Praveen S. Vulimiri

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Education

University of Pittsburgh, Swanson School of Engineering   *August 2025*
> Doctor of Philosophy in Mechanical Engineering
> Advisor: Dr. Albert C. To
> Thesis: Data-Driven Surrogate Models for Architectural and Multiphysics Constraints for Topology Optimization

University of Pittsburgh, Swanson School of Engineering   *December 2021*
> Master of Science in Mechanical Engineering
> Relevant Coursework: Elasticity, Optimization Methods, Deep Learning for Mechanical Engineers
> GPA: 3.97/4.00

University of Pittsburgh, Swanson School of Engineering   *August 2019*
> Bachelor of Science in Mechanical Engineering, Summa Cum Laude
> Certificates: Engineering Simulation in Design; Innovation, Product Design, and Entrepreneurship
> Awards: Dean's List (2015-2019), Full Tuition Scholarship
> GPA: 3.95/4.00   GRE: Quantitative: 170   Verbal: 157   Analytical: 4.0

Publications

Vulimiri, P. S., Riley, S., Dugast, F. X., & To, A. C. (2025). A mean-variance estimation bidirectional convolutional long short-term memory surrogate model predicting residual stress and model error for laser powder bed fusion. *Additive Manufacturing,* 97. https://doi.org/10.1016/j.addma.2024.104591

Deng, H., Vulimiri, P. S., & To, A. C. (2022). CAD-integrated topology optimization method with dynamic extrusion feature evolution for multi-axis machining. *Computer Methods in Applied Mechanics and Engineering, 390,* 114456. https://doi.org/10.1016/J.CMA.2021.114456

Deng, H., Vulimiri, P. S., & To, A. C. (2022). An efficient 146-line 3D sensitivity analysis code of stress-based topology optimization written in MATLAB. *Optimization and Engineering*, *23*(3), 1733–1757. https://doi.org/10.1007/S11081-021-09675-3

Vulimiri, P. S., Deng, H., Dugast, F. X., Zhang, X., & To, A. C. (2021). Integrating geometric data into topology optimization via neural style transfer. *Materials*, 14(16), 4551. https://doi.org/10.3390/ma14164551

Johnson, N. S., Vulimiri, P. S., To, A. C., Zhang, X., Brice, C. A., Kappes, B. B., & Stebner, A. P. (2020). Invited review: Machine learning for materials developments in metals additive manufacturing. Additive Manufacturing, 36, 101641. https://doi.org/10.1016/j.addma.2020.101641

Presentations

2024 Annual International Solid Freeform Fabricatoin Symposium (SFF)   *August 2024*
> Vulimiri, Praveen S. and Albert C. To. "Universal Differential Equations for Transient Thermal Modeling of Directed Energy Deposition Additive Manufacturing." Oral presentation.

Fourth International Congress on Simulation for Additive Manufacturing (Sim-AM 2023)   *July 2023*
> Vulimiri, Praveen S. and Albert C. To. "Additive Manufacturing Process-Aware Topology Optimization Using Deep Learning Surrogate Model-Based Constraint Functions." Oral presentation.

17th U.S. National Congress on Computational Mechanics   *July 2023*
> Vulimiri, Praveen S. and Albert C. To. "Transfer Learning a Data-driven Residual Stress Prediction for Laser Powder Bed Fusion Additive Manufacturing to Different Materials and Processes." Oral presentation.

2022 Annual International Solid Freeform Fabrication Symposium (SFF)   *July 2022*

> Vulimiri, Praveen S., Florian X. Dugast, Shane Riley, and Albert C. To. "Reducing Part Distortion in Laser Powder Bed Fusion through Data-Driven Topology Optimization." Oral & poster presentation.

TMS 2022 150th Annual Meeting & Exhibition   *March 2022*

> Vulimiri, Praveen S. "Process-Aware Design Optimization Methods for Metal Additive Manufacturing." Oral presentation.

16th U.S. National Congress on Computational Mechanics   *July 2021*

> Vulimiri, Praveen S. et al. "A Fast Data-Driven Residual Strain and Stress Prediction in Stainless Steel 316L Laser Powder Bed Fusion Additive Manufacturing." Oral presentation.

ASME IMECE 2020   *November 2020*

> Vulimiri, Praveen S. and Albert C. To. "Appearance Constrained Topology Optimization using Neural Style Transfer." Oral presentation.

NASA TFAWS 2019   *August 2019*

> Sapunkov, Oleg, Praveen Vulimiri et al. "Passive Thermal Analysis and Regulation for a Lightweight Lunar CubeRover." Conference publication and oral presentation.

Experience

PhD Candidate   *November 2022 – Present*
University of Pittsburgh   *Pittsburgh, PA*

- Thesis: Data-Driven Surrogate Models for Architectural and Multiphysics Constraints for Topology Optimization
- Anticipated graduation date: April 2024
- Mentoring 3 undergraduate and 2 graduate students for machine learning and topology optimization

Graduate Student Researcher   *August 2019 – November 2022*
University of Pittsburgh   *Pittsburgh, PA*

- Researching novel machine learning techniques for use in topology optimization (TO) using Pytorch
- Adapted an image classification neural network to incorporate architectural design constraints in TO
- Developing an in-house finite element analysis for GPUs to redesign cast and machined complex parts for additive manufacturing, ensuring strength and manufacturability

Mechanical Engineering Intern / Team Lead   *December 2017 – January 2020*
CubeRover   *Pittsburgh, PA*

- Managed 6 graduate and undergraduate students as Thermal Team Lead as an undergraduate student
- Created a template analysis using Ansys Workbench Mechanical to automate thermal analyses for lunar rover operations for all operating conditions and in transit to lunar surface
- Collaborated with other team leads to set design requirements and operating procedures within thermal limits
- Presented research and development findings at a national NASA conference in August 2019 and technical reports for NASA scientists
- Learned and developed structural modal analysis for launch conditions on rover body and experimentally validated simulation with small scale models
- Performed power efficiency testing with Alta Devices solar cells before and after vacuum testing for viability of solar power on rover

Software Development Co-Op   *May 2018 – August 2018, January 2019 – April 2019*
Ansys, Inc.   *Canonsburg, PA*

- Designed a template in Azure Databricks using Python and SQL to visualize analytics data for all business units
- Added a new main product feature using C++ to streamline the workflow process

- Created a monitoring tool for the user analytics server using Go to alert if the server is down

Research Laboratory Assistant　　　　　　　　　　　　　　　　　　　*May 2016 – December 2016*
Human Movement and Balance Laboratory (HMBL)　　　　　　　　　　　　　　　　*Pittsburgh, PA*
- Assisted in human-subject study to develop a slip-resistance standard for shoes
- Analyzed trial data to determine coefficient of friction of shoes using Vicon Nexus and MATLAB
- Produced a new analysis procedure for shoe wear study to test three times as many shoes compared to previous

Academic Projects

Deep Learning for Engineers, Super-Resolution of Melt Pool Morphologies　　　　　　*Spring 2021*
- Used U-Net convolution neural networks to reconstruct fine resolution simulation melt pool shape from coarse simulation data for laser powder bed fusion (LPBF) additive manufactured scan tracks
- Peak Signal to Noise Ratio (PSNR) improved by 58% and simulation time reduced from 13hrs to 3min

Product Realization, Gadget Guard　　　　　　　　　　　　　　　　　　　　　*Summer 2019*
- Worked with the Security Labs to develop patented technologies for production
- Used SolidWorks sheet metal tools to design a prototype for stamping and communicated with many prototyping facilities discussing GD&T and DFM of the prototype
- Repaired 3D printer in lab and became lead for rapid prototyping with the printer for the class

Senior Capstone Project

Skeletal Canoe: Manufacturing Reinforced Concrete in Lightweight 3D Structures　　　*Fall 2018*
- Utilized structural optimization and additive manufacturing to create a lighter and stronger concrete canoe for the American Society of Civil Engineers (ASCE) Concrete Canoe Competition
- Designed the custom concrete mixture and performed compression tests to determine ideal reinforcement
- 1st team in three semesters to finish with an intact prototype

Mechatronics, "The Claw"　　　　　　　　　　　　　　　　　　　　　　　　*Spring 2018*
- Created the CAD model and wrote code in C for a claw machine with Atmel microcontrollers and stepper motors

Skills

Design　　　*ANSYS Mechanical APDL & Workbench, Autodesk Inventor & Fusion, SolidWorks*

Computer　　*Python (PyTorch), MATLAB, C++, CUDA, Git, SQL*

Technical　　*Mechatronics, Finite Element Analysis, Biomechanics, Mechanical Design*

Extracurricular Projects

Randall Family Big Idea Competition, Finalist　　　　　　　　　　　　　　　　*Spring 2019*
- Matured an idea to a Minimum Viable Product (MVP) and business plan in three months
- Developed a new instrumental based voice synthesizer using an Arduino Mega and MATLAB
- Target markets were those with aphasia (inability to speak) and amateur musicians

IBM BlueHack, Honorable Mention　　　　　　　　　　　　　　　　　　　　*October 2018*
- Developed a business plan and product sketch for a music tutoring app in 24 hours
- Designed to be used for any instrument and connect musicians to each other

ASME Human Powered Vehicle Competition, 4th Overall / 1st Endurance　　　*January 2018 – April 2018*
- Seat Design Lead for the 2018 Pitt competitor
- New design was 50% lighter and easier to adjust for riders, having designated placement for the ideal position of each rider
- Contributed to the team's improved performance in the 2018 HPVC East Competition

- Highest rank in the Boy Scouts of America
- Designed, organized, and led volunteers to construct an outdoor seating area with two picnic tables and a 16' x 22' concrete pad at the Greenwich Twp Public Library