

# Hanning Liu

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## EDUCATION

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### Tongji University

Master of Architecture (M.Arch)

Thesis: "Improving Accuracy in AR-Assisted Plastic 3D Printed Panel Assembly"

Advisor: Philip F. YUAN

Sep. 2022 - Jun. 2025 (Expected)

Shanghai, China

### Xi'an University of Architecture and Technology

Bachelor of Architecture (B.Arch)

Overall GPA: 3.93/5      Ranking: 3/192

Sep. 2017 - Jul. 2022

Xi'an, China

## PUBLICATIONS

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- H Liu**, X Xie, Y Li, X Gao, H Wu, Y Zhang, PF Yuan\*, "Leveraging Motion Capture System for High Accuracy AR-Assisted Assembly" (accepted by the 6th International Conference on Computational Design and Robotic Fabrication (CDRF)), **2024**.
- H Chai, L Orozco, F Kannenberg, L Siriwaedena, T Schwinn, **H Liu**, A Menges\*, PF Yuan\*, "Agent-Based Principal Strips Modeling for Freeform Surfaces in Architecture", *Nexus Network Journal*, 26: 369–396, **2024**.
- PF Yuan\*, **H Liu**, "Spatial Implementation of Behavioral Performance: Tourist Center of Shanghai Xuhui West Coast", *Chinese and Overseas Architecture*, 01: 8-13, **2024**.
- J Wang, **H Liu**, L Qian, H Wu, X Xie, M Yuan, PF Yuan\*, "Prestressed 3D Printed Reinforced Concrete Composite Structure Design and Construction: A Case Study of Experimental Bridge Building", In *2023 Computational Design Symposium and the Annual Conference of Computational Design Academic Committee of the Architectural Society of China*, **2023**. (Outstanding Paper Award)
- H Liu**, H Wu, X Xie, M Yuan, PF Yuan\*, "Prompt Writing Approach in GAI Tools Aided Architectural Design: Taking Urban Camp Center Design as an Example", In *Proceeding of 2023 National Architectural Academy Department of Architectural Digital Technology Teaching and Research Academic Symposium*, 433-436, **2023**.

**Under Review and In Progress:** (Working paper available by request)

- H Liu**, C Yan, X Xie, T Zhang, R Yang, H Wu, Y Zhang, PF Yuan\*, "Bending Form in Extended Reality: A Gesture-Based Workflow of Chair Design and Fabrication", (under review for ACADIA **2024**).
- X Xie, X Gao, **H Liu**, M Yuan, PF Yuan\*, "Aerial Robotics Fabrication: Precise and Flexible Assembly with 6-DOF Parallel Manipulator", (under review for ACADIA **2024**).

## PRESENTATIONS

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"Prompt Writing Approach in GAI Tools Aided Architectural Design: Taking Urban Camp Center Design as an Example", 2023 National Architectural Academy Department of Architectural Digital Technology Teaching and Research Academic Symposium, Xiang Tan City, China, **Oct 14, 2023**.

## PATENTS

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- China Software Copyright, "Fiducial marker-based AR-assisted assembly plugin for Grasshopper", 2024 (under review)
- China invention patent, "AR Motion Capture integrated Handle for Assembly Workflow", 2024 (in progress)

## RESEARCH EXPERIENCE

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**Tongji University**

**Feb. 2024 - present**

**Research Assistant (with Prof. Chao Yan)**

*Shanghai, China*

*Humanizing Mixed Reality—Spatial Behavior Computation based on AR Media*

- Utilizing head-mounted display device (HoloLens 2 & Quest 3) to design and construct adjustable mixed reality spaces for supporting iterative optimization experiments on physical spaces.
- Conducting mixed reality spatial experiences to collect human behavior data, involving micro-level eye and head movement data, meso-level body posture data, and macro-level multi-target locomotion data.
- Conducting multi-dimensional environment-behavior coupling analysis and ultimately using virtual media for the visualization of the research outcomes.

**Tongji University**

**Sep. 2023 - Mar. 2024**

**Research Assistant (with Prof. Philip F. Yuan)**

*Shanghai, China*

*Research on Positional Tracking Technology*

- Developed a Grasshopper plugin for pose estimation with fiducial markers (ArUco and AprilTags) and a monocular camera.
- Implemented real-time positional tracking using SLAM with stereo depth cameras (ZED 2i & RealSense D455), eliminating the need for fiducial markers.
- Integrated motion capture pose tracking system into the assembly workflow for high accuracy using custom hardware and Unity3D-developed software.

## TEACHING EXPERIENCE

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**Teaching Assistant** for “AI-Driven Performance-Based Tectonics” Class, Tongji University

**Spring 2024**

- Design with AI tools like Stable Diffusion.
- Basic Python programming knowledge.
- Curve crease folding.
- AR-assisted steel tube bending.
- Humaning data gathering with HoloLens and Depth Camera.

**Teaching Assistant** for “Computational Design” Class, Shanghai University

**Fall 2023**

- Rhino & Grasshopper 3D modeling.
- Basic C# programming knowledge.
- Making animation with V-Ray for GH.

**Teaching Assistant** for ZAHA “Tectonism” Workshop, DigitalFUTURES

**Summer 2023**

- Curve crease folding.
- Robotic hot wire cutting.

## OTHER PROFESSIONAL EXPERIENCE

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**Editor**, DigitalFUTURES Social Media

**Sep. 2022 - present**

- Monthly academical news posts.
- Tutorial post introducing linear algebra.
- Posts introducing AR-related research papers.

**Webinar Host**, DigitalFUTURES Webinar Series: Augmented Reality and Digital Fabrication

**Nov 4, 2023**

- Designed and created promotional materials.
- Coordinated with lecturers and gathered participants
- Managed details, including scheduling, communication, and technical setup.

**Architectural Intern**, Archi-Union Architects, Shanghai

**Jul. 2021 - Aug. 2021**

- Designed an exhibition building, made presentation slides.
- Made a scale-down physical model for a hotel building.
- Explored the possibilities of parametric brick walls.

**Architectural Intern**, Architectural Design & Research Institute of Tsinghua University, Beijing **Jul. 2020 - Aug. 2020**

- Designed the landscape around a teaching building on a college campus.
- Made a set of rendering images of the college campus.
- Designed the entrance pavilion of a residential complex.

**Ancient Buildings Mapping Group Leader**, City God Temple of Sanyuan Country, Xi'an

**Jul. 2019**

- Utilized laser rangefinder to measure building dimensions accurately.
- Utilized drones for aerial scans, capturing data from angles inaccessible from ground-level perspectives.
- Produced floor plans, elevations, and sections for buildings based on collected data.

**Engineering Mapping Group Leader**, Xi'an University of Architecture and Technology, Xi'an

**Jul. 2018**

- Employed level instruments for precise elevation measurements between ground points.
- Utilized total station for accurate coordinate measurement of building keypoints.
- Created detailed 3D models and 2D drawings based on total station data.

## **HONORS AND AWARDS**

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- **Silver Prize**, Ninth China International College Students' Innovation Competition in Tongji University **2023**
- **Distinguished Design Outcome**, College of Architecture and Urban Planning, Tongji University **2023**
- **Distinguished Design Outcome**, Xi'an University of Architecture and Technology **2021**
- **National Encouragement Scholarship**, Xi'an University of Architecture and Technology **2019, 2020**
- **The Third Prize**, UIA-CBC International Colleges and Universities Competitive Construction Workshop **2019**
- **First Class Student Scholarship**, Xi'an University of Architecture and Technology **2018**
- **The Third Prize**, Harbin Institute of Technology "Ice and Snow Construction Workshop" Competition **2018**
- **Freshman Scholarship**, Xi'an University of Architecture and Technology **2017**

## **RESEARCH INTERESTS**

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- Develop design and fabrication tools on the spatial computation platform to streamline the process.
- Investigate methods to enhance the accuracy of XR-assisted assembly workflows in challenging outdoor conditions, such as bright sunlight and random human movement.
- Integrate AI technology with XR to optimize object recognition and streamline the assembly process.
- Explore methods for translating human behavioral data into instructions for robotic fabrication processes.

## **SKILLS**

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### **Languages**

- Chinese, Native (Mandarin Grade 2A)
- English, TOEFL iBT 101 (R: 29 L: 27 S: 21 W: 24)

### **Professional Skills**

- Programming: C#, Python, Anaconda, HTML, Git, Unity3D, Visual Studio, Docker.
- Design: Rhinoceros, Grasshopper, Blender, Photoshop, Illustrator, Indesign, Premiere, AutoCAD, Vray, D5.
- Fabrication: Robot Control, Extended Reality, Curve Crease Folding, Steel Tube Bending, Hot-wire Cutting.