Yi Zhan

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Research Interests

- Fluid-structure interactions (FSI) in coastal engineering
- High performance computing for Smoothed Particle Hydrodynamics (SPH)
- Multi agent deep reinforcement learning (MADRL) for fluid mechanics and flow control

Education

University of Vigo, Visiting Scholar in EphysLab (Spain) 04/2025 – 04/2026

- Advisor: Alejandro J. C. Crespo [Link]

Zhejiang University, PhD in Marine Technology and Engineering (China) 09/2020 – 06/2026

- Advisor: Min Luo [Link], Abbas Khayyer [Link]

Hohai University, BS in Harbour, Coastal and Offshore Engineering (China) 09/2016 – 06/2020

- GPA: 4.44/5.0, ranking 4/18
- Thesis: Develops a two-dimensional numerical model for tidal wave simulation

Research Experience

Hydrodynamic characteristics analysis and optimization of multi-connected floating flexible Structures 06/2025 – Present

- Develops a coupled fluid-structure interaction model for multiple hinged flexible floating bodies simulations based on DualSPHysics+
- The model is validated through physical experiments, the motion, deformation response and hydrodynamic characteristics of the array under extreme wave conditions are investigated

Develops GPU-parallelized simulation platform coupling MADRL and SPH models 09/2024 – 12/2025

- Integrates the SPH solver DualSPHysics+ with machine learning framework LibTorch, enabling in-time communications between high-fidelity fluid simulations and intelligent control agents
- Applies the SPH-MADRL model to wave-energy point-absorber array, where active control of the power take-off damping coefficient led to an overall 25% increase in energy capture efficiency

Enhances the SPH model for simulating fluid flow, structure deformation and fluid–structure interactions 09/2022 – 09/2024

- Proposes several novel numerical schemes to enhance the accuracy, stability, and energy conservation of the SPH method in free-surface flow simulations, while simultaneously reducing stress noise and suppressing hourglass modes in structural dynamics
- All the advanced schemes were implemented with GPU parallelization and incorporated into the open-source SPH framework DualSPHysics, leading to the development of DualSPHysics+

Publications

A. First-Author Publications

[A4] **Yi Zhan**, Iván Martínez-Estévez, Min Luo, Alejandro J. C. Crespo, and Abbas Khayyer. "Coupling smoothed particle hydrodynamics with multi-agent deep reinforcement learning for cooperative control of point absorbers." *Engineering Applications of Artificial Intelligence*, manuscript under review. [Arxiv Link]

[A3] **Yi Zhan**, Min Luo, and Abbas Khayyer. "DualSPHysics+: An enhanced DualSPHysics with improvements in accuracy, energy conservation and resolution of the continuity equation." *Computer Physics Communications*, 306 (2025): 109389. [Link]

[A2] **Yi Zhan**, Min Luo, and Abbas Khayyer. "An enhanced SPH-based hydroelastic FSI solver with structural

dynamic hourglass control." *Journal of Fluids and Structures*, 135 (2025): 104295. [Link]

[A1] **Yi Zhan**, Min Luo, and Abbas Khayyer. "An enhanced numerical wave tank for wave–structure interaction based on DualSPHysics+." *Ocean Engineering*, 340 (2025): 122413. [Link]

B. Co-Author Publications

[B3] Guozhen Cai, Min Luo, Matteo Rubinato, **Yi Zhan**, and Abbas Khayyer. "Simulation of multi-body floating structures under wave actions using DualSPHysics+." *Ocean Engineering*, 349 (2026): 124073. [Link]

[B2] Xiujia Su, Chen Wang, Min Luo, and **Yi Zhan**. "Development of a smoothed particle hydrodynamics model for porous media flows with enhanced volume conservation and the revisit of the mass conservation equation." *Physics of Fluids*, 36 (2024). [Link]

[B1] Zhouteng Ye, Mark Sussman, **Yi Zhan**, and Xizeng Zhao. "A decision-tree based moment-of-fluid (DTMOF) method in 3D rectangular hexahedrons." *arXiv preprint*, arXiv:2108.02533 (2021). [Link]

Presentations

Coupling SPH with a Multi-Agent DRL Framework for Active Flow Control [Link] 10/2025

- *Particles 2025*, Barcelona — Oral Presentation

An Enhanced SPH-Based FSI Solver with Dynamic Hourglass Control [Link] 06/2025

- *SPHERIC*, Barcelona — Oral Presentation

An enhanced DualSPHysics with improvements in accuracy, energy conservation and resolution of the continuity equation [Link] 10/2024

- *SPHERIC*, Zhuhai — Oral Presentation, Outstanding Student Paper Award

Teaching Experience

Teaching Assistant, Computational fluid dynamics course, Zhejiang University Fall 2023

- Lectured on the mesh-free particle method
- Designed and graded homework assignments

Relevant Skills

Programming Languages: C++, Cuda, Python, MATLAB

Software & Tools: DualSPHysics+, OpenFOAM, Paraview, PyTorch, LaTeX

Languages: Chinese (Native), English (Fluent in academic and daily communication)

Hobbies: Traveling, Badminton

Awards and Honors

National Scholarship for Joint-Training Program, China Scholarship Council 2024

SPHERIC-2024 Excellent Student Paper Award, SPHERIC Committee 2024

Award of Honor for Graduate, Zhejiang University 2024

Excellent Graduate Student Award, Zhejiang University 2023

Outstanding Student Award, Hohai University 2020

National Encouragement Scholarship, Ministry of Education of China 2019

Third Prize, National College Student Mathematics Competition, Chinese Mathematical Society 2018

Second Prize, Jiangsu Provincial Advanced Mathematics Competition, Jiangsu Society of Higher Mathematics 2018