

# Yi Zhan

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## Research Interests

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- 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

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<b>University of Vigo</b> , Visiting Scholar in EphysLab (Spain)	04/2025 – 04/2026
• Advisor: Alejandro J. C. Crespo [Link]	
<b>Zhejiang University</b> , PhD in Marine Technology and Engineering (China)	09/2020 – 06/2026
• Advisor: Min Luo [Link], Abbas Khayyer [Link]	
<b>Hohai University</b> , 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

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<b>Hydrodynamic characteristics analysis and optimization of multi-connected floating flexible Structures</b>	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	
<b>Develops GPU-parallelized simulation platform coupling MADRL and SPH models</b>	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	
<b>Enhances the SPH model for simulating fluid flow, structure deformation and fluid-structure interactions</b>	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

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### 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.

[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*, manuscript under review.

[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**

<b>Coupling SPH with a Multi-Agent DRL Framework for Active Flow Control</b> [Link]	10/2025
• <i>Particles 2025</i> , Barcelona — Oral Presentation	
<b>An Enhanced SPH-Based FSI Solver with Dynamic Hourglass Control</b> [Link]	06/2025
• <i>SPHERIC</i> , Barcelona — Oral Presentation	
<b>An enhanced DualSPHysics with improvements in accuracy, energy conservation and resolution of the continuity equation</b> [Link]	10/2024
• <i>SPHERIC</i> , Zhuhai — Oral Presentation	

**Teaching Experience**

<b>Teaching Assistant</b> , 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**

<b>National Scholarship for Joint-Training Program</b> , China Scholarship Council	2024
<b>SPHERIC-2024 Excellent Student Paper Award</b> , SPHERIC Committee	2024
<b>Excellent Graduate Student Award</b> , Zhejiang University	2023
<b>Outstanding Student Award</b> , Hohai University	2020
<b>National Encouragement Scholarship</b> , Ministry of Education of China	2019
<b>Third Prize, National College Student Mathematics Competition</b> , Chinese Mathematical Society	2018
<b>Second Prize, Jiangsu Provincial Advanced Mathematics Competition</b> , Jiangsu Society of Higher Mathematics	2018