

Tanay Mangal

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Education

Massachusetts Academy of Math and Science at WPI

Expected May 2027

GPA: 4.0/4.0 — Coursework: Numerical Methods for Linear and Non-Linear Systems (CS4032), Fundamentals of Aerospace Structures (AE3420), Ordinary Differential Equations, Linear Algebra, Vector and Tensor Calculus

Research Experience

Research Intern – Multiphysics Modeling for Metal Additive Manufacturing

2026-Present

Worcester Polytechnic Institute

- Refined a COMSOL model coupling heat transfer, laminar flow, phase change, and surface forces to study melt-pool formation and solidification in metal additive manufacturing.
- Diagnosed solver convergence failures by isolating recoil, evaporation, and Marangoni terms; ran parameter sweeps and checked solidification against liquidus/solidus temperature probes and an approximately 1 ms benchmark.

Research Intern – Computational Physics and Semiconductor Modeling

2026-Present

Worcester Polytechnic Institute

- Developed finite-element and quantum electrodynamics calculations for electron g-factors in confined InSb, InAs, GaSb, GaAs, and InP semiconductor nanostructures.
- Applied dimensional regularization and renormalization to one-loop corrections; reproduced the free-electron result ($g = 2.00232$) and compared quantum-well predictions with published bulk values.

Selected Engineering and AI Projects

- **ARTICULATE – Speech Accessibility AI:** Fine-tuned a Whisper speech-recognition model for atypical speech and paired it with Flan-T5 grammar repair, text-to-speech playback, live waveform feedback, and high-contrast accessibility features for users with dysarthria, Down syndrome, and related speech disabilities.
- **STATERA – Adaptive Fall-Prevention Wearable:** Built an ESP32-based glasses-mounted system with three MPU-6050 IMUs and a custom PCB; classified balance events with 88% accuracy across 50 trials and delivered stimulation in all trials.
- **FIRST Robotics – 180-Degree Level 3 Climb:** Designed a high-torque system for a world-qualifying team that rotated the robot 180 degrees to complete the 2026 REBUILT Level 3 climb; fewer than 1% of teams used this approach. Selected materials and analyzed force paths, torque, structural loads, and safety factors.
- **Etosha Wildlife Protection Optimization:** Built a spatial and temporal optimization model across 940 grid cells and five ecological guilds to allocate ranger patrols, drone bases, and sensors under limited resources.
- **Hazard-Aware Emergency Evacuation Routing:** Built a dynamic graph model using Dijkstra and A* search to optimize firefighter sweep routes as fire, smoke, and responder fatigue changed over time.

Leadership

Co-Founder and Programs & Education Lead – Tech Awareness Association

2025–Present

- Expanded the organization to five chapters and led electronics-recycling efforts that diverted more than 1,000 pounds of e-waste and 500 devices from landfills.

Selected Honors

- HiMCM Meritorious Award (top 13% internationally; advanced to IMMC)
- Climate Resilience Award Finalist and Modeling the Future Challenge National Finalist
- Top 20% Worldwide, MathWorks M3 Challenge
- Top 25% Worldwide, IMC Prosperity Trading Competition
- Bronze Medal, ACSL Finals Senior Division
- MathCON National Qualifier (97th percentile)
- 1st in Massachusetts, Purple Comet Math Meet (15th U.S.; 51st worldwide)

Technical Skills

Programming and AI: Python, PyTorch, Transformers, machine learning, natural language processing, data analysis

Modeling and Algorithms: COMSOL Multiphysics, finite-element analysis, differential-equation modeling, numerical methods, Monte Carlo simulation, stochastic processes, regression analysis, parameter estimation, sensitivity analysis, model validation, spatial and temporal modeling, graph algorithms, constrained optimization

Engineering: CAD/Onshape, embedded systems, ESP32, IMU sensors, PCB design, structural analysis, LaTeX