

# HARDIK Y. PATIL

+1 (734) 882-1248 ◊ hardikyp@umich.edu  
linkedin.com/in/hardikpatil ◊ www.hardikpatil.com

## EDUCATION

<b>University of Michigan (U of M)</b> <i>Doctoral Candidate, Civil Engineering (Structures) &amp; Scientific Computing</i>   GPA: 4.0 / 4.0 Coursework: Machine Learning, Numerical Linear Algebra, Theory of Elasticity, Computer Programming For Scientists & Engineers (C++), Statistics & Data Analysis	<b>Ann Arbor, USA</b> 2021 - Present
<b>University of Michigan (U of M)</b> <i>Master of Science in Engineering, Civil Engineering (Structures)</i>   GPA: 4.0 / 4.0 Coursework: Plastic Analysis & Design of Steel Frames, Finite Element Methods, Non-linear Analysis, Deployable & Reconfigurable Structures, Reliability of Structures, Infrastructure Systems Optimization, Design of Wood Structures	<b>Ann Arbor, USA</b> 2019 - 2021
<b>Indian Institute of Technology Bombay (IIT-B)</b> <i>Bachelor of Technology with Honors, Civil Engineering</i>   GPA: 8.5 / 10.0 Coursework: Reinforced & Pre-stressed Concrete Design, Bridge Engineering, Steel Structure Design, Dynamics of Structures	<b>Mumbai, India</b> 2015 - 2019

## PROFESSIONAL EXPERIENCE

<b>Thornton Tomasetti</b> Structural Forensics Intern   Supervisor: Jason (Jake) Albright, P.E.	<b>San Francisco, USA</b> 2025
<ul style="list-style-type: none"><li>Developed a single-zone fire simulator by implementing a one-dimensional heat transfer solver in Python, predicting char depth in mass-timber members to support structural performance assessments in various fire scenarios</li><li>Performed nonlinear pushover analysis of steel frames in SAP2000, validating collapse mechanisms for demolition projects against analytical calculations</li><li>Supported forensic investigation reports by preparing site documentation (foundation markups, coring data, field images) and researching concrete material deficiencies affecting slab performance</li><li>Reviewed slab reinforcement submittals and backchecked structural drawings, ensuring design compliance and quality control on a healthcare facility project</li></ul>	

## RESEARCH EXPERIENCE

<b>Transforming Static Trusses into Functional Shape-morphing Systems</b> Graduate Student Research Assistant   Advisor: Dr. Evgueni T. Filipov	<b>U of M, USA</b> 2023 - 2024
<ul style="list-style-type: none"><li>Created a workflow to transform static triangles in traditional trusses into quadrilateral linkages, enabling flat-foldable and reconfigurable trusses that reduce footprint by up to 97% without loss of stiffness or peak load capacity</li><li>Built a kinematic simulator based on the analytical solution of quadrilateral linkages in MATLAB, allowing the visualization of truss deployment due to sequential actuation of kinematic degrees of freedom</li></ul>	
<b>Shape-morphing Curved-crease Origami Hulls for Rapid Deployment &amp; Tunable Hydrodynamics</b> Graduate Student Research Assistant   Advisor: Dr. Evgueni T. Filipov & Dr. Kevin J. Maki	<b>U of M, USA</b> 2021 - 2023
<ul style="list-style-type: none"><li>Implemented the principles of curved-crease origami to develop a method for the rapid fabrication of planing hulls from flat sheets, enabling the creation of deployable hulls that match traditional hull shapes and emulate desired hydrodynamics</li><li>Demonstrated the shape-morphing ability of curved-crease origami hulls, enabling on-demand transition between low &amp; high deadrise configurations to optimize hydrodynamic efficiency &amp; passenger comfort across varying water conditions</li></ul>	
<b>Hurricane Induced Surge &amp; Wave forces on Coastal Bridges</b> Undergraduate Thesis   Advisor: Dr. Jaydipta Ghosh	<b>IIT-B, India</b> 2018-2019
<ul style="list-style-type: none"><li>Investigated deck unseating in coastal bridges subjected to hurricane-induced storm surges and wave impacts</li><li>Performed fluid-structure interaction analysis of coastal highway bridge deck in ANSYS, simulating wave-induced forces across surge levels, and validating uplift and slamming forces against experimental data</li></ul>	
<b>Soil Moisture Mapping Using P-Band Radiometer</b> International Summer Research Experience   Advisor: Dr. Jeffery Walker	<b>Monash University, Australia</b> 2018
<ul style="list-style-type: none"><li>Collected ground samples to create a time series dataset of parameters including soil moisture, temperature, ground roughness, particle size distribution, vegetation water content and normalized difference vegetation index (NDVI)</li><li>Analyzed ground and radiometer data to support development of a soil-moisture retrieval algorithm in the P-band spectrum, demonstrating 15 cm penetrability compared to 5 cm for L-band radiometers</li></ul>	

## JOURNAL PAPERS

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- **Patil, H. Y.** & Filipov, E. T., (under review) *Transforming static trusses into shape-morphing systems using principles of quadrilateral linkages*
- **Patil, H. Y.**, Maki, K., & Filipov, E. T., 2024. Rapidly deployable hulls & on-demand tunable hydrodynamics with shape morphing curved crease origami. *Journal of Fluids & Structures*, 130, 104176. [Link](#)

## CONFERENCE TALKS

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- **Patil, H. Y.**, & Filipov, E.T., 2025. Force-stable reconfigurable truss structures using quadrilateral linkage principles. *ASCE Engineering Mechanics Institute Conference*, Anaheim, CA, May 27 – May 30, 2025
- **Patil, H. Y.**, & Filipov, E. T., 2022. Adaptable Hull hydrodynamics using shape-morphing curved-crease origami. *ASME International Mechanical Engineering Congress & Exposition*, Columbus, OH, Oct 30 – Nov 3, 2022
- Woodruff, S. R., Patil, H. Y., & **Filipov, E. T.**, 2022. Curved-crease origami for functional shape-morphing structures. *ASME International Mechanical Engineering Congress & Exposition*, Columbus, OH, Oct 30 – Nov 3, 2022
- **Patil, H. Y.**, & Filipov, E.T., 2022. Hydrodynamic Characteristics of Shape Morphing Curved-Crease Origami Surfaces. *ASCE Engineering Mechanics Institute Conference*, Baltimore, MD, May 31 – June 3, 2022

## TEACHING EXPERIENCE

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<b>Graduate Student Instructor (GSI)</b> ENG 100 – Introduction to Adaptable & Deployable Structures   College of Engineering	<b>U of M, USA</b> 2023
<ul style="list-style-type: none"><li>• Co-developed and co-taught the first-ever course on adaptable and deployable structures for first-year engineering students, designing assignments, exams, and grading rubrics</li><li>• Led weekly lab sessions introducing AutoCAD, Fusion360 and Arduino programming through structured follow-along activities, preparing students for design, analysis, and fabrication of deployable structures</li><li>• Provided one-on-one guidance during weekly office hours, supporting students' assignments, and term project design &amp; fabrication efforts</li></ul>	
<b>Course Grader</b> CEE 312 – Analysis of Structures   Civil & Environmental Engineering	<b>U of M, USA</b> 2020
<ul style="list-style-type: none"><li>• Graded weekly assignments for a class of 40 students which covers basic analysis and design concepts in structural engineering like virtual work, flexibility method, stiffness method, influence lines and matrix structural analysis</li></ul>	

## LEADERSHIP & ORGANISATIONAL ROLES

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<b>Student Mentor</b> Summer Research Internship Program   Deployable & Reconfigurable Structures Lab	<b>U of M, USA</b> 2021
<ul style="list-style-type: none"><li>• Mentored Jared Davis-Sims in <i>Design and Fabrication of Large Scale Curved Crease Origami Structures</i></li></ul>	
<b>Student Mentor</b> Department Academic Mentorship Program   The Department of Civil Engineering	<b>IIT-B, India</b> 2018 - 2019
<ul style="list-style-type: none"><li>• Mentored two junior students in setting short-term academic goals, fostering improved performance and engagement</li><li>• Partnered with academic advising faculty to integrate curriculum adjustments from feedback, enhancing support for students on academic probation</li></ul>	
<b>Head of Media &amp; Marketing</b> The Entrepreneurship Cell, IIT-B   Largest student-run body promoting entrepreneurship in India	<b>IIT-B, India</b> 2017 - 2018
<ul style="list-style-type: none"><li>• Worked in a 22-member core team to organize various international &amp; national events within an annual budget of <b>\$290,000</b></li><li>• Spearheaded a 2-tier team of 40 students to handle media associations, event coverage &amp; social media-marketing</li><li>• Negotiated terms of association with top media houses in India, bringing in deliverables worth <b>\$140,000</b></li><li>• Launched targeted campaigns and formed brand integrations, achieving <b>150%</b> YOY increase in social media followers</li></ul>	

## AWARDS

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- 2025 ASCE Engineering Mechanics Institute Conference's Structural Stability Student Paper Competition 2nd Place
- 2025 Rackham Doctoral Intern Fellowship
- 2025 & 2022 Rackham Conference Travel Grant
- 2022 ASME IMECE National Science Foundation Student Poster Competition Travel Grant

- 2021 Michigan Institute of Computational Discovery and Engineering Fellowship
- 2019 Narotam Sekhsaria Foundation's Post Graduate Scholarship (among top 0.16% applicants)
- 2019 K. C. Mahindra Education Trust's Post Graduate Scholarship (among top 4.65% applicants)

## TECHNICAL SKILLS

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### Analysis & Design Tools

ANSYS, Abaqus, AutoCAD, Revit, Fusion360, STAAD.Pro, SAP2000, ETABS

### Software Packages

Microsoft Office, Adobe (Photoshop, Lightroom & Illustrator), Bluebeam

### Programming Experience

MATLAB, Python, C++, Arduino, R, HTML, CSS, GAMS

## COURSE PROJECTS

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### Solving Wordle using Deep Reinforcement Learning

**U of M, USA**

*EECS 545 – Machine Learning*

2022

- Implemented the Advantage Actor-Critic Deep Reinforcement Learning method to solve 4, 5, and 6-letter variations of Wordle with varying dictionary sizes, demonstrating expertise in advanced machine learning techniques & algorithms

### Analysis of a Wooden Arch Bridge using STAAD.Pro

**U of M, USA**

*ARCH 544 – Wood Structures*

2021

- Performed a comprehensive analysis of glued laminated members of the Eagle River Timber Bridge (Michigan, USA) using STAAD.Pro and AITC 1994 Code, accounting for load combinations as per AASHTO LRFD guidelines

### Optimization of Traffic Flow Network

**U of M, USA**

*CEE 553 – Infrastructure Systems Optimization*

2021

- Optimized the total travel time for a transportation network of centrally guided, autonomous vehicles by utilizing the General Algebraic Modeling System (GAMS)

### Arduino-driven Equatorial Mount (Star Tracker) for Astrophotography

**U of M, USA**

*CEE 575 – Sensing for Infrastructure Systems*

2021

- Designed & fabricated an Arduino-driven equatorial mount under \$50, optimized for tracking deep-sky objects and capturing high-quality astrophotographs

### Origami Inspired Foldable Bridge with Rigid Thick Panels

**U of M, USA**

*CEE 501 – Deployable & Reconfigurable Structures*

2020

- Utilized Fusion360 to model the kinematics of zipper-coupled Miura origami tubes, incorporating rigid thick panels to develop a flat-packable, deployable bridge

### Geometric Non-linear Analysis of Truss Structures

**U of M, USA**

*CEE 512 – Non-linear Analysis*

2020

- Developed a matrix structural analysis program in MATLAB by implementing Newton-Raphson and Arc-Length methods to perform geometric non-linear analysis of 2D truss structures, capable of capturing snap-through behavior

### Delineation of Water Bodies from Satellite Imagery

**IIT-B, India**

*CE 712 – Digital Image Processing*

2017

- Developed a MATLAB program that generates a binary image for delineating water bodies from LANDSAT-8 satellite images using Normalized Difference Water Index (NDWI), Modified NDWI, and Automated Water Extraction Index