Matthew Vernacchia, Ph.D.

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I develop software to aid the design of superconducting magnets and fusion devices for clean energy. Previously, I led the design and testing of a solid rocket propulsion system (at MIT) and developed spacecraft software (at SpaceX). Core skills:

Programming: python (10+ years), git (8+ years), Rust (learning), Typescript (learning)
CAD: Solidworks, Onshape, GD&T
Fabrication: 3-axis CNC mill, CNC lathe, additive manufacturing (plastic and metal), composite layups, polymer casting, solid rocket propellant production.

Education

Massachusetts Institute of Technology Cambridge, MA

Ph.D. in Aeronautics and Astronautics, Space Propulsion Aug 2017 – May 2020

Developed a transonic rocket propelled UAV. Designed, produced and tested ultra-slow-burn solid rocket motors. Managed a team of undergraduate research assistants.

S.M. in Aeronautics and Astronautics Feb 2015 – June 2017

5.0/5.0 GPA. Thesis focus: solid rocket propulsion for small UAVs.

S.B. in Aeronautics and Astronautics with Information Tech. Aug 2011 - Feb 2015

4.9/5.0 GPA. Led student Rocket Team in building a liquid engine, grow team membership from 3 to ~40.

Work Experience

Commonwealth Fusion Systems Cambridge, MA

Scientific Software Lead Feb 2022 – Present

Managing scientific software projects that help engineers understand and build magnets and tokamaks, including: neutronics and optics models, a web app to store and visualize experimental data, design optimization tools, and techno-economic analysis tools. Set hiring strategy and grew the team from 2 to 6 engineers. Helping define the startup's software engineering workflows.

Scientific Software Engineer May 2020 – Feb 2022

Developed optimization software to support the design and manufacture of the world's most powerful high-temperature superconductor magnets. Developed models for thermo-fluid systems.

Space Exploration Technologies Hawthorne, CA

Dragon Propulsion Intern July – Sept 2017

Developed propulsion FDIR algorithms. Automated flight-critical propulsion component tests. Modeled thermal response of spacecraft thrusters. Designed & built pneumatic test hardware.

Guidance, Navigation and Control Intern June - Aug 2015, 2014, 2013

Modeled uncertainty in spacecraft docking maneuvers. Simulated human interactions for control interface testing. Integrated a flight simulator in C++. Trained NASA astronauts to fly a simulator and collected feedback on UI/UX and handling qualities. Simulated lighting conditions using ray tracing. Designed and executed tests for a LiDAR sensor. Programed and operated a large (400 kg) robot arm.

NASA Jet Propulsion Laboratory Advanced Robotics Controls Group Pasadena, CA

Robotics Intern June - Aug 2012

Developed a hand gesture UI for human-robot interaction in MATLAB and C. Decoded hand gestures from muscle activity signals using machine learning in MATLAB.

Publications and Conferences

"Low-Thrust Solid Rocket Motors for Small, Fast Aircraft Propulsion: Design and Development", AIAA Journal of Propulsion and Power, Sept 2021, DOI: 10.2514/1.B38104

"Slow-burn Ammonium Perchlorate Propellants with Oxamide: Burn Rate Model, Testing, and Applications," AIAA Journal of Propulsion and Power, June 2021. DOI: 10.2514/1.B38106

"Strategies for Reuse of Launch Vehicle First Stages," International Astronautical Congress, Oct 2018. IAC-18-D2.4.3