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

Torsional Spring Formulation for the Analysis of Reconfigurable Bar-linked Structures **U of M, USA**
Graduate Student Research Assistant | Advisor: Dr. Evgueni T. Filipov *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 **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

- **Patil, H. Y.** & Filipov, E. T., *(in prep) Three-node torsional spring element formulation for the analysis of reconfigurable bar-linked structures*
- **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

- **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) **U of M, USA**
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 **U of M, USA**
CEE 312 – Analysis of Structures | Civil & Environmental Engineering *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 **U of M, USA**
Summer Research Internship Program | Deployable & Reconfigurable Structures Lab *2021*

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

Student Mentor **IIT-B, India**
Department Academic Mentorship Program | The Department of Civil Engineering *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 **IIT-B, India**
The Entrepreneurship Cell, IIT-B | Largest student-run body promoting entrepreneurship in 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 Institue 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), 2024

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

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