bangalore, October 2009
7. *Thermal Management of Computing Platforms*, Invited lecture in Indo-German Frontiers of Engineering Workshop, Chennai, October 2009
8. *Virtual Paint shop in Automotive Industry: Technologies and Challenges*, Invited lecture in Manufacturing Technologies Workshop, Vishwakarma Institute, Pune, January 2012
9. *Materials Science Inspired Innovations in Electronic Thermal Management*, Invited Lecture at University of Hyderabad, October 2012.
10. *Transport in Porous Media and Cooling of Electronic Devices and Systems*: 2 presentations in National Workshop on "Recent Advances in Heat and Fluid Flow" at Govt. College of Engineering and Textile Technology, Berhampore, under TEQIP – II, October, 2016.
11. *Thermal design challenges in electronic devices and systems*: Invited Talk at MCKV Institute of Engineering under TEQIP – II, April 2017.
12. *Thermal Design Challenges in Electronic Devices and Systems*, Invited Lecture at National Conference on Heat Transfer and Fluid Flow (HTFF'18), Future Institute of Technology and Management, October 2018.

13. *Recent Advances in Cooling of Electronic Devices and Systems*, presentation at ISRO U R Rao Satellite Centre (URSC), Bangalore, May 2019.
14. *Electrohydrodynamics for Electronic Thermal Management*, Presentation at the Indo-French Workshop on Electrohydrodynamics organized by CEFIPRA, IIT Kharagpur Nov 2019.
15. *COVID 19 Pandemic: Technology Innovations at IIT Kharagpur*, Online Short Term Course at NIT Uttarakhand, July 2020
16. *Global Collaboration and its Growing Importance in a Connected World*, Invited Lecture in Professional Development Program in Engineering organized by US-India Education Forum, 27 October 2020
17. *Direct Energy Conversion Devices and Heat Pumps (L1) and Energy Economics (L2)*, QIP Short Term Course (online) on Waste Heat Recovery organized by IIT BHU, 17-22 Jan, 2021
18. *Alternate Air Movers for Thermal Management of Portable Electronics*, Keynote lecture at Fluid Mechanics and Fluid Power Conference organized by BITS Pilani, 27-29 Dec, 2021
19. Invited talks on the theme *Recent Advances in Thermal Management of Portable Computing Platforms* at University of Greenwich, University of Nottingham and Loughborough University, UK, July 2022.