

EDUCATION

| Program | Institution | %/CGPA | Completion |
|---|--|-----------|------------|
| B.Tech Metallurgical and Materials Engineering + M.Tech Computational Engineering | Indian Institute Of Technology Madras (Inter-Disciplinary Dual Degree) | 8.92/10.0 | 2026 |

RESEARCH INTERESTS

ML-Assisted Mechanical Design, Convex Optimization, Architected Materials

RELEVANT COURSES

- Machine Learning Techniques
- Deformation and Failure of Materials
- Foundations of Computational Fluid Dynamics
- Materials Characterization
- Computational Materials Engineering Lab
- Engineering Design of Additively Manufactured Components
- Numerical Methods for Metallurgists
- Optimisation Methods for Mechanical Design
- Biofluid Mechanics
- Soft Robotics
- Fundamentals of Finite Element Analysis*
- Constitutive Modeling in Continuum Mechanics*
- Advanced Solid Mechanics*

PUBLICATIONS AND PATENTS

- Jaswanth V. Gurudev and Ratna Kumar Annabattula, “Dual-Purpose Architected Materials: Optimizing Graded BCC Lattices for Toughness and Thermal Efficiency.” (*Publication in preparation*)
- “A device for spectral analysis of soil samples and a method thereof”, Indian Patent (application number: 202541068459) - filed on July 17, 2025

CONFERENCES

- Jaswanth VG and Ratna Kumar Annabattula, “Design of functionally graded lattice structures for heat dissipation and energy absorption”, 14th International Symposium on Plasticity and Impact Mechanics ([IMPLAST 2025](#)) - oral presentation (October 2025)
- Jaswanth V. Gurudev and Ratna Kumar Annabattula, “Multi-objective design of spatially-graded BCC lattice structures for thermal dissipation and energy absorption”, 10th International Congress on Computational Mechanics and Simulation ([ICCMS 2025](#)) - accepted

RESEARCH PROJECTS

GRADED BCC LATTICE STRUCTURES FOR CRASHWORTHINESS AND HEAT DISSIPATION

MAR'25 - PRESENT

Advisor: Prof. Ratna Kumar Annabattula, Mechanics of Materials Group, IIT Madras

- Utilized Latin Hypercube Sampling (LHS) to generate datapoints for multi-objective optimisation
- Automated repetitive Abaqus and Ansys simulations using Python scripting
- Surrogate modelling with goal programming was used to identify the optimal design variables
- The optimal lattice demonstrated a 115% and 31% improvement in absorbed energy and pressure drop, respectively
- Implementing Physics-Informed Geometric Operators (PIGOs) to accurately model and analyze thermal behavior

BIOMIMETIC HIERARCHICAL CELLULAR STRUCTURES FOR IMPACT ABSORPTION

DEC'24 - MAR'25

Advisor: Prof. Ratna Kumar Annabattula, Mechanics of Materials Group, IIT Madras

- Performed high strain-rate impact simulations of regular and auxetic honeycomb structures in Abaqus/Explicit
- Developed Python scripts to generate Voronoi substructures within each honeycomb unit cell for hierarchy
- Achieved a 2× improvement in overall energy absorbed per unit mass during low velocity impacts

PARTICLE ANISOTROPY CORRELATION WITH SLM POWDER SPREADING DIRECTION

MAR'25 - JUNE'25

Personal Project, Mechanics of Materials Group, IIT Madras

- Exploited Voro++ to generate Voronoi tessellations of monodispersed and polydispersed packings
- Developed C++ script to calculate Minkowski tensors for quantifying anisotropy index
- Developed a Python script to generate .vtk files to visualize the generated Voronoi tessellations in Paraview

MECHANICAL DESIGN OPTIMISATION AND FABRICATION

JULY'22- JAN'24

Team Anveshak, Mars Rover Team, IIT Madras

- Performed analysis of the rocker-bogie suspension kinematics in MATLAB for tuning geometric parameters
- Revamped the rocker-bogie system, increasing the maximum climbing angle to 42° and ground clearance by 6 cm

- Developed a 3D-printed **gearbox** with a **57:1 reduction**, with a **planetary** (3:1) and a **dual-stage cycloidal** (19:1).
- Designed and fabricated lightweight **3D-printed wheels**, optimized for traction
- Ideated the next-gen four-wheeled independent-steering system with a double-pivoted rear-mounted differential

STUDY AND PREDICTION OF STEEL MELTING SHOP DEFECTS IN Ti-STABILIZED SS COILS MAY'24 - JULY'24

Summer Internship, Jindal Stainless Ltd., Odisha

- Investigated seven frequent inclusion-based and surface defects in Ti-stabilized grades - 416L, 439, and 441
- Developed a **classification model** to predict the defect probability and identified the top five influencing factors
- Built and tuned **Random Forest** and **LightGBM** models, with accuracy scores of 94.12% and 93.73%, respectively

DESIGN AND DEVELOPMENT OF AN ELECTRO-MECHANICAL TESTBED FOR HES SYSTEMS MAY'23- AUG'24

Advisor: Prof. Tiju Thomas, Applied Nanostructures Engineering and Nanochemistry (ANEN) Group, IIT Madras

- Fabricated an electro-mechanical testbed for **simulating real-life EV functions** of a Battery-Supercapacitor system
- Implemented **remote monitoring** of real-time voltage, current, and power readings via an **ESP32 microcontroller**
- Conducted **stress testing** on Li-ion and HES systems and fabricated 3D-printed enclosures for supercapacitors
- Tailored the testbed to **measure capacitance** above 100mF (accuracy: $\pm 10\%$) for stress-tested supercapacitors

COURSE PROJECTS

PROCESS PARAMETERS OF AN ADDITIVELY MANUFACTURED HEAT EXCHANGER

APRIL'24

(Course Instructor: Prof. Gnanamoorthy, Mechanical Engineering, IIT Madras)

- Designed a **shell-and-tube heat exchanger** that requires minimal support structures for manufacturing via L-PBF
- Identified process parameters from literature to minimize **surface roughness** and **porosity**

3D CONVEX HULL CONSTRUCTION

NOV'24

(Course Instructor: Prof. Prasad Patnaik, Applied Mechanics, IIT Madras)

- Developed a Python script uses the **Gift-Wrapping** algorithm to construct a 3D convex hull from random points
- Visualized the 3D convex hull using the PyQt library for an interactive graphical representation

2D LID DRIVEN CAVITY FLOW AND ANALYSIS OF NUMERICAL SCHEMES

NOV'24

(Course Instructor: Prof. Arul Prakash, Applied Mechanics, IIT Madras)

- Coded Python solvers for **Navier-Stokes** and **2D Laplace equations** using the Finite Difference Method (FDM)
- Applied psi-omega formulation with Upwind schemes and compared Gauss-Seidel, SOR, and ADI methods
- Generated visualisations for a $Re = 100$ flow and validated the flow results against [ghia et al. \(1982\)](#)

ACHIEVEMENTS AND AWARDS

- 2nd place, **CAD Design Challenge**, AIRSS 2024 - Ideation and modelling of a three-component **stair-climbing bot**
- Recipient of **Viswesvariah Scholarship for Excellence in Technology**, awarded **full tuition waiver** in 2021
- 2nd overall, **International Rover Challenge 2024**, Space Robotics Society
- Secured **99.35** percentile in JEE Mains B.E/B.Tech and **99.74** percentile in JEE Mains B.Arch in 2021
- Received the **NTSE Scholarship**, an academic excellence scholarship awarded to 2,103 high school students in 2019

SKILLS

- **Modeling and Simulation:** Ansys, Abaqus, Autodesk Inventor, AutoCAD, Solidworks, Gazebo
- **Programming languages:** MATLAB, Python, C, Arduino IDE, LaTeX
- **Lab:** FT-IR Spectroscopy, Optical Microscopy, Rheometry, Contact-angle Goniometry

EXTRACURRICULAR POSITIONS

HEAD OF OPERATIONS - TEAM ANVESHAK

JAN'24 - JUL'24

- Led a team of over 40 students in international competitions by managing logistics and technical strategies, resulting in podium ranks.
- Scheduled inter-module meetings to facilitate team bonding and streamlined deliverables for upcoming competitions

DESIGN ENGINEER (MECHANICAL MODULE) - TEAM ANVESHAK

JULY'22 - JAN'24

- Responsible for **Design, Manufacturing, Assembly, Testing and Validation** of the traversal system
- Responsible for Project Division and Management of 4-member subsystem with adherence to Overall Project Timeline

SCHOOL PUPIL LEADER - HIGHER SECONDARY SCHOOL

MAY'20 - OCT'21

- Organized annual events and represented the student body to improve faculty-student interaction
- Represented the school in inter-school sports and cultural competitions
- Played a pivotal role in organising the annual Tech Fest