

Justin Dugan

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Objective

Seeking Spring 2027 research and Summer 2027 internship opportunities in robotics, embedded systems, or applied math.

Education

Georgia Institute of Technology | Atlanta, GA

Aug 2025 – Present

Bachelor of Science in Computer Engineering, Minor in Mathematics, GPA 3.85

Expected Graduation, May 2029

Completed Coursework: Data Structures & Algorithms, Linear Algebra, Multivariable Calculus, Digital Design, Discrete Mathematics

In progress (Fall 2026): Programming Hardware/Software Systems, Differential Equations, Circuit Analysis, Quantum Computing

Honors: FIRST World Championship — Innovation in Control (2025), Autonomous (2024); OEIS Sequence Acceptance

Skills

Languages: C++, C, C#, Python, Java, GLSL, x86/6502 assembly

Embedded: Teensy, STM32, Raspberry Pi, I²C, SPI, UART, PWM, PID/feedforward control, odometry

Scientific Computing: NumPy, MathNet.Numerics, FFT, numerical integration, MNA, optimization

Tools: Linux, Git, Docker, Godot, FastAPI, SQLite

Experience

RoboJackets (Georgia Tech) | Atlanta, GA

Sep 2025 – Present

RoboRacing Project Manager

Autonomous robotics team primarily competing in Micromouse.

- Lead software for a ~10-person subteam; FSM-based motion planning with trapezoidal velocity profiles and feedforward+PID motor control, competed at APEC 2026
- Built Teensy peripheral drivers — I²C IMU, four time-multiplexed IR emitter/phototransistor pairs (300 μ s pulse each, 1.2 ms sense cycle), PWM motor control via DRV8833 — into a closed-loop odometry pipeline
- Designed IR-based wall detection and used those readings to correct dead-reckoning drift between maze cells

The Robot Collective VIP (Georgia Tech) | Atlanta, GA

Jan 2026 – May 2026

Undergraduate Researcher

- Trained a YOLOv5 robot detector on a 500-image single-class dataset, reaching 0.98 mAP@0.5 and 0.69 mAP@0.5:0.95
- Exported to ONNX for Raspberry Pi deployment, tripling inference throughput from 10 to 30 FPS; deployed in a robot-following behavior on the team's platform
- Built a battery monitor integrating measured current to profile energy draw per task (640 mA idle, 720 mA driving, 1040 mA inference), establishing a 5–10 minute inference budget per charge

FIRST Robotics Competition | Exton, PA

Sep 2022 – Aug 2025

Lead Programmer, Team Captain, Drive Team

International high school robotics competition

- Designed state-space control, autonomous routines, vision-based pose estimation and odometry
- Designed a swerve drive input-to-module-state mapping that reduced oscillation in competition

Mathnasium | West Chester, PA

Aug 2023 – Aug 2026

Instructor

After-school mathematics learning center providing individualized instruction from arithmetic through calculus.

- Taught ~200 students over three years at 15–20 hrs/week, individually and in groups, spanning arithmetic through calculus

Projects

Circuit Simulator

June 2026 – August 2026

Interactive analog circuit simulator; place and wire components + transient response in real time

- Modified Nodal Analysis solver in Godot/C# with MathNet.Numerics, supporting R/L/C, diodes, and independent sources
- Disjoint-set partitioning to split schematics into independent subcircuits and collapse connected grid points into single nodes
- TR-BDF2 transient integration (replacing backward Euler for better damping at equal step size) with Newton's method for nonlinear devices

Fractal Renderer / Expression-to-GLSL Compiler

May 2025 – May 2026

Renders fractals from arbitrary user-defined math expressions in real time.

- Built a custom expression parser and GLSL code generator to compile user-defined math into GPU shaders at runtime
- Sustained 1920×1080 at 60 fps while hot-recompiling shaders on expression edits, with no restart or frame-rate drop

6502 Breadboard Computer

2024

- Designed and assembled a 1 MHz 6502 system on breadboard (32K ROM, 8K RAM, 6522 VIA, interrupt-driven LCD input) and wrote 6502 assembly up to a working calculator.
- Debugged timing, signal integrity, and bus contention at the hardware level to reach stable operation

Physics Simulator & Numerical Optimizer

2024–2025

Charged-particle dynamics simulator with evolutionary trajectory optimization under electromagnetic fields

- Designed a differential evolution optimizer evaluating 600k–2M parameter configurations per run to solve projectile
- Cut runtime ~20× via 16-thread parallelism on 4 cores and JIT compilation