ABHIJITH SIVAPRASADAN

M.Sc. Sustainable Energy Engineering (KTH, 2026) | CFD | Conjugate Heat Transfer | Numerical Methods
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RESEARCH INTERESTS

Computational fluid dynamics, conjugate heat transfer, and numerical methods for thermal-fluid systems. My master's thesis at Siemens Energy gave me hands-on experience with compressible flow and CHT modelling, mesh independence methodology, and the practical challenges of resolving solid-fluid interfaces accurately. I am drawn to research that connects rigorous CFD methodology with optimization and design, and I am motivated to develop deeper expertise in turbulent heat transfer modelling, shape and topology optimization, and the numerical methods that enable design exploration in regimes where intuition is insufficient.

EDUCATION

M.Sc. in Sustainable Energy Engineering (expected 2026)

KTH Royal Institute of Technology, Stockholm, Sweden 2023 - 2026

Master thesis at Siemens Energy AB, Fluid Dynamic Lab, Finspang. Academic supervisor: Prof. Jens Fridh.

Thesis title: Numerical Investigation of Steady-State Thermo-Fluid Performance of a Reducer for a High-Temperature Dynamic Pressure Sensor Calibration Rig (TRITA-ITM-EX 2026:14).

Selected coursework relevant to CFD, heat transfer, and numerical methods:

- Numerical Heat Transfer in Energy Technology (MJ2515) - grade A. Finite volume methods for conduction, convection, and conjugate heat transfer; numerical schemes for advection-diffusion problems.
- Applied Heat and Power Technology (MJ2426) - turbomachinery, compressible flow fundamentals, thermodynamic cycle analysis.
- Modeling of Energy Systems - Heat and Power Generation (MJ2438) - system-level thermal modeling, dynamic simulation.
- AI Applications in Sustainable Energy Engineering (MJ2507) - grade A. Machine learning methods for energy and engineering data.
- Practical Optimization of Energy Networks (MJ2505) - numerical optimization methods applied to energy systems.
- Methods of Research in Sustainable Energy (MJ2510) - scientific methodology, measurement uncertainty, experimental design.
- Sustainable Power Generation (MJ2405) - thermodynamic analysis, energy system performance.
- Energy Storage Technology (MJ2386) - grade B. Thermal storage, phase change materials, system integration.
- Small Scale Polygeneration (MJ2503) - multi-energy system performance assessment.

Circular Economy for Energy Storage

Aalto University, Finland (Unite! Virtual Exchange) Oct - Dec 2024

Battery systems, lifecycle analysis, and circular design principles for energy storage.

B.Tech in Mechanical Engineering

APJ Abdul Kalam Technological University, Kerala, India 2017 - 2021

Relevant coursework: Heat and Mass Transfer, Fluid Mechanics and Machinery, Thermodynamics, Compressible Fluid Flow, Computer Aided Design and Analysis, Mechanics of Fluids.

RESEARCH EXPERIENCE

Master’s Thesis Student, Fluid Dynamic Lab

Siemens Energy AB, Fluid Dynamic Lab, Finspang Apr 2025 - Nov 2025

Numerical investigation of compressible flow and conjugate heat transfer in reducer geometries for a high-temperature dynamic pressure sensor calibration rig (Pulsatorn). Academic supervision by Prof. Jens Fridh, KTH.

- Built compressible CFD and conjugate heat transfer models in ANSYS Fluent 2025 R1 using the k-omega SST turbulence model. Inlet conditions: T = 673 K, P_gauge = 100,000 Pa. Three outlet pressure cases per geometry, six adiabatic and six CHT simulations in total.

- Conducted a three-level mesh independence study confirming spatial discretisation independence to within 2% on key performance indicators before proceeding to the full simulation campaign.
- Managed full CFD workflow independently: geometry reconstruction in ANSYS SpaceClaim, structured meshing with prismatic inflation layers in ANSYS Meshing, solver configuration, convergence monitoring, and post-processing.
- Identified flow-regime asymmetry between two geometry configurations through systematic simulation: redesigned geometry achieved near-choked conditions (Ma 0.990) while legacy geometry produced localised supersonic vena contracta (Ma 1.006).
- Applied Biot number analysis (Bi 0.003 to 0.004) and insulated reference simulations to decompose thermal performance, establishing that external convective surface area dominates thermal delivery independently of internal geometry.
- Authored thesis manuscript and presented findings to industrial supervisors and academic supervisor at KTH.

Experimental phase (prior to project scope change due to heater hardware failure):

- Commissioned NI-DAQ measurement chains, wired thermocouples, modified LabVIEW VIs for data logging, and ran independent thermal test campaigns at temperatures up to 700 degrees C.
- Conducted formal root cause analysis following heater failure: systematically eliminated candidate causes, identified ceramic insulation damage on heater leads as the root cause, documented findings, and delivered a recommendation that resulted in an approved scope change to numerical-only investigation.

Research Assistant Internship - Pyrolysis Oil Extraction

KTH Royal Institute of Technology Feb 2024 - Jun 2024

- Conducted techno-economic analysis and structured literature review on polymer pyrolysis for oil extraction within an academic research group. Reviewed reactor designs and summarised findings to support research direction planning.

ACADEMIC PROJECTS

Heating Dispatch Optimisation - Mixed-Integer Linear Programming

KTH Course Project (Python, PuLP) 2025

- Designed and implemented an annual dispatch optimisation model in Python using PuLP to meet Stockholm heat demand across multiple demand profiles. Formulated objective function and operational constraints for a multi-source system including CHP, heat pump, and storage.
- Coupled CHP operation to electricity prices and modelled operational dynamics between heat demand and electricity supply for the heat pump. Integrated diurnal (hot water tank) and seasonal (borehole) thermal storage and evaluated their impact on flexibility.
- Defined a 2030 future scenario with forecast demand and resized sources, then re-ran optimisation to compare dispatch, capacity mix, and seasonal allocation against the base case.
- Implemented both cost-based and emissions-based optimisation objectives and compared dispatch outcomes, fuel use, and trade-offs.

ML Heating Demand Forecasting

KTH Course Project (Python, scikit-learn) 2025

- Developed a day-ahead heat demand prediction model achieving 93.7% accuracy. Built baseline regression models and shallow and deep neural networks; applied feature engineering, time-series analysis, and error decomposition. Practical experience in distinguishing systematic bias from stochastic error in time-series data.

Distribution Grid Studies - EV Charging and PV/Storage Impacts

KTH Course Project (Python power-flow workflow) 2025

- Modelled the CIGRE MV distribution grid: load flow analysis, N-1 contingency studies, and 24-hour time-series simulation with hourly load profiles. Identified critical lines and voltage-risk buses through systematic numerical analysis.
- Integrated EV charging stations through MV-LV transformer architecture and assessed voltage and line loading impacts under different EV penetration and N-1 contingency scenarios.

Thermal Energy Storage for District Cooling Peak Shaving

KTH Course Project (Python) 2024

- Simulated TES control logic to cap peak cooling demand. Sized storage and compared ice storage vs phase-change material options on efficiency, cost, and volume trade-offs.

Hylkisaari Smart Energy Island Modelling

KTH Course Project 2024

- Modelled building energy demand, PV generation, battery storage, and heat pump scenarios using IDA ICE and HOMER Pro. Coupled component-level models to system-level performance metrics across BAU and renewable-storage scenarios.

Residential Heating Techno-Economic Comparison (BRF Arstaterrassen)

KTH Course Project 2025

- Compared district heating, PV with electric boiler, PV with heat pump, and solar thermal with TES configurations using hourly demand and irradiance data. Built CAPEX/OPEX/LCOE/payback KPIs with sensitivity analysis.

OTHER EXPERIENCE

Energy Efficiency Intern

Alleima AB, Sandviken (Remote) Dec 2024 - Jun 2025

- Developed ISO 50001-aligned energy performance methodology for industrial sites. Designed KPI and EnPI frameworks, load driver normalization logic, and measurement-readiness assessments. Built data analysis workflows in Python.

Backend Engineer

QBurst, Thiruvananthapuram, India Sep 2021 - Jun 2023

- Developed and maintained backend APIs and automated test workflows in agile teams using JIRA. Built strong skills in version control, structured debugging, documentation, and systematic testing applicable to scientific computing workflows.

TECHNICAL SKILLS

CFD / Simulation:	ANSYS Fluent (compressible flow, CHT, k-omega SST, mesh independence methodology), ANSYS Meshing, SpaceClaim, COMSOL (coursework). Motivated to extend toward OpenFOAM/SU2 if required.
Numerical methods:	Finite volume methods for advection-diffusion problems, structured mesh generation with prismatic inflation layers, convergence diagnostics, near-wall treatment for turbulent flows
Numerical optimisation:	Mixed-integer linear programming with Python and PuLP, scenario analysis, multi-objective trade-offs (cost vs emissions). strong interest in developing adjoint and topology optimisation methods for thermal-fluid design.
Heat transfer & fluid mechanics:	Compressible flow, conjugate heat transfer, turbulence modelling fundamentals (RANS), boundary layer analysis, dimensional analysis (Biot, Nusselt, Reynolds)
Programming:	Python (NumPy, SciPy, pandas, matplotlib, scikit-learn), MATLAB, C++, TypeScript, Golang. Git for version control.
Energy modelling:	IDA ICE, HOMER Pro, SAM (Solar Advisor Model), LEAP for building-energy, microgrid, solar-thermal, and national energy-scenario studies.
Instrumentation / DAQ:	NI-DAQ, NI MAX, LabVIEW (data logging, signal conditioning), thermocouple and pressure sensor commissioning
CAD / PLM:	Siemens NX, SolidWorks, Teamcenter, ANSYS SpaceClaim

CERTIFICATIONS AND TRAINING

Applied Computational Fluid Dynamics (Siemens) | IBM Python for Data Science | Digital Manufacturing and Design Technology (University at Buffalo) | SSG Entre / Industrial Safety (valid Jan 2025 - Jan 2028) | Digital Signal Processing (in progress) | Building Energy Systems and Electrification (in progress)

OTHER

Personal academic interests beyond the curriculum include nuclear engineering, statistical thermodynamics, and numerical methods. Founded the SAEINDIA Collegiate Club at College of Engineering Perumon; later served as Secretary, Treasurer and Project Team Lead.