Chitransh Atre

Indian Institute of Technology Madras | AM19D017 | PR/99/AM/25/017

Education and Scholastic Achievements

Program	Institution	CGPA / %	Year
Ph.D. (Applied Mechanics)	Indian Institute of Technology Madras	8.00	2025
M.Tech (Atmospheric Science)	Indian Institute of Technology Kharagpur	9.25	2019
B.Tech. (Mechanical Engineering)	National Institute of Technology Bhopal	8.26	2016
XII (CBSE)	Jawahar Navodaya Vidyalaya	85.6 %	2011
X (CBSE)	Jawahar Navodaya Vidyalaya	85.2 %	2009

- **DAAD** International Fellow at **Leibniz Universität Hannover, Germany**.
- **MHRD fellowship** throughout Masters and Ph.D.
- Contributed to the facilitation of **₹102 million** funding from DST for a **National IMPRINT** project at IIT Madras.
- **GATE** 2017 Score - **693**/1000 (Mechanical Stream);
- **IIT-JEE** 2012, AIR - **11,133**; **AIEEE** 2012, AIR - **9152.**
- **MPPET** 2012, Rank - **157 (99.94 %ile);** International Mathematics Olympiad (**IMO**): **State rank** - **207** (Intermediate).

Patent

- **Flat Heat Pipe with Micro Capillary Wick** (*Application No: 2038486107830*)

Projects

Capillary Rise in Corner Geometries *Ph.D. Thesis, IIT Madras* *Jul 2019 – Jul 2024*	• Developed a **novel** theoretical **scaling laws** for inertial and non-inertial capillary rise in corner geometries formed by circular **micro-capillaries**. • Conducted high-performance **parallel CFD simulations** using modified **OpenFOAM** solvers and meshing performed in **ANSYS Fluent**. • Performed visualization **experiments** using UV illumination and backlighting imaging techniques and extracted the data using **image processing**. • Tools used: **Python**, **MATLAB**, and **Mathematica**.
Heat Pipe *IC & SR, IITM* *Jan 2019 – Mar 2023*	• Modeled low-cost flat **heat pipe** with **porous wick** structures for efficient thermal management in MMIC chips. • **Designed** and **fabricated** the heat pipe, and performed prototype testing using capillaries*. • Collaborated with **IISc**, **DRDO,** Astra Microwave Pvt. Ltd under the National IMPRINT initiative.
Defects in Paints *SG R&D, Research Park* *Mar 2025 – present*	• Developed an optimized **image processing** system to minimize **pinhole defects** in **paint-coated glass** surfaces by analyzing effects of temperature, paint thickness. • Theoretically modeled **bubble dynamics** inside paint to understand bubble growth. • Collaborated with the Dept. of MME, IIT Madras; Project funded by **Saint-Gobain India.**
ML with CFD *May 2024 – Dec 2025*	• Implemented a Physics-Informed Neural Network **(PINN)** model to solve the 2D **lid-driven cavity** flow by embedding NS equations and PDE. • Demonstrated **mesh-free** model and validated with CFD simulation in OpenFOAM. • Developed deep neural networks in **TensorFlow/Keras**.
Thin-Film Evaporation *Dept. of Applied Mechanics* *May 2023 - present*	• Investigated evaporation dynamics in **micro capillaries bundle** experiments. • Measured **evaporation rates** using precision weighing, with IR **heat radiation** imparted from the top and temperature distribution recorded via **IR thermal imaging**. • Captured complex **thin-film** evaporation processes in the corner and bulk menisci.
Droplet impact on a surface *Course Project, IITM* *Jan 2020 – Jun 2020*	• Simulated **droplet** impact on moving and **textured surfaces** using modified VOF solver with dynamic contact angle model. • Incorporated the **phase change effects** for **evaporation** and **condensation**. • Validated and analyzed droplet post-impact regimes on **moving surfaces**.
Heat Transfer in a coupled porous media *IIT Madras* *Aug 2019 – Jan 2020*	• **Heat transfer** and **fluid flow** through coupled homogeneous porous and non-porous regions in a **forward step** channel, applying slip conditions at the interface. • Modified OpenFOAM **solver** to include Darcy-Brinkman-Forchheimer equations for porous media flow and **coupled heat transfer**; • Used **Tecplot** and **ParaView Python** programming.
Human Solar Exposure *Leibniz Uni., Germany* *Master's Thesis, IIT KGP* *Aug 2018 – Mar 2019*	• Simulated **UV solar radiations** on human reflected from various surfaces (concrete, grass, sand, snow) using **IDL programming**, incorporating environmental factors. • Assessed on **Vitamin-D synthesis** in humans, factoring in clothing behavior, shading, and seasonal variations specific to Berlin's urban environment. • Estimated **optimal** outdoor **exposure times** for sufficient **vitamin-D generation**, providing insights into public health recommendations.

Ocean Circulation Model *Course project, IIT KGP* *Jan 2018 – Apr 2018*	• Visualized basic Stommel model outputs as latitude versus longitude flow patterns to illustrate **ocean circulation**. • Generated contour plots of the stream function to depict flow intensity and circulation cells.
Development of Fluidized Bed Gasifier *4th year, NIT Bhopal* *Jul 2015 – Mar 2016*	• Designed a **gasifier** to convert biomass into **nitrogen-free** combustible gas with **low tar** production, targeting cleaner and efficient **syngas generation**. • **Optimized reactor design** by enhancing vortex circulation in the cyclone filter. • Modeled prototype using **CATIA V5** to design the geometry.
Autonomous Bot *Techfest, IIT Bombay* *Aug 2014 - Dec 2015*	• Built an autonomous bot for **Techfest IIT Bombay** 2014, programmed in **C++** using an **ARM 7** development board. • Bot solved grids by following white lines and avoiding nodes using sensor inputs.
Simulation of Semi-Automatic Transfer Case *3rd year, NIT Bhopal* *Jul 2014 – Mar 2015*	• Mechanism to **automate actuation** from **2WD to 4WD**, enabling 4WD mode for enhanced road grip during **high-speed cornering**. • Addressed synchronization between front and rear wheel rotation and incorporated **low-range gears** to improve off-road vehicle performance • Prototypes **designed** using **CATIA V5** with simulations conducted in **ANSYS**.
Professional Experience	
Project Officer *ICSR, IIT Madras* *Jul 2019 – Mar 2023*	• Led a **₹1.2 Crore** project for developing a **novel, low-cost heat spreader** for high-power Monolithic Microwave Integrated Circuit (**MMIC**) amplifiers. • **Optimized** the design of heat spreader device to improve **thermal efficiency** and enhancing performance. • Worked in the Dept. of Applied Mechanics, IC & SR, IIT Madras.
Project Associate *ICSR, IIT Madras* *Apr 2019 – Jun 2019*	• Helped **build** and **operated** a **15 ft. fluidized bed** reactor that uses coal to improve the magnetic properties of **low-quality iron ores**. • Worked on **improving** the process to make iron ores easier to **separate in magnetic equipment**. • Project funded by the Ministry of Science, Technology & Environment **(MSTE)**.
Internships	
Risk Management Solutions (RMS) *Noida* *Jun 2018 – Aug 2018*	• Part of the **Spatial Modeling Group**, consolidated and corrected **cyclone data** from **IMD**, **ISRO** and **IBTrACS databases** for the **Indian Ocean**. • **Categorized** cyclones, identified landfall events, and **estimated economic losses** from stochastic cyclone events. • Developed **R programming** codes to **plot cyclone tracks** and perform **data analysis**.
Bharat Heavy Electricals Ltd. (B.H.E.L) *Bhopal* *May 2015 – Jun 2015*	• Gained hands-on experience with **manufacturing** and operations of **turbines** and **heat exchangers**. • Observed inspection and **quality control** processes like **NDT** to ensure reliability and safety of power plant equipment. • Learned about working-fluid systems in hydro and thermal **power plants**.

Publications

- **Chitransh Atre**, Puthenveettil A P, Arul Prakash, *Dynamics of Liquid Rise in the Interstices of Circular Capillaries under Non-Inertial Regime,* **Soft Matter**, 2025; 21:7318-7332. http://dx.doi.org/10.1039/D5SM00691K
- **Chitransh Atre**, B. A. Puthenveettil, K A Prakash, *Inertial period corner rise in the interstice of circular tubes*, **Journal of Fluid Mechanics**. *(under submission)*
- **Chitransh Atre**, B. A. Puthenveettil, K A Prakash, *Bulk meniscus rise in the three sharp corners geometry*, **Physics of Fluids**. *(under submission)*
- Tripathi, N.K., Shevkar, P.P., **Atre, C**., & Puthenveettil, B.A, *Design to Avoid Dry Out in a Flat Heat Pipe Based on Cu Foam, Fluid Mechanics and Fluid Power,* Volume 1, **Springer**, 2024. https://doi.org/10.1007/978-981-99-7827-4_16
- **C. Atre**, A. Manoj and B. A. Puthenveettil, *Bulk rise in the interstices of capillaries*, *17th Asian Congress of Fluid Mechanics* **IEEE Xplore IET**, Beijing, China, 2023, pp. 244-248, 10.1049/icp.2023.1956
- **Atre, C**., Manoj, A., Puthenveettil, B.A, *Capillary Rise in the Interstices of Tubes*, Fluid Mechanics and Fluid Power, Volume 5, **Springer**, 2024. https://doi.org/10.1007/978-981-99-6074-3_31

Conferences

• **EFDC 25, Dublin, Ireland**	Corner Meniscus Rise in Capillary Interstitial Spaces.
• **ICHMT 24, Turkey**	Numerical Study Of Corner Meniscus Rise In Interstice Of Circular Capillaries.
• **APS DFD 24 , Utah, USA**	Inertial period corner rise in the interstice of circular tubes.
• **CompFlu 24 , IIT Hyd.**	Dynamics of capillary meniscus rise inside a sharp three cornered micro-channel geometry.
• **ACFM 23, Beijing, China**	Bulk rise in the interstices of capillaries.
• **FMFP 22, IIT Roorkee**	Design to Avoid Dry Out in a Flat Heat Pipe Based on Cu Foam.
• **FMFP 22, IIT Roorkee**	Capillary rise in the interstices of tubes.

• **ICFTES22, NIT Calicut**	A Design Procedure for Sintered Copper Flat Heat Pipes
• **CompFlu 25, IISc**	Evaporation from Corner and Bulk Menisci in Micro-Capillaries Bundle under IR radiations.
• **CompFlu 25, IISc**	Strategies for Reducing Pinhole Defects in Paint Coatings on Glass Substrates. (submitted)

Relevant Coursework & Skills

• *Advanced Fluid Mechanics* • *Introduction to Turbulence*	• *Heat and Mass Transfer* • *Surfaces and Interfaces*	• *Advanced Meteorology* • *Ocean Dynamics*

• OpenFOAM, Ansys (Fluent), MATLAB. • CATIA V5, AutoCAD, SolidWorks.	• Python, C/C++, R programming. • IDL, Blender, LATEX, MS Office, MATHEMATICA.

Technical Exposure and Co-curricular Activities

- Assisted in **mentoring 2 interns** on **experiments** and **theoretical work** with the supervision of my PhD co-advisor.
- Worked as **Teaching Assistant** for undergraduate courses in **Fluid Mechanics**, **Introduction to CFD**, and **Engineering Mechanics** at IIT Madras.
- Selected for **Summer Internship 2018** at **IIT Mandi**.
- Attended Global Initiative of Academic Networks (**GIAN**) course at **IIT Indore** and **IIT Madras**.
- **Editor** for the **book** "Futuristic Trends in Mechanical Engineering Vol. 3 Book 4" (E-ISBN: 978-93-5747-908-1) for IIP series.
- **A1 level German** Language certification.
- Certification in **ANSYS** and **CATIA V5**.
- Certification in **OpenFOAM** (**FOSSEE**, IIT Bombay; CFD Flow Engineering, **VNIT Nagpur**; **Udemy**).
- Certification in **MATLAB (Coursera)**.
- Certification in **Python (Internshala; Data Flair)**.
- Certification in **Artificial Intelligence (Coursera)**.
- Participated in **SPARC workshop** at IIT Madras.

Extra-curricular Activities

- Corporate Communicator at **KSHITIJ 2017, IIT Kharagpur**.
- Participant in **TECHNOSEARCH 2012**, 2013 (**NIT Bhopal**), and **TECHFEST 2014** (**IIT Bombay**).
- Coordinated technical workshops and guest lectures at **SRAJAN'13, IEEE MANIT Student Chapter**.
- Member of **Rotaract Club MANIT**; organized collection and distribution drives for villagers near Bhopal.
- Conducted biweekly teaching classes at an open school for children aged 13–17.
- **Achieved 1st rank** (Synthesizer) at Regional level in Orchestra and performed at cultural fest, **MAFFICK 2013**.
- Volunteered at blood donation camp organized by Sankalp India Foundation.
- Participated in **Dramatics (Yuva Sansad Munch)** and **musical events**.
- **One-year degree** in **Classical Music** from Prayag Sangeet Samiti, Allahabad.
- Participated in **badminton** competitions.
- Member of **Institute of Scholars (INSc)**.