

# HARDIK PATIL

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Check out my website [www.hardikpatil.com](http://www.hardikpatil.com)

## EDUCATION

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### University of Michigan (U of M)

Ann Arbor, USA

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

Aug '21 - Present

Coursework: Machine Learning, Numerical Linear Algebra, Theory of Elasticity, Programming for 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

Sep '19 - Apr '21

Coursework: Plastic Analysis & Design of Frames, Finite Element Methods, Non-linear Analysis, Deployable & Reconfigurable Structures, Reliability of Structures, Infrastructure Systems Optimization, Wood Structures

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

Mumbai, India

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

Jul '15 - Apr '19

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

## RESEARCH EXPERIENCE

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### Hydrodynamic Characteristics of Shape Morphing Curved Crease Origami Structures

U of M, USA

*Research Assistant* | Advisor: Prof. Evgueni Filipov

Sep '20 - Present

- Designed curved crease patterns to obtain watertight volume upon folding a sheet or adhesion of multiple CCO surfaces
- Performed hydrodynamic simulations on varying parameters of origami hulls to show the adaptable performance of origami structures
- Performed strength & durability tests on materials & adhesives for the fabrication of prototype
- Developed a program to automate analysis process by integrating CCO folding simulations & shape matching in MATLAB, exporting geometry using AutoCAD and perform hydrodynamic analysis using ANSYS

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

IIT-B, India

*Undergraduate thesis* | Advisor: Dr. Jaydipta Ghosh

Jul '18 - Apr '19

- Studied the phenomenon of deck unseating observed in coastal bridges in the event of hurricane induced surge and waves
- Developed a coupled Fluid-Structure Interaction model of US Highway 90 bridge over Biloxi Bay in ANSYS subjected to waves under varying surge levels & validated results by comparing uplift & slamming forces with experimental observations

### Soil Moisture Mapping Using P-Band Radiometer

Monash University, Australia

*International Summer Research Experience* | Advisor: Dr. Jeffery Walker

May '18 - Jul '18

- Collected ground samples to build a time series dataset of parameters like soil moisture & temperature, ground roughness, particle size distribution, vegetation water content, & NDVI
- Analyzed ground samples & radiometer data to aid the development of soil moisture retrieval algorithm in the P-band frequency spectrum, leading to 15cm ground penetrability over 5cm penetrability achieved with L-band radiometers

## JOURNAL PAPERS

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- Patil, H., Maki, K., and Filipov, E. T. (In Prep.) Tunable Hydrodynamic Characteristics Using Shape Morphing Curved-Crease Origami Hulls

## CONFERENCE PROCEEDINGS

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- Patil, H. Y., and 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., and 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., and Filipov, E. T. (2022) "Hydrodynamic Characteristics of Shape Morphing Curved-Crease Origami Surfaces", *ASCE Engineering Mechanics Institute Annual Conference*, Baltimore, MD, May 31 – June 3, 2022

## TEACHING EXPERIENCE

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### Civil & Environmental Engineering, University of Michigan

Graduate Student Instructor - ENGR 100 Introduction to Adaptable and Deployable Structures

Ann Arbor, USA

Jan '23 - Apr '23

- TBD

### Civil & Environmental Engineering, University of Michigan

Grader - CEE 312 Analysis of Structures

Ann Arbor, USA

Sep '20 - Dec '20

- Graded assignments for a class of 40 students which covers basic analysis & 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

May '21 - Dec '21

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

### Student Mentor

Department Academic Mentorship Program | The Department of Civil Engineering

IIT-B, India

Apr '18 - Mar '19

- Helped 2 junior-year students set short & long-term goals to achieve overall academic & extracurricular success
- Worked in close liaison with advising faculty to incorporate feedback-based curriculum changes for students on academic probation

### Head of Media & Marketing

The Entrepreneurship Cell, IIT-B | India's largest student-run entrepreneurship promoting body

IIT-B, India

Mar '17 - Feb '18

- 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
- Successfully negotiated terms of association with top media houses in India, bringing in deliverables worth **\$140,000**
- Achieved **150%** YOY increase in social media followers by launching targeted campaigns & forming brand integrations

## AWARDS

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- 2022 ASME IMECE National Science Foundation Student Poster Competition Travel Grant worth \$1,200
- 2021-22 Rackham Conference Travel Grant worth \$900
- 2021 Michigan Institute of Computational Discovery and Engineering fellowship worth \$4,000
- 2019 Narotam Sekhsaria Foundation's Post Graduate Scholarship worth \$28,500 (among top 0.16% applicants)
- 2019 K.C. Mahindra Education Trust's Post Graduate Scholarship worth \$5,700 (among top 4.65% applicants)

## TECHNICAL SKILLS

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### Analysis & Design Tools

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

### Software Packages

Microsoft Office, Adobe (Photoshop, Lightroom and Illustrator)

### Programming Experience

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

## COURSE PROJECTS

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### Solving Wordle using Deep Reinforcement Learning

Course: EECS 545 Machine Learning | Source Code

U of M, USA

Winter '22

- Developed state representation, reward function and dictionary reduction functionality for a Gym environment of Wordle
- Implemented Advantage Actor-Critic Deep Reinforcement Learning method to solve 4, 5, 6-letter variations of Wordle
- Explored word-level and character-level predictor model's performance against varying size of action space

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

Course: ARCH 544 Wood Structures

U of M, USA

Winter '21

- Modeled the iconic Eagle River Timber Bridge (Michigan, USA) in STAAD.Pro & analyzed glued laminated bridge members using AITC 1994 Code subjected to load combinations as mentioned in AASHTO LRFD Guidelines

### Optimization of Traffic Flow Network

Course: CEE 553 Infrastructure Systems Optimization

U of M, USA

Fall '21

- Optimized the total travel time for a system of automated vehicles guided by a central controller in a transportation network using the General Algebraic Modeling System (GAMS) for two scenarios: independent versus platooned vehicles

**Inexpensive Arduino-driven Star Tracker****U of M, USA***Course: CEE 575 Sensing for Infrastructure Systems**Fall '21*

- Contrived an inexpensive Star Tracker driven by an Arduino & a stepper motor to aid deep-sky astro-photography

**Origami Inspired Foldable Bridge with Rigid Thick Panels****U of M, USA***Course: CEE 501 Deployable and Reconfigurable Structures**Winter '20*

- Modelled kinematics of zipper coupled Miura origami tubes with rigid thick panels in Fusion360 to create a foldable bridge

**Geometric Non-linear Analysis of Truss Structures****U of M, USA***Course: CEE 512 Non-linear Analysis**Winter '20*

- Developed a matrix structural analysis program in MATLAB implementing Newton-Raphson & Arc-Length algorithms to perform geometric non-linear analysis on truss bridges & capture snap-through behavior of a shallow arch truss

**Delineation of Water Bodies from Satellite Imagery****IIT-B, India***Course: CE 712 Digital Image Processing**Winter '20*

- Developed a MATLAB program to produce binary image output delineating water bodies from LANDSAT-8 images by using thresholds governed by water indices such as NDWI, MNDWI & AWEI