

# Yefan Zhi

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Yefan Zhi is a Ph.D. Candidate in Architecture at the University of Pennsylvania, supervised by Dr. Masoud Akbarzadeh. His research interests are in toolpath design for 3D concrete printing, its application in structural systems, form-finding by graphic statics, and methods of multi-material extrusion 3D printing. He developed Ovenbird, a slicing and optimization software for concrete and multi-material printing, which is widely used by the 3D printing community and recognized by the IASS Hangai Prize.

## Education

**Doctor of Philosophy - PhD**, Architecture, [University of Pennsylvania](#) Philadelphia, PA, USA Jul 2023 - Present  
**Master of Science in Design - MSD**, Architecture, [University of Pennsylvania](#) Philadelphia, PA, USA Aug 2021 - Aug 2022  
**Bachelor of Architecture - BArch**, Architecture, [Tsinghua University](#) Beijing, China Aug 2016 - Jun 2021  
**Bachelor of Arts - BA**, Sociology, [Tsinghua University](#) Beijing, China Aug 2016 - Jun 2020

## Research Experience

[Polyhedral Structures Laboratory](#), [University of Pennsylvania](#) Philadelphia, PA, USA  
- PhD Fellow, Full-Time. National Science Foundation (NSF) Future Manufacturing Research Grant Jul 2023 - Present  
- Research Assistant, Full-Time. Advanced Research Projects Agency–Energy (ARPA-E) Grant Sep 2022 - Jun 2023  
[People's Architecture Office](#) Beijing, China  
- Research Intern, Full-Time Jul 2019 - Sep 2019

## Under Review Papers

**Design-to-Fabrication Workflow for 3D Concrete Printed Structures with Embedded Periodic Anticlastic Surfaces**  
Hua Chai, Mathias Bernhard, Yefan Zhi, Maximilian E. Ororbia, Masoud Akbarzadeh  
Submitted to Automation in Construction

## Journal Papers (Peer-Reviewed)

- [J5] [3D Concrete Printing of Triply Periodic Minimum Surfaces for Enhanced Carbon Capture and Storage](#)  
Kun-Hao Yu, Teng Teng, So Hee Nah, Hua Chai, Yefan Zhi, Kun-Yu Wang, Yinding Chi, Peter Psarras, Masoud Akbarzadeh, Shu Yang  
Advanced Functional Materials 2025
- [J4] [Automated Toolpath Design of 3D Concrete Printing Structural Components](#)  
Yefan Zhi, Hua Chai, Teng Teng, Masoud Akbarzadeh  
Additive Manufacturing 2025
- [J3] [Prototyping High-Fidelity Multifunctional Objects Using Single-Nozzle Multi-Filament Additive Manufacturing System with Active Mixing](#)  
Teng Teng, Yefan Zhi, Masoud Akbarzadeh  
Materials & Design 2025
- [J2] [Designing 3D-Printed Concrete Structures with Scaled Fabrication Models](#)  
Yefan Zhi, Teng Teng, Masoud Akbarzadeh  
Architectural Intelligence 2024

- [J1] **Research on the Villagers' Behavior Characteristics in Rural Area: Analysis Using Spatio-Temporal Data from Wi-Fi and Surveillance Video**  
Yefan Zhi, Ziyu Huang, Weixin Huang  
Urban, Environment, Design (UED) 2023 in Chinese, *on Cover*

## Conference Papers (Peer-Reviewed)

- [C12] **Toolpath Optimization for a Post-Tensioned Concrete 3D-Printed Floor Structure**  
Yefan Zhi, Maximilian E. Ororbia, Amir Mostavaselian, Hua Chai, Andrea Machado Romero, Meizhu Xu, Fang Sun, Masoud Akbarzadeh  
ACM Symposium on Computational Fabrication (SCF) 2025 (Adjunct) *Cambridge, MA, USA*
- [C11] **Surface-Toolpath Twins of Shell Components in 3D Concrete Printing for Optimized Buildability and Surface Quality**  
Yefan Zhi, Masoud Akbarzadeh  
International Association for Shell and Spatial Structures (IASS) Annual Symposium 2025 *Mexico City, Mexico*  
*Hangai Prize (Best researcher under 30)*
- [C10] **Advanced Finite Element Modeling of 3D-Printed Post-Tensioned Concrete Beams with Experimental Validation**  
Fahimeh Yavartanoo, Damon Bolhassani, Masoud Akbarzadeh, Maximilian E. Ororbia, Hua Chai, Yefan Zhi, Ibrahim Alachek, Leon Trouset, Mylene Bernard, Karolina Pajak  
International Association for Shell and Spatial Structures (IASS) Annual Symposium 2025 *Mexico City, Mexico*
- [C9] **KlimaStol: 3D-printed Cooling Chair for Mitigating Outdoor Heat Stress**  
Ji Yoon Bae, Yefan Zhi, Eric Teitelbaum, Masoud Akbarzadeh, Dorit Aviv  
Association for Computer Aided Design in Architecture (ACADIA) Annual Conference 2025 (Project Paper) *Miami, FL, USA*
- [C8] **Merged Force Diagrams for Expanded Tension-Compression Design Space in Polyhedral Graphic Statics**  
Hua Chai, Yao Lu, Yefan Zhi, Masoud Akbarzadeh  
Advances in Architectural Geometry 2025 *Cambridge, MA, USA*
- [C7] **Functionally Graded Architectural Materials: Integrated and Tailored Thermal Insulation through Gradient Multimaterial Additive Manufacturing for Masonry Architectural Components**  
Teng Teng, Yefan Zhi, Masoud Akbarzadeh  
Association for Computer Aided Design in Architecture (ACADIA) Annual Conference 2024 *Banff, Canada*  
*Best Paper Award (Runner-Up)*
- [C6] **The Effect of Post-Tensioning on the Behavior of Small-Scale 3D-Printed Concrete Beams**  
Damon Bolhassani, Fahimeh Yavartanoo, Javier Tapia, Masoud Akbarzadeh, Maximilian E. Ororbia, Hua Chai, Yefan Zhi, Mylene Bernard, Leon Trouset, Karolina Pajak, Blaise Waligun, Paul Kassabian  
International Association for Shell and Spatial Structures (IASS) Annual Symposium 2024 *Zurich, Switzerland*
- [C5] **Experimental Study of a Funicular Concrete Beam Prototype**  
Maximilian E. Ororbia, Hua Chai, Yefan Zhi, Pouria Vakhshouri, Jorge Huisa Chacon, Joseph R. Yost, Mathias Bernhard, Fahimeh Yavartanoo, Javier Tapia, Damon Bolhassani, Mylene Bernard, Leon Trouset, Karolina Pajak, Blaise Waligun, Paul Kassabian, Masoud Akbarzadeh  
International Association for Shell and Spatial Structures (IASS) Annual Symposium 2024 *Zurich, Switzerland*
- [C4] **Design Approach for a Post-Tensioned Funicular Concrete Beam**  
Hua Chai, Maximilian E. Ororbia, Yefan Zhi, Ryan Welch, Billie Faircloth, Fahimeh Yavartanoo, Damon Bolhassani, Masoud Akbarzadeh  
International Association for Shell and Spatial Structures (IASS) Annual Symposium 2024 *Zurich, Switzerland*
- [C3] **Diamanti: 3D-Printed, Post-Tensioned Concrete Canopy**  
Masoud Akbarzadeh, Hua Chai, Yefan Zhi, Maximilian E. Ororbia, Teng Teng, Mathias Bernhard, Damon Bolhassani, Fahimeh Yavartanoo, Javier Tapia, Karolina Pajak, Mylene Bernard, Leon Trouset, Paul Kassabian, Blaise Waligun  
FABRICATE 2024 *Copenhagen, Denmark*

- [C2] **Local Optimization of Self-Supporting Shell Structures in 3D Printing: a Skeleton Method**  
 Yefan Zhi, Hua Chai, Teng Teng, Masoud Akbarzadeh  
 International Association for Shell and Spatial Structures (IASS) Annual Symposium 2023 *Melbourne, Australia*
- [C1] **Continuous Multi-Filament 3D Printing for Tension-Compression Structure Components**  
 Teng Teng, Yefan Zhi, Kun-Hao Yu, Shu Yang, Masoud Akbarzadeh  
 International Association for Shell and Spatial Structures (IASS) Annual Symposium 2023 *Melbourne, Australia*

## Book Chapters

**Prototyping 3D-Printed Compression-Dominant Funicular Floors Using Scaled Fabrication Models** (And Five Other Chapters)

Yefan Zhi, Teng Teng, Masoud Akbarzadeh

Chapter in *Architected Structures* by Masoud Akbarzadeh, 2025, Edition DETAIL *Munich, Germany*

### Broader Applications of Polyhedral Graphical Statics

Masoud Akbarzadeh, Yefan Zhi, Georgios Athanasopoulos, Marina Konstantatou, Maximilian E. Ororbia, Salma Mozaffari, Teng Teng, Mostafa Akbari, Hao Zheng, Hossein Mofatteh, Hamid Akbarzadeh, Armin Mirabolghasemi, Zakaria Hsain, James Pikul, Yao Lu, Shu Yang, Kun-Hao Yu, Hua Chai, Mohammad Bolhassani, Paria Yavartanoo, Allan McRobie, Joseph Robert Yost, Jen Schneider

Chapter in *Polyhedral Graphical Statics: For Funicular Structural Form Finding* by Masoud Akbarzadeh, 2025, Cambridge University Press *Cambridge, UK*

## Theses

### A Wi-Fi and Video Data-Based Study on Spatial-Temporal Characteristics of Rural Space Behavior

Yefan Zhi, Advised by Weixin Huang

Bachelor of Architecture thesis 2021, Tsinghua University *Beijing, China, in Chinese*

### Forming Norms in a Small Community: a Sociological Study of Birdwatching

Yefan Zhi, Advised by Yue Du

Bachelor of Arts in Sociology thesis 2020, Tsinghua University *Beijing, China, in Chinese*

## Software

**Ovenbird**, A cross-scale shell printing slicer and optimizer

2022 - 2025

Yefan Zhi, Hua Chai, Teng Teng, Masoud Akbarzadeh

**PolyFrame 2**, Structural Form-Finding with Polyhedral Graphic Statics

2022 - 2025

Yao Lu, Andrei Nejur, Mathias Bernhard, Yefan Zhi, Hua Chai, Mostafa Akbari, Márton Hablicsek, Masoud Akbarzadeh

## Teaching

### Courses (Instructor)

**ARCH 7327 Tech Elective: Developing Computational Solutions for Design Problems**

University of Pennsylvania

Spring 2026

Yefan Zhi

### Courses (Teaching Fellow)

**ARCH 5350 Structures I** University of Pennsylvania

Fall 2025

Richard Farley, Masoud Akbarzadeh

## Workshops

**Ovenbird: Automated toolpath design for 3D concrete printing**

Nov 2025

Advances in Architectural Geometry *Cambridge, MA, USA*

Yefan Zhi, Masoud Akbarzadeh

## Design/Construction Projects

*Projects not associated with academic publications are listed here.*

**Diamanti**, Venice 2025 Architecture Biennial Exhibition by European Cultural Centre Venice, Italy May - Nov 2025

- As designer

**Glass Bridge**, Corning Museum of Glass Corning, NY, USA Dec 2024 - Sep 2025

- As part of the installation/disassembly team

**Floralis: an ETFE-Clad, Multilaminar Timber Structure**, Florissant Fossil Beds Denver, CO, USA Dec 2024

- As part of the installation team

**Inventory-Constrained Design Competition by Eventscape 2022** New York, NY, USA May 2024

- First place: **Dove Wave: Inventory Constrained Design**, as lead researcher

## Exhibitions

**Advanced Research Projects Agency-Energy (ARPA-E) Energy Innovation Summit 2025** Washington, DC, USA Mar 2025

- 3D concrete printing technology showcase

**Greenbuild International Conference & Expo 2024** Philadelphia, PA, USA Nov 2024

- 3D concrete printing technology showcase

**Advanced Research Projects Agency-Energy (ARPA-E) Energy Innovation Summit 2024** Dallas, TX, USA Mar 2024

- 3D concrete printing technology showcase

**Advanced Research Projects Agency-Energy (ARPA-E) Energy Innovation Summit 2023** Washington, DC, USA Apr 2023

- 3D concrete printing technology showcase

**Association for Computer Aided Design in Architecture (ACADIA) Conference 2022** Philadelphia, PA, USA Oct 2022

- Faculty research exhibition, as part of Polyhedral Structures Laboratory research team

- Student work exhibition, as part of Master of Science in Design program

**Weitzman School Year End Show 2022** Philadelphia, PA, USA May 2022

- Student work exhibition, as part of Master of Science in Design program