ARYAN GUPTA

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EDUCATION

University of Michigan September 2019 – May 2023
Major: BSE Engineering Physics GPA: 3.25/4.0, *Cum Laude*
Minors: Electrical Engineering, Computer Science, Entrepreneurship
Selected Coursework: Multivariable & Vector Calculus; Differential Equations; Matrix Algebra; Mathematical Methods in Physics; Honors Physics I-III; Advanced Mechanics, Electricity & Magnetism, Statistical & Thermal Physics; Data Structures & Algorithms; Logic Design; Signals & Systems; Embedded Systems (Intro & Advanced); Computer Architecture; Control Systems

WORK EXPERIENCE

Technip Energies July 2025 - Present
Specialist Engineer I – Instrumentation & Controls

- Perform instrumentation design and verification tasks on energy projects, ensuring compliance with client specifications and industry standards (ISA, IEC, etc.).
- Contributed to several cross-disciplinary initiatives exploring applications of AI and automation in engineering, supporting teams in process, electrical, and digital disciplines on use cases such as data validation, equipment tagging, and design quality checks.
- Co-founded and structured the Americas AI Solutions Initiative, developing its mission, operations, and training framework to promote practical AI adoption across engineering teams; subsequently endorsed and sponsored by leadership.
- Recognized for emerging leadership in AI and digital transformation, invited as an AI panelist at the company's annual Technology Day to speak on initiatives across business lines and the broader role of automation in engineering.

Technip Energies August 2023 – July 2025
Technology Developer I (Applied Physics Lead, Novel Carbon Capture R&D Team)

- Established a first-principles molecular modeling capability for internal carbon capture technology development; reproducible MD/DFT pipelines (LAMMPS, NWChem) across HPC and cloud (GPU + parallel I/O) reduced simulation walltime by ~two-thirds and meaningfully lowered cloud spend (verified via internal benchmarks).
- Bridged atomistic → continuum: injected MD/DFT outputs into diffusion and CFD models with a nucleation-delay term; sensitivities to critical nucleus size improved continuum accuracy and re-prioritized model assumptions; maintained diffusion-scale codebase with new verification tests.
- Physical fidelity: evaluated force fields beyond LJ (Morse, EAM, TraPPE, SPC/E; polarizable) and benchmarked interfacial energies, diffusion rates, crystallization barriers vs bench + literature with acceptable error bounds; designed and supervised crystal growth experiments.
- Automation at scale: parameter sweeps across composition-T-P grids; continuous ingest of experimental images + tables so analyses auto-updated.
- Image analytics: Python/C++ (OpenCV) pipelines with QA segmented terabyte-scale image sets; produced UQ-backed particle-size distributions (KS/AD) replacing multi-day manual workflows with a multi-hour pipeline.
- ML integration: engineered physics-informed features; PCA/UMAP/k-means for structure discovery; RF/linear surrogates identified crystallization-rate drivers later confirmed experimentally; piloted active-learning loops for simulation design.
- Rigor & reproducibility: multi-level UQ (sensitivities, CIs, error propagation); authored 14 internal technical notes (two-reviewer process) and a data processing code archive forming the team's reproducibility library.
- Collaboration & leadership: integrated atomistics with MATLAB/Fortran utilities (stress/thermowell analysis for large scale experiments); mentored teammates and onboarded a new engineer to extend the pipelines.
- Strategic impact: distilled findings into decision-ready decks supporting multi-million-dollar internal funding decisions; authored a 70-page market analysis & business plan that informed the team roadmap and funding discussions.

PREPRINTS & OPEN RESEARCH SOFTWARE

ThermoBench-Consist (v1.0) Sep 2025 – Oct 2025
Preprint: 10.5281/zenodo.17489426 *Code DOI: 10.5281/zenodo.17330440*

- Designed a CPU-only diagnostic/benchmark to vet ML equations-of-state and VLE surrogates before they are plugged into CFD/combustion/process simulators.
- Formalizes four physics checks (C1-C4): ρ-p monotonicity, $\kappa_t>0$ stability, Clapeyron slope, and speed of sound (a^2) with configurable tolerances, critical-region exclusion, and near-spinodal flagging.
- Provides reference grids for CO_2 and N_2, deterministic sampling (and seeded random grids), and guardrails (phase filtering, critical-band avoidance) to reduce false positives in fragile regimes.
- Ships a clean adapter API (finite-difference fallbacks, unit handling via pint) and a deliberately inconsistent surrogate to illustrate failure modes and expected report signatures; emits MD/HTML reports with plots, severity badges (info/warn/fail), and a machine-readable JSON score.
- Includes tests/CI, tiny datasets, and reproducible example outputs to enable drop-in evaluation of third-party surrogates across labs.

REB-1: Robot Energy Benchmark (v0.1) Aug 2025 – Aug 2025

Code DOI: 10.5281/zenodo.17204853

- Built a WSL-friendly CLI micro-benchmark that logs power via nvidia-smi (or a deterministic demo source) and writes tidy CSV traces with reproducible 60-second workloads.
- Provides an analysis notebook that integrates power to Wh, converts to gCO_2 with a user-set grid-intensity factor, and exports bar charts and a short demo GIF for side-by-side comparisons.
- Focuses on power/impact, deliberately complementing existing ROS tools centered on latency/throughput; enables fast A/B of autonomy workloads on commodity laptops.
- Includes schema-checked outputs, lightweight tests/CI, and turn-key examples so other groups can replicate figures exactly and contribute logs.

Assessing the Limits of Graph Neural Networks for Vapor-Liquid Equilibrium May 2025 – Sep 2025

Preprint: 10.48550/arXiv.2509.10565

- Negative-results study on cryogenic mixtures: documents phase-dependent errors and liquid-phase inconsistency that prevent trained GNN surrogates from supporting VLE solvers.
- Traces failure to derivative pathologies (e.g., density/enthalpy behaviors across phases), demonstrating why seemingly accurate pointwise fits can violate global thermodynamic identities.
- Provides a diagnostic workflow (finite-difference checks, phase-aware tests, hybrid fallback with classical property libraries) and released failure cases to help other teams avoid silent breaks.

Energy-Efficient Robotics Software (2020-2024): Systematic Literature Review Jan 2025 – Aug 2025

Preprint: 10.48550/arXiv.2508.12170 Code DOI: 10.5281/zenodo.16907564

- 79-study synthesis of post-2020 work on energy in autonomy stacks (planning, perception, middleware, hardware acceleration) across mobile and manipulator platforms.
- Proposes a taxonomy of energy-aware techniques (e.g., scheduling/DVFS, algorithmic refactoring, compute off-loading, task-level policy design) and a reporting checklist for fair energy claims.
- Quantifies coverage gaps (e.g., Wh/mission, energy-latency trade-offs, standardized workloads) and surfaces under-measured components (sensing, comms, OS services).
- Releases a full replication package (screening spreadsheet, code to regenerate figures, inclusion/exclusion rationale) to support future surveys and benchmark design in the community.
- Provides the analytical springboard for later software artifacts (e.g., REB-1's Wh→gCO_2 framing and quick-run workloads).

RESEARCH EXPERIENCE

BIRDS Lab, UMich Jan 2021 – Apr 2023

Research Assistant

- Built adaptable quadcopter HW/SW stack; implemented Wi-Fi ↔ UART bridges (ESP32/FTDI) for real-time control/telemetry; redesigned power boards; contributed to motor control reliability in a 5-person team.

MiTEE (Miniature Tether Electrodynamics Experiment) Jan 2020 – Dec 2020

Plasma Team; Liaison to Structures

- Studied electrodynamic tether propulsion feasibility for pico/nanosats; supported thermodynamic analysis & electronics prototyping; coordinated interfaces with Structures team.

PROJECTS

Electric Longboard Remote Controller Sep 2022 – Dec 2022

- Designed a modular remote on STM32L010C6T6 with UART/LPUART smartphone link; added speed/turn indicators, music control, battery telemetry, and display updates. Modified VESC firmware (GPIO/PWM) and produced a 3D-printed enclosure; delivered under 3.5-month / $1k constraints.

Out-of-Order Processor Architecture Feb 2022 – Apr 2022

- Implemented a MIPS R10K-style OOO core in System Verilog with I/D caches, LSQ, and branch predictor; 2-way superscalar issue and precise exceptions; added baseline SMT (round-robin), cache optimizations, and a visual debugger for bring-up.

Low-Autonomy Follower Robot Feb 2022 – Apr 2022

- Built a vision + ultrasonic follower platform (Arduino/Nucleo, PID control) using LED-encoded commands; warehouse POC for leader-follower flows.

TEACHING EXPERIENCE

UMich College of Engineering Sep 2022 – Apr 2023

EECS 314 (Circuit Design and Analysis) Instructional Aide

- Led discussion groups for ~80 students; ran lab of 20 on DC/AC circuits, RLC transients, op-amps; shaped course structure for 160+ students and supported bench instrumentation (Keysight/HPE, scopes, DMMs).

LEADERSHIP & SERVICE

Citizens for Animal Protection (CAP) Dec 2023 – Nov 2024
Volunteer
- Assisted with dog walking, kennel cleaning, and shelter operations in Houston community.

HelixCases Feb 2022 – Aug 2022
Co-founder & Software Developer
- Secured a $10k Lyft contract, designed coding competition platform reaching 550+ students at 20 universities; built UI/backend, hosted custom competitions.

StartUM Jan 2021 – Apr 2022
Member & Mentor
- Guided a pre-seed medical-volunteer startup through ideation, validation, and re-targeting of its core technology to a new market.

Project RISHI Sep 2020 – Apr 2021
Fundraising Co-Chair
- Filtered/applied to 25+ grants; secured $16k toward a $35k budget; organized campus fundraising events (raffles, trivia nights, crowdfunding, game nights) with 100+ participants.

SKILLS
- **Programming & Numerics:** Python, C/C++, MATLAB/Simulink
- **Modeling & Control:** MD/DFT (LAMMPS, NWChem), basic CFD integration, control systems (PID)
- **HPC & Data:** SLURM, GPU computing, profiling, cloud/cluster workflows
- **Vision & Machine Learning:** scikit-learn (classical ML), OpenCV, PyTorch (prototyping)
- **Embedded & Control Systems:** STM32/ARM microcontrollers, FreeRTOS, Linux/Unix
- **Reproducibility:** Git, Docker/Conda, CI, documentation, uncertainty quantification

HONORS
- University Honors: 2019, 2020
- Dean’s List: 2019, 2020