HARDIK PATIL

(734) 882-1248 | hardikp@umich.edu | [in]/hardikypatil/
2350 Hayward St. | 1124 G.G. Brown Building | Ann Arbor, MI, USA - 48109

EDUCATION

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

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 performacne 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

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

CONFERENCE PROCEEDINGS

- Patil, H., 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
- Patil, H., 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., 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

COURSE PROJECTS

Solving Wordle using Deep Reinforcement Learning   **U of M, USA**
Course: EECS 545 Machine Learning | [Source Code]   *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 — U of M, USA
Course: ARCH 544 Wood Structures — *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 — U of M, USA
Course: CEE 553 Infrastructure Systems Optimization — *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

TEACHING EXPERIENCE

Civil & Environmental Engineering, University of Michigan — Ann Arbor, USA
Graduate Student Instructor - ENGR 101 Introduction to Engineering — *Jan '22 - Apr '22*

- TBD

Civil & Environmental Engineering, University of Michigan — Ann Arbor, USA
Grader - CEE 312 Analysis of Structures — *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

Student Mentor — U of M, USA
Summer Research Internship Program | Deployable & Reconfigurable Structures Lab — *May '21 - Present*

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

Student Mentor — IIT-B, India
Department Academic Mentorship Program | The Department of Civil Engineering — *Apr '18 - Mar '19*

- Helped 2 junior-year students create short-term & 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 — IIT-B, India
The Entrepreneurship Cell, IIT-B | India's largest student-run entrepreneurship promoting body — *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

- 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

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, GAMS