

HARDIK Y. PATIL

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EDUCATION

University of Michigan (U-M)

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

Coursework: Machine Learning, Numerical Linear Algebra, Theory of Elasticity, C++ Programming, Statistics & Data Analysis

Master of Science in Engineering, Civil Engineering (Structures) | 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

Indian Institute of Technology Bombay (IIT-B)

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

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

Ann Arbor, MI

2021 - Present

2019 - 2021

Mumbai, India

2015 - 2019

PROFESSIONAL EXPERIENCE

Thornton Tomasetti

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

San Francisco, CA

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 a planned demolition project 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

Torsional Spring Formulation for the Analysis of Reconfigurable Bar-linked Structures

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

U-M, Ann Arbor

2025

- Derived closed-form internal force and tangent stiffness expressions of a torsional (coil) spring element for modeling semi-rigid joints with programmable stiffness in 2D truss-like structures while avoiding rotational degrees of freedom
- Developed a nonlinear structural analysis program in MATLAB implementing the torsional spring element to capture global structural response, including buckling behaviour and actuation force demands in bar-linked reconfigurable structures

Transforming Static Trusses into Functional Shape-morphing Systems

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

U-M, Ann Arbor

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

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

U-M, Ann Arbor

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

Undergraduate Thesis | Advisor: Dr. Jaydipta Ghosh

IIT-B, India

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

International Summer Research Experience | Advisor: Dr. Jeffery Walker

Monash University, Australia

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

- **Patil, H. Y.** & Filipov, E. T. (2026) Three-node torsional spring element formulation for the analysis of reconfigurable bar-linked structures. *ASME. J. Appl. Mech.* March 2026; 93(3): 034502. **DOI**
- **Patil, H. Y.** & Filipov, E. T. (*under review*) *Transforming static trusses into shape-morphing systems using principles of quadrilateral linkages.* Submitted: *International Journal of Solids and Structures*
- **Patil, H. Y.**, Maki, K. J. & Filipov, E. T. (2024) Rapidly deployable hulls & on-demand tunable hydrodynamics with shape morphing curved crease origami. *Journal of Fluids & Structures*, 130, 104176. **DOI**

CONFERENCE TALKS

- **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

Graduate Student Instructor (GSI)

CEE 211 – Statics & Dynamics | Civil & Environmental Engineering

U-M, Ann Arbor

2026 - Present

- Supported instruction for an undergraduate civil engineering course through teaching assistance, grading, and office hours to provide guidance in core concepts of structural statics and dynamics

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

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-M, Ann Arbor

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

Student Mentor

Summer Research Internship Program | Deployable & Reconfigurable Structures Lab

U-M, Ann Arbor

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

- 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)

PEER REVIEW AND EDITORIAL SERVICE

- Ad hoc reviewer, *Scientific Reports* (Nature Portfolio), *Journal of Engineering Mechanics* (ASCE)

TECHNICAL SKILLS

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
<i>EECS 545 – Machine Learning</i> | U-M, Ann Arbor
2022 |
| <ul style="list-style-type: none"> • 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
<i>ARCH 544 – Wood Structures</i> | U-M, Ann Arbor
2021 |
| <ul style="list-style-type: none"> • 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
<i>CEE 553 – Infrastructure Systems Optimization</i> | U-M, Ann Arbor
2021 |
| <ul style="list-style-type: none"> • 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
<i>CEE 575 – Sensing for Infrastructure Systems</i> | U-M, Ann Arbor
2021 |
| <ul style="list-style-type: none"> • 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
<i>CEE 501 – Deployable & Reconfigurable Structures</i> | U-M, Ann Arbor
2020 |
| <ul style="list-style-type: none"> • 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
<i>CEE 512 – Non-linear Analysis</i> | U-M, Ann Arbor
2020 |
| <ul style="list-style-type: none"> • 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
<i>CE 712 – Digital Image Processing</i> | IIT-B, India
2017 |
| <ul style="list-style-type: none"> • 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 | |