

# Zhongyuan Wo

## EDUCATION

- Fall 2022 **Ph.D., Civil Engineering, University of Michigan, Ann Arbor, MI**  
(Expected) – Advisor: *Prof. Evgueni T. Filipov*  
– Major: Structural Mechanics
- Jul 2017 **B.Eng., Civil Engineering, Tsinghua University, Beijing, China**  
– Bachelor of Engineering in Structural Engineering (*summa cum laude*)  
– Bachelor of Economics (dual degree)

## REFERRED PUBLICATIONS

- 2022 **Wo, Z.**, and Filipov, E. T., “Tunable Mechanics of the Multi-stable Corrugated Tube with Conical Kresling Pattern”, *Submitted to Extreme Mechanics Letters*
- 2022 **Wo, Z.**, and Filipov, E. T., “Bending Stability of Corrugated Tubes With Anisotropic Frustum Shells”, *ASME. J. Appl. Mech.* 89(4): 041005. [doi:10.1115/1.4053267](https://doi.org/10.1115/1.4053267)
- 2022 **Wo, Z.**, Ranases, J.M., and Filipov, E. T., “Locking Zipper-coupled Origami Tubes for Deployable Energy Absorption”, *ASME. J. Mech. Rob.* 14(4): 041007. [doi:10.1115/1.4054363](https://doi.org/10.1115/1.4054363)
- 2021 **Wo, Z.**, Ranases, J.M., and Filipov, E. T., “A Numerical and Experimental Study on the Energy Absorption Characteristics of Deployable Origami Tubes”, *Proceedings of the ASME 2021 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference. Volume 8B: 45th Mechanisms and Robotics Conference (MR)*. [doi:10.1115/DETC2021-66723](https://doi.org/10.1115/DETC2021-66723)  
Virtual, Online. August 17-19, 2021. V08BT08A029.

## PEER REVIEW SERVICES

- 2022 **Wo, Z.**, Manuscript CADJ-22-00077, *Computer-aided Design*  
Editor: Meera Sitharam

## CONFERENCE POSTERS/PRESENTATIONS

- Nov 2022 **Wo, Z.**, and Filipov, E. T., “Buckling-induced Functionalities of Origami Tubes”, *ASME International Mechanical Engineering Congress & Exposition*, Columbus, OH.
- Jun 2022 **Wo, Z.**, and Filipov, E. T., “Tunable Mechanics of the Multi-stable Corrugated Tube”, *ASCE Engineering Mechanics Institute Conference*, Baltimore, MD.
- Aug 2021 **Wo, Z.**, Ranases, J.M., and Filipov, E. T., “A Numerical and Experimental Study on the Energy Absorption Characteristics of Deployable Origami Tubes”, *ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference*, Virtual, Online.
- Mar 2019 **Wo, Z.**, Ranases, J.M., and Filipov, E. T., “Using Tunable Origami for Active Energy Absorption”, *APS March Meeting*, Boston, MA.
- Jul 2018 **Wo, Z.**, and Filipov, E. T., “Geometric Implications for Stress Concentration in Miura Origami”, *World Congress in Computational Mechanics*, New York, NY. **Student Poster Competition Finalist**

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## RESEARCH EXPERIENCES

**Dissertation Title: “Functionalities created by Buckling and Instability in Deployable Origami Tubes”,** Advisor: *Prof. Evgueni T. Filipov*

My research aims to explore the instability of morphing tubes and harness buckling for functional applications. Folding motions allow for deployment, reconfiguration, and compact storage of the systems, while buckling of the thin walls can be used to tune the system properties or achieve secondary functions such as energy absorption, multi-stable bending, and multi-dimensional stiffening.

- 2021 – Present **Buckling-induced Stiffening of Axial and Bending Deformation: An Exercise in the Corrugated Tube of Conical Kresling Origami** (ongoing), Collaborator: Kjell Westra
- Identified a unique mechanism of the Origami corrugated tube, where the buckling of the valley creases can result in global stiffening of axial and bending deformations.
  - Developed a reduced-order model that captures the buckling and the subsequent stiffening.
  - Building a finite-element model to verify and calibrate the reduced-order model.
  - Will perform a parametric study to find how the buckling and stiffening is related to the geometry.
- 2021 **Large-scale Origami Inspired Systems for Structural Applications**, Collaborator: Joseph Ryan, Pauline Wang, Yi Zhu
- Collaborated with a team to fabricate meter-scale origami structures with thick panels, bolts, and nuts.
  - Guided two undergraduate students in using lab equipments, including a ULS laser cutting machine and a Mark-10 load-deformation testing apparatus.
- 2019 – 2021 **Bending Stability of Corrugated Tubes With Anisotropic Frustum Shells**
- Developed a reduced-order model of bars and hinges to analyze the stability of thin-walled corrugated tubes.
  - Used MATLAB and Python to parameterize the ABAQUS model for calibrating stiffness of the bars and hinges.
  - Performed parametric studies to show the geometric influence on the global multi-stability of the corrugated tubes.
  - Demonstrated the anisotropy with paper prototypes, 3D-printed models, and a four-bar linkage mechanism.
- 2018 – 2020 **Locking Zipper-coupled Origami Tubes for Deployable Energy Absorption**, Collaborator: Julia Raneses
- Developed a finite-element model for analyzing the energy-absorbing characteristics of deployable zipper-coupled origami tubes.
  - Built a MATLAB program to parameterize the analysis to find the optimal design of the origami energy absorber, and analyzed the results using [ABAQUS Python](#).
  - Fabricated a series of physical models with a laser-cutting machine to measure the experimental energy absorptions, which show a good match as compared to the numerical results.
- 2018 **Geometric Implications for Stress Concentration in Miura Origami**
- Developed a finite-element model for modeling the folding and loading of Miura-origami, using shell elements for sheets and a connector scheme to model creases.
  - Performed strain-energy analysis to find the pattern of the stress concentration with respect to the deployment and the loading condition.

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## EXPERIENCES & SERVICES

- Fall 2020; **Graduate Student Instructor**, CEE 413: Design of Metal Structures
- Fall 2021
- Worked with the principal instructor *Prof. Jason P. McCormick*
  - Conducted in-person and virtual lab sessions which cover the exercise problems of the steel design.
  - Holding office hours and discussions to help students with the course material and homework.
- 2019 **Xplore Engineering**, Program Assistant  
University of Michigan
- 2019 **Civil and Environmental Engineering Research Lab Open House**, Program Assistant  
Department of Civil and Environmental Engineering, University of Michigan
- 2018 **Responsible Conduct of Research and Scholarship**, Certificate  
University of Michigan
- 2018 **Girls in Science and Engineering**, Program Organizer  
University of Michigan

- 2017 **“Structural Origami for Kids”**, Program Assistant  
Ann Arbor District Library, Ann Arbor, MI
- 2015; 2016 **Association of Science & Technology**, Department Leader  
Tsinghua University, Beijing, China

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## SELECTED AWARDS AND HONORS

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|---------------------------|---|---------------------|--|
| 2018; 2019;<br>2021; 2022 | <b>Rackham Graduate School Travel Grant</b><br>University of Michigan | 2014; 2015;<br>2016 | <b>Academic Excellence Scholarship</b><br>Tsinghua University  |
| 2017                      | <b>Outstanding Graduate</b><br>Tsinghua University                    | 2015                | <b>Meritorious Winner</b><br>Mathematical Contest in Modelling |
| 2015                      | <b>National Scholarship</b><br>Ministry of Education of China         | 2015                | <b>First Prize</b><br>China Mathematical Contest in Modeling   |

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## SKILLS

### Programming Language

MATLAB Python Julia Mathematica

### Engineering Software

ABAQUS, AutoCAD, Fusion 360, and more

### Lab Experience

Laser-cutting Machine, Load-deformation Test, High-speed Displacement Measure

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## REFERENCES

### **Evgueni T. Filipov**

Assistant Professor  
Department of Civil and Environmental Engineering  
Department of Mechanical Engineering  
University of Michigan  
filipov@umich.edu

### **Jason P. McCormick**

Arthur F. Thurnau Professor  
Department of Civil and Environmental Engineering  
University of Michigan  
jpmccorm@umich.edu