

# HARDIK Y. PATIL

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## EDUCATION

### University of Michigan (U of M)

Ann Arbor, USA

Doctoral Candidate, Civil Engineering (Structures) & Scientific Computing | GPA: 4.0/4.0

2021 - Present

Coursework: Machine Learning, Numerical Linear Algebra, Theory of Elasticity, Computer Programming For Scientists & Engineers (C++), Statistics & Data Analysis

### University of Michigan (U of M)

Ann Arbor, USA

Master of Science in Engineering, Civil Engineering (Structures) | GPA: 4.0/4.0

2019 - 2021

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

### Indian Institute of Technology Bombay (IIT-B)

Mumbai, India

Bachelor of Technology with Honors, Civil Engineering | GPA: 8.5/10.0

2015 - 2019

Coursework: Reinforced & Pre-stressed Concrete Design, Bridge Engineering, Steel Structure Design, Dynamics of Structures

## PROFESSIONAL EXPERIENCE

### Thornton Tomasetti

San Francisco, USA

Structural Forensics Intern | Supervisor: Jason (Jake) Albright, P.E.

2025

- 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
- Performed nonlinear pushover analysis of steel frames in SAP2000, validating collapse mechanisms for demolition projects against analytical calculations
- Supported forensic investigation reports by preparing site documentation (foundation markups, coring data, field images) and researching concrete material deficiencies affecting slab performance
- Reviewed slab reinforcement submittals and backchecked structural drawings, ensuring design compliance and quality control on a healthcare facility project

## RESEARCH EXPERIENCE

### Transforming Static Trusses into Functional Shape-morphing Systems

U of M, USA

Graduate Student Research Assistant | Advisor: Dr. Evgueni T. Filipov

2023 - 2024

- 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
- 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

### Shape-morphing Curved-crease Origami Hulls for Rapid Deployment & Tunable Hydrodynamics

U of M, USA

Graduate Student Research Assistant | Advisor: Dr. Evgueni T. Filipov & Dr. Kevin J. Maki

2021 - 2023

- 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
- Demonstrated the shape-morphing ability of curved-crease origami hulls, enabling on-demand transition between low & high deadrise configurations to optimize hydrodynamic efficiency & passenger comfort across varying water conditions

### Hurricane Induced Surge & Wave forces on Coastal Bridges

IIT-B, India

Undergraduate Thesis | Advisor: Dr. Jaydipta Ghosh

2018-2019

- Investigated deck unseating in coastal bridges subjected to hurricane-induced storm surges and wave impacts
- 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

### Soil Moisture Mapping Using P-Band Radiometer

Monash University, Australia

International Summer Research Experience | Advisor: Dr. Jeffery Walker

2018

- 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)
- 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

## 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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### Graduate Student Instructor (GSI)

ENG 100 – Introduction to Adaptable & Deployable Structures | College of Engineering

**U of M, USA**  
2023

- 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
- 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
- Provided one-on-one guidance during weekly office hours, supporting students' assignments, and term project design & fabrication efforts

### Course Grader

CEE 312 – Analysis of Structures | Civil & Environmental Engineering

**U of M, USA**  
2020

- 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

## LEADERSHIP & ORGANISATIONAL ROLES

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### Student Mentor

Summer Research Internship Program | Deployable & Reconfigurable Structures Lab

**U of M, USA**  
2021

- Mentored Jared Davis-Sims in *Design and Fabrication of Large Scale Curved Crease Origami Structures*

### Student Mentor

Department Academic Mentorship Program | The Department of Civil Engineering

**IIT-B, India**  
2018 - 2019

- Mentored two junior students in setting short-term academic goals, fostering improved performance and engagement
- Partnered with academic advising faculty to integrate curriculum adjustments from feedback, enhancing support for students on academic probation

### Head of Media & Marketing

The Entrepreneurship Cell, IIT-B | Largest student-run body promoting entrepreneurship in India

**IIT-B, India**  
2017 - 2018

- Worked in a 22-member core team to organize various international & national events within an annual budget of **\$290,000**
- Spearheaded a 2-tier team of 40 students to handle media associations, event coverage & social media-marketing
- Negotiated terms of association with top media houses in India, bringing in deliverables worth **\$140,000**
- Launched targeted campaigns and formed brand integrations, achieving **150%** YOY increase in social media followers

## 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 Software Packages Programming Experience

ANSYS, Abaqus, AutoCAD, Revit, Fusion360, STAAD.Pro, SAP2000, ETABS  
Microsoft Office, Adobe (Photoshop, Lightroom & Illustrator), Bluebeam  
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 AISC 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