HARDIK 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, 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 *2019 - 2021*
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 *2015 - 2019*
Coursework: Reinforced & Pre-stressed Concrete Design, Bridge Engineering, Steel Structure Design, Dynamics of Structures

RESEARCH EXPERIENCE

Tunable Hydrodynamic Characteristics of Shape Morphing Curved Crease Origami Hulls **U of M, USA**
Research Assistant | Advisor: Prof. Evgueni Filipov *2021 - Present*

- Innovated a novel technique for manufacturing high-speed planing hulls utilizing curved crease origami, resulting in shape-morphing planing hulls with on-demand tunable hydrodynamic performace
- Developed a comprehensive software package that integrates curved origami folding, shape matching with crease pattern optimization, geometry generation, and hydrodynamic analyses using MATLAB, AutoCAD, and Powersea
- Conducted extensive research and testing on various materials such as PVC, Ultem, Mylar, and Aluminum to evaluate their strength and durability during the curved folding process

Hurricane Induced Surge & Wave Forces on Coastal Bridges **IIT-B, India**
Undergraduate thesis | Advisor: Dr. Jaydipta Ghosh *2018-2019*

- 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 *2018*

- Collected ground samples to build a time series dataset of parameters like soil moisture & temperature, ground roughness, particle size distribution, vegetation water content, & normalized difference vegetation index
- 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. Y., Maki, K., and Filipov, E. T. (In Prep.) Tunable Hydrodynamic Characteristics Using Shape Morphing Curved-Crease Origami Hulls

CONFERENCE PROCEEDINGS

- 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

Graduate Student Instructor (GSI) **U of M, USA**
ENG 100 - Introduction to Adaptable and Deployable Structures | College of Engineering *2023*

- Facilitated weekly laboratory sessions for 40 undergraduate students, promoting critical thinking and active participation in learning Computer Aided Design and Arduino programming through interactive activities
- Developed and delivered course materials, including lectures, assignments, and assessments, to align with departmental goals and standards
- Provided personalized feedback and guidance to students, enhancing their understanding of course concepts and improving their writing skills for individual and team assignments
- Assisted with course administration tasks, including grading, record-keeping, and collaborating with other instructors to ensure course consistency
- Supervised students in completing their term project, overseeing the design, analysis, fabrication, and testing of deployable structures

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 & 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 & Fabrication of Large Scale Curved Crease Origami Structures*

Student Mentor **IIT-B, India**
Department Academic Mentorship Program | The Department of Civil Engineering *2018 - 2019*

- Assisted two junior-year students in setting achievable short-term and long-term goals to enhance their academic performance and excel in extracurricular activities
- Collaborated closely with academic advising faculty to integrate curriculum modifications based on feedback to support 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
- 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

- 2024 College of Engineering's Richard and Eleanor Towner Prize for Outstanding Graduate Student Instructor Finalist
- 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++, Arduino, R, HTML, CSS, GAMS

COURSE PROJECTS

Solving Wordle using Deep Reinforcement Learning **U of M, USA**
EECS 545 Machine Learning | Source Code *2022*

- Implemented the Advantage Actor-Critic Deep Reinforcement Learning method to solve the 4, 5, and 6-letter variations of Wordle, showcasing advanced knowledge of machine learning techniques and algorithms

- Developed a Gym environment for Wordle by designing the state representation, reward function, and dictionary reduction functionality
- Investigated the performance of word-level and character-level predictor models with varying sizes of the action space, demonstrating a strong understanding of statistical analysis and data processing techniques

Analysis of Wooden Arch Bridge using STAAD.Pro **U of M, USA**
ARCH 544 Wood Structures *2021*

- Performed comprehensive analysis of glued laminated bridge members of the Eagle River Timber Bridge (Michigan, USA) using STAAD.Pro and AITC 1994 Code, subject to load combinations specified by 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 and 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 and 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 & Arc-Length algorithms to perform geometric non-linear analysis of two-dimensional truss structures

Delineation of Water Bodies from Satellite Imagery **IIT-B, India**
CE 712 Digital Image Processing *2017*

- Developed a MATLAB program to accurately identify and delineate water bodies from LANDSAT-8 satellite images using various water indices, including NDWI, MNDWI, and AWEI, resulting in a binary image output