Anthony Joseph (A.J.) Vetturini II

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Education

Carnegie Mellon University **Aug. 2022 – Present**
Ph.D. Candidate, Mechanical Engineering *Pittsburgh, PA*

Case Western Reserve University **Aug. 2015 – May 2019**
B.S.E Aerospace and Mechanical Engineering, Cum Laude *Cleveland, OH*

Research Interests

- DNA Nanostructures
- Self-assembly
- Generative Design
- Optimization
- Baseball & Football Analytics

Ph.D. Research

A generative design framework for DNA origami nanostructures **Aug 2022 – Present**
Ph.D. Candidate *Pittsburgh, PA*

- Member of Microsystems and MechanoBiology Lab (MMBL) and the Integrated Design Innovation Group (IDIG) in the Department of Mechanical Engineering at Carnegie Mellon Univeristy.
- Researching innovative design strategies for the self-assembly of DNA nanostructures
- Using generative design methodologies to systematically generate DNA nanostructures

Technical Skills

Programming Languages: Python, MATLAB, R
Frameworks: Pandas, NumPy, SciPy, JAX, PyTorch, tidyverse
CAD: Creo Parametric, SolidWorks, OnShape
FEA: Creo Simulate, ANSYS Mechanical
CFD: Simerics MP, ANSYS Fluent, OnShape SimScale
PLM: Windchill 11.0 – 12.0
Hardware: Mill, Lathe, 3D Printing

Peer Reviewed Journal Publications

1. **Vetturini, A. J.**, Cagan, J., and Taylor, R. E., Generative design-enabled exploration of wireframe DNA origami nanostructures. Nucleic Acids Research, gkae1268 (2024). https://doi.org/10.1093/nar/gkae1268

2. **Vetturini, A. J.**, Cui, W., Liao, YT. et al. Flame Spread Over Ultra-thin Solids: Effect of Area Density and Concurrent-Opposed Spread Reversal Phenomenon. Fire Technol 56, 91–111 (2020). https://doi.org/10.1007/s10694-019-00878-w
   Selected as a top paper of the year and printed within the Editors' Choice of *Fire Technology*

Conference Presentations

1. **Vetturini, Anthony J.**, Cagan, Jonathan, and Taylor, Rebecca E. "Design exploration of wireframe DNA origami through multiobjective optimization-driven generative design." DNA30, 16 September 2024, Johns Hopkins University, Baltimore, MD. Conference Presentation.

2. **Vetturini, Anthony J.**, Cagan, Jonathan, and Taylor, Rebecca E. "A Grammar-Enabled Generative Design Framework for Design Exploration of Deoxyribonucleic Acid (DNA) Nanostructures." International Design Engineering Technical Conferences, Design Automation Conference, 27 August 2024, JW Marriott, Washington, DC. Conference Presentation.

3. **Vetturini, Anthony J.**, and Liao, Ya-Ting. "Effects of Area Density on Thin Fuel Flammability." 34th Annual Meeting of the American Society for Gravitational and Space Research, 1 November 2018, Bethesda North Marriott Hotel and Conference Center, Bethesda, MD. Conference Presentation.

Teaching Experience

Carnegie Mellon University **August 2024 – December 2024**
Teaching Assistant - 2D Mechanics *Pittsburgh, PA*

- Prepared materials and delivered recitation sections for a ∼150-student undergraduate section.
- Oversaw teams of 3 from ideation to physical demonstrations of 4-bar linkages for hexapod robot.

Carnegie Mellon University **August 2023 – December 2023**
Teaching Assistant - Product Design *Pittsburgh, PA*

- Guided ∼40 final-year student design teams from project ideation to a working prototype in their capstone engineering course by providing expertise in manufacturing, CAD, and testing
- Prepared lectures on materials and manufacturing processes selection.

PDSVISION US **June 2019 – August 2022**
Certified Creo Instructor *Middleburg Heights, OH*

- Certified instructor on Creo Parametric, Creo Simulate, and Windchill Manufacturing Process Management

Development of Engineering Standards Course **January 2018 – April 2018**
Teaching Assistant *Cleveland, OH*

- Researched and prepared presentations to be used in an engineering standards pilot course
- Worked in conjunction with Underwriters Laboratories (UL)

Industry Experience

PDSVISION US **June 2019 – August 2022**
Mechanical Engineer *Middleburg Heights, OH*

- Consulted on and implemented mechanical design software into companies of varying sizes (local to global corporations)
- Creo Parametric Professional Certification
- Specialized in running both FEA and CFD simulations in consulting projects requiring the ability to learn various concepts quickly to provide valid results
- Use educational background to perform engineering evaluations of customer models to offer design alternatives for customer requirements

Projects and Software

kodak: a react application for data visualization

- Visualization application developed to give a UI to plot design with a default towards academic publications.
- Uses React, Vite, and plotly-js to populate design where a Python application has been developed to assist in creation of .plots files
- Project Page GitHub Repo

mango: a generative design framework for wireframe DNA origami

- Python package implementing grammars and optimization algorithms for the generative design of wireframe DNA origami
- Uses grammar-based generative design (i.e., Shape Annealing) to guide the generated design to a user-defined objective using designer-specific constraints
- GitHub Repo

BALK: Predictive baseball model for predetermined "edge" games

- Personal project with colleagues where we have developed a supervised machine learning model to predict baseball game outcomes
- Assisted in development of random forest algorithm to predict a game winner using sabermetrics
- Developed Python-based web scraper using BeautifulSoup to pull daily lineups and produce required data for algorithm input
- 2020 Season resulted in a model accuracy of 55.6% and a projected yielded return of 27 units compared to DraftKings odds

Undergraduate Research

Computational Fire Dynamics Laboratory **Summer 2017 – Winter 2018**

Research Assistant *Cleveland, OH*

- Studied effects of area density on flame spread using the Zero-G Drop Tower located at NASA Glenn Research Center at Lewis Field
- Prepared samples, observed tests, and composed original MATLAB code leveraging computer vision to track flame position and shape during and experiment

Honors & Awards

Department of Defense National Defense Science and Engineering Graduate Fellowship	2024 – 2027
Jochum-Moll Foundation Scholarship	2018 – 2019
Case Alumni Association Scholarship	2017 – 2019
All-Academic UAA Winter Team	2016

Professional Society Membership

American Society for Gravitational and Space Research (ASGSR)	2018 – 2020