Thamilmani Murugan

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Summary

Experienced and passionate CFD researcher specializing in **turbulence, heat transfer, energy systems, aerodynamics**, and turbo-machinery. PhD. thesis submitted at **IIT Bombay** focusing on **supercritical heat transfer**. Proven track record of tackling complex engineering challenges, with active alignment toward dynamic job opportunities to drive technical learning, contribution, and professional growth.

Areas of Research

Turbulence Modeling, Supercritical heat transfer, CFD based Optimization, Hydraulic and Thermodynamic System analysis, Aerodynamics.

Skills

- **Programming & Scripting Languages**: Python, C, C++, MATLAB, SciLab, BASH
- **Tools & Libraries**: ANSYS Fluent, CFX, OpenFOAM, AutoCAD, SOLIDWORKS

Work Experience

Research Consultant | ***HINCOL India - IITB Collaborative Project*** *(Jan 2026 - Sep 2026)*

- Audited industrial plant layout, piping networks, and tank designs to assess system-wide heater and pumping requirements to reduce the production time of modified bitumen **below 2 hours**.
- Developed automated theoretical frameworks for designing new tanks and extending existing tanks with external heat-exchangers for **30-MT PMB production**.
- Executed trade-off studies to assess operating volume, tank orientation, fuel consumption to achieve **optimum production cost** and time for modified bitumen plant.

Research Consultant | ***Tabrej DesignLife, Thane*** *(Dec 2022 - Feb 2023)*

- Evaluated the thermodynamic **feasibility study** of a novel HVAC design, identifying critical performance bottlenecks such as rapid system stalling and **thermodynamic constraints on heat rejection**.

Project Officer | ***Center of Propulsion Technology, IIT Madras, Chennai*** *(July 2018 - Dec 2018)*

- Conducted numerical studies on the "Unsteady flow physics and **loss mechanisms** and shock boundary layer interactions in turbine flow field" under Prof. BVSSS Prasad for DRDO Project using ANSYS CFX.

Education

PhD. Mechanical Engineering | *IIT Bombay* | **7.71 CPI** *(Jan 2019 - May 2026)*

- **Thesis:** *Characterization, modeling and mitigation of heat transfer deterioration in supercritical fluids.*
- Developed a novel **turbulent Prandtl number model** to improve heat transfer predictions within accuracy of **9.5%** for different supercritical fluids.
- Investigated pulsations to mitigate the heat transfer deterioration process, achieving an average **enhancement of 52%**. Employed **Dynamic Mode Decomposition** (DMD) to isolate dominant modes and coherent structures.
- Executed **CFD based optimization** for the selection of baffle size for maximizing the effective heat transfer enhancement resulting in **maximum of 66% enhancement**.

M.Tech. Thermal & Fluids Engineering | *Amrita University, Kerala* | **9.48 CGPA Gold Medalist***(Aug 2016 - Jun 2018)*

- **Thesis:** *Numerical analysis of flow over multiple square cylinders in tandem arrangement*
- Numerically investigated flow interactions between multiple square cylinders in tandem to assess the criticality of **drag reduction behavior** in the wake region.
- Served as a Project Intern at IIT Bombay at PIV Lab, under Prof. Amit Agrawal.

B.E. Mechanical Engineering | *SSN College of Engineering, Chennai* | **7.39 CGPA** *(Aug 2011 - May 2015)*

- **Thesis:** *Studies on inward solidification of PCM dispersed with macro-particles.*
- Analysed the inward **solidification of phase change material** with macro-particles to assess the effect of particle fraction and thermal conductivity on solidification time using in-house C code.

Self Projects

- Collaborated with MS. Research student from Western University, Canada for implementing Reduced order model for **moving boundary method in Heat pipes**.
- **foam_to_fluent2D**: Built Python based custom automation workflow to convert 2.5D OpenFOAM Meshes to 2D ANSYS Fluent compatible meshes, **reducing mesh-conversion time by 40%** compared to foamMeshToFluent2D utility.
- **residual_HPC**: Built Python based CLI tool for simultaneous residual monitoring of multiple remote ANSYS Fluent jobs running on ROCKS or OpenHPC Clusters.

Journal Publications

- Thamilmani Murugan, Amit Agrawal, Sandip K Saha, "Numerical Analysis of Pulsatile Flow of Supercritical Fluids Through a Vertical Pipe", *Heat Transfer Journal*, Oct 2026. (DOI: 10.1002/htj.70399)
- Thamilmani Murugan, Amit Agrawal, Sandip K Saha, "Proposal of turbulent Prandtl number models for predicting heat transfer deterioration in supercritical flows", *Physics of Fluids*, Sep 2025. (DOI: 10.1063/5.0284649)
- Thamilmani Murugan, Arun K. Raj, Amit Agrawal, Sandip K Saha, "Study on Convective Heat Transfer of Supercritical Water in Annular Square Channel", *Heat Transfer Engineering*, Jan 2023. (DOI: 10.1080/01457632.2022.2162012)
- N. Lakshmi Narasimhan, V. Veeraraghavan, G. Ramanathan, B. Sanjay Bharadwaj, M. Thamilmani"Studies on the inward spherical solidification of a phase change material dispersed with macro particles", *Journal of Energy Storage*, Apr 2018. (DOI:10.1016/j.est.2017.10.016)

Conference Presentations

- "Characterization of Helmholtz oscillator for mitigating heat transfer deterioration in supercritical flows," **ECOS 2025**, Ecole des Mines, PSL, Paris, France, June 29 – July 4, 2025.
- "Numerical studies on flow over multiple cylinders in tandem arrangement: Effect of number of cylinders," **FMFP 2018**, IIT Bombay, Mumbai, India, Dec 2018.

Teaching Assistance

- **ME684** : Air Conditioning system design *(Jan 2020 - Apr 2020)*
- **ME661** : Advanced Thermodynamics and Combustion *(Aug 2020 - Dec 2020 & Aug 2021 - Dec 2021)*
- **ME415** : Computational Fluid dynamics and Heat transfer *(Jan 2021 - Apr 2021 & Jan 2022 - Apr 2022)*
- **ME346** : Heat transfer *(Aug 2022 - Dec 2022)*
- **ME306** : Applied Thermodynamics *(Jan 2023 - Apr 2023)*

POR & Extra-curricular Activities

- Organized and **Co-hosted** ASME India Seminar on *"Engineering Education with focus on Computational Mechanics"*, held at IIT Bombay on August 9, 2025.
- Managed and maintained HPC, **ROCKS and OpenHPC based cluster** for the Thermal Science Lab under Prof. Sandip Kumar Saha during 2024-26.
- Organized events **leading more than 50 member team** for Tamil literary club "Saaral" for Inter-college Annual cultural festival "Instincts" in March 2015.
- Core Team Member of *"Teach a School"* Project, with SSN Lakshya to lead volunteers to impart science-based learning to school children in 2015.
- Member of **SAE SUPRA F2 Team**, "Mach Racing Team" from SSN College of Engineering, for the year 2014.