

# XIANTAO FAN

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## ACADEMIC EXPERIENCE

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<b>Postdoctoral Research Associate</b> <i>Sibley School of Mechanical and Aerospace Engineering, Cornell University, NY, USA</i>	<i>07/2025 - Present</i>
<b>Postdoctoral Research Associate</b> <i>Aerospace and Mechanical Engineering, University of Notre Dame, IN, USA</i>	<i>06/2022 - 06/2025</i>
<b>Affiliate Postdoctoral Research Associate</b> <i>Environmental Change Initiative (ECI), University of Notre Dame, IN, USA</i>	<i>06/2022 - 05/2024</i>

## EDUCATION

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<b>Ph.D., Mechanical Engineering</b> <i>Tianjin University, China</i>	<i>09/2018 - 01/2022</i>
<b>M.S., Mechanical Engineering</b> <i>Tianjin University, China</i>	<i>09/2016 - 01/2022</i>
<b>B.S., Mechanical Engineering</b> <i>Tianjin University, China</i>	<i>09/2012 - 07/2016</i>

## RESEARCH INTERESTS

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- Scientific machine learning
- Differentiable physics
- Computational fluid dynamics (CFD)
- Fluid-solid interaction (FSI)
- Wall-bounded turbulence
- Renewable energy harvesting

## PUBLICATIONS

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**Journal Articles**(Google Scholar)      \* Indicates corresponding author

1. **Xiantao Fan**, Meet Hemant Parikh, Yi Liu, Xin-Yang Liu, Junyi-Guo, Meng Wang, Jian-Xun Wang\*. Generative Reconstruction of Spatiotemporal Wall-Pressure in Turbulent Boundary Layers via Patch-wise Latent Diffusion, 2025, arXiv. (DOI)
2. **Xiantao Fan**, Xin-Yang Liu, Meng Wang, Jian-Xun Wang\*. Diff-FlowFSI: A GPU-Optimized Differentiable CFD Platform for High-Fidelity Turbulence and FSI Simulations, *Computer Methods in Applied Mechanics and Engineering*, 2026, 448, 118455. (DOI)
3. Meet Hemant Parikh, **Xiantao Fan**, Jian-Xun Wang\*. Conditional Flow Matching for Generative Modeling of Near-wall Turbulence with Quantified Uncertainty, *Journal of Fluid Mechanics*, 2026, 1029(A32). (DOI)
4. Sifan Wang\*, Shyam Sankaran, **Xiantao Fan**, Panos Stinis, Paris Perdikaris\*. Simulating Three-dimensional Turbulence with Physics-informed Neural Networks, 2025, arXiv. (DOI)
5. Junyi Guo, Pan Du, **Xiantao Fan**, Yahui Li, Jian-Xun Wang\*. Conditional Neural Field for Spatial Dimension Reduction of Turbulence Data: A Comparison Study, *Physics of Fluids*, 2026, 38(2). (DOI)

6. Xin-Yang Liu, Meet Hemant Parikh, **Xiantao Fan**, Pan Du, Qing Wang, Yifan Chen, and Jian-Xun Wang\*. CoNFILD-Inlet: Synthetic Turbulence Inflow Using Generative Latent Diffusion Models with Neural Fields, *Physical Review Fluids*, 2025, 10(5), 054901. (DOI)
7. Bowen Tang, **Xiantao Fan**, Jiawei Wang, Hewei Yang, Rui Bai, Xiaoyang Yu, and Wei Tan\*. Energy Harvesting of Unequal-Height Cylindrical FIV Considering Wind Direction, *International Journal of Mechanical Sciences*, 2025, 290, 110118. (DOI)
8. **Xiantao Fan**, Deepak Akhare, and Jian-Xun Wang\*. Neural Differentiable Modeling with Diffusion-Based Super-resolution for Two-Dimensional Spatiotemporal Turbulence, *Computer Methods in Applied Mechanics and Engineering*, 2024, 433, 117478. (DOI)
9. Pan Du, Meet Hemant Parikh, **Xiantao Fan**, Xin-Yang Liu, and Jian-Xun Wang\*. CoNFILD: Conditional Neural Field Latent Diffusion Model Generating Spatiotemporal Turbulence, *Nature Communications*, 2024, 15(1), 10416. (DOI)
10. Bowen Tang, **Xiantao Fan**, Jiawei Wang, and Wei Tan\*. Suppression of Wake-induced Galloping of Tandem Cylinders by Helical Strakes, *International Journal of Mechanical Sciences*, 2024, 273, 109301. (DOI)
11. Han Gao, Xu Han, **Xiantao Fan**, Luning Sun, Li-Ping Liu, Lian Duan, and Jian-Xun Wang\*. Bayesian Conditional Diffusion Models for Versatile Spatiotemporal Turbulence Generation, *Computer Methods in Applied Mechanics and Engineering*, 2024, 427, 117023. (DOI)
12. **Xiantao Fan** and Jian-Xun Wang\*. Differentiable Hybrid Neural Modeling for Fluid-Structure Interaction, *Journal of Computational Physics*, 2024, 496, 112584. (DOI)
13. Kai Guo, Jianxu Jiang, Deqiang Zhang, Linyuan Meng, Yiran Zhang, **Xiantao Fan\***, Hongsheng Zhang\*. Hydrodynamic Performance Study of a Reciprocating Plate Column Driven by Electropermanent Magnet Technology, *Machines*, 2024, 12(5), 330. (DOI)
14. Kai Guo, Yuxuan Cheng, **Xiantao Fan**, Yang Wang, Wei Tan, Hongsheng Zhang\*. Insights to the Transition Regimes of Flow-induced Vibration for Three Tandem Cylinders, *International Journal of Acoustics and Vibration*, 2024, 29(4), 337-390. (DOI)
15. Bowen Tang, **Xiantao Fan**, Jiawei Wang, and Wei Tan\*. Energy Harvesting from Flow-induced Vibrations Enhanced by Meta-Surface Structure under Elastic Interference, *International Journal of Mechanical Sciences*, 2022, 236, 107749. (DOI)
16. **Xiantao Fan\***, Guo Kai, and Yang Wang\*. Toward a High-Performance and Strong-Resilience Wind Energy Harvester Assembly Utilizing Flow-induced Vibration: Role of Hysteresis, *Energy*, 2022, 251, 123921. (DOI)
17. **Xiantao Fan**, Mingwei Ge, Tan Wei, and Li Qi\*. Impacts of Coexisting Buildings and Trees on the Performance of Rooftop Wind Turbines: An Idealized Numerical Study, *Renewable Energy*, 2021, 177, 164-180. (DOI)
18. **Xiantao Fan**, Yang Wang, and Wei Tan\*. Aerodynamic Wake Oscillator for Modeling Flow-induced Vibration of Tandem Cylinders with Short Spans, *International Journal of Mechanical Science*, 2021, 204, 106548. (DOI)
19. Liyan Liu, Kai Shi, **Xiantao Fan**, Wei Tan, and Yang Wang\*. Risk and Characteristics Analysis of the Flow-induced Vibration of the Dip Tube in Opposed Multi-Burner Gasifier, *Journal of Loss Prevention in the Process Industries*, 2021, 71, 104508. (DOI)
20. **Xiantao Fan**, Zhongchen Wang, Yang Wang\*, and Wei Tan\*. The Effect of Vortex Structures on the Flow-induced Vibration of Three Flexible Tandem Cylinders, *International Journal of Mechanical Science*, 2021, 192, 106132. (DOI)

21. **Xiantao Fan**, Zhongchen Wang, Xiaoyu Chen, Yang Wang\*, and Wei Tan\*. Experimental Investigation on Flow-induced Vibration of Flexible Multi-Cylinders in Atmospheric Boundary Layer, *International Journal of Mechanical Science*, 2020, 183, 105815. (DOI)
22. **Xiantao Fan**, Kai Guo, Zhanbin Jia, Yang Wang\*, and Wei Tan\*. Vibration Mode and Velocity Interference Mechanism of Tandem Cylinders at Subcritical Reynolds Number, *Journal of Wind Engineering and Industrial Aerodynamics*, 2020, 199, 104316. (DOI)
23. Wei Tan, **Xiantao Fan**, Le Xu, and Yang Wang\*. New Approach for Vibration Suppression through Restrictors on Towering Steel Structures with Supporting Frame, *Mathematical Problems in Engineering*, Volume 2020, 2020: 1-16. (DOI)

### Manuscripts to be Submitted

24. **Xiantao Fan**, Jiaqiang Peng, Fei Ding, Daniel Herrington, Jian-Xun Wang\*. JAX-ECM: A GPU-Optimized Differentiable Solver for Pulsed ElectroChemical Machining (PECM).

### Manuscripts in Preparation

25. **Xiantao Fan**, Meng Wang, Jian-Xun Wang\*. Differentiable Hybrid Neural-CFD Modeling of Spatiotemporal Dynamics in 3D Wall-Bounded Turbulence.

### Conference Papers

1. Bowen Tang, **Xiantao Fan**, and Wei Tan. Experimental Study on Flow-induced Vibration Control of Multiple Cylinders in Tandem with Helical Strakes. *Proceedings of the ASME Pressure Vessels and Piping Conference*, 2022, 11. (DOI)
2. Kai Guo, Yuxuan Cheng, **Xiantao Fan**, Hongsheng Zhang, and Wei Tan. An Investigation on Vortex-induced Vibration and Wake-induced Galloping in Tandem Cylinders System. *Proceedings of the ASME Pressure Vessels and Piping Conference*, 2022, 11. (DOI)
3. **Xiantao Fan**, Yian Du, and Wei Tan. Vibration Suppression in Frame-structural Tower with Fluid Viscous Dampers. *Proceedings of the ASME Pressure Vessels and Piping Conference*, 2019, 5. (DOI)
4. Wei Tan, **Xiantao Fan**, Yian Du, Zhanbin Jia, and Liyan Liu. A Study on Damping Ratio in the Design Code of Vertical Vessels Supported by Skirt. *Proceedings of the ASME Pressure Vessels and Piping Conference*, 2018, 1B. (DOI)
5. Wei Tan, Kai Guo, **Xiantao Fan**, Yipeng Wang, Guorui Zhu, and Liyan Liu. Numerical Simulation on Flow-induced Vibration and Fretting Wear of a Steam Generator. *Proceedings of the ASME Pressure Vessels and Piping Conference*, 2018, 4. (DOI)

### Presentations ‡ Indicates presenter

1. **Xiantao Fan**‡, Jian-Xun Wang. JAX-ECM: AI-enhanced GPU-native differentiable solver for pulsed electrochemical machining (PECM), Seminar with Corning, Ithaca, NY, January 12, 2026.
2. **Xiantao Fan**‡, Meet Hemant Parikh, Yi Liu, Xin-Yang Liu, Junyi Guo, Meng Wang, Jian-Xun Wang. Generative AI for Synthesizing Spatio-temporal Wall Pressure Fluctuations in Turbulent Boundary Layers, 77th Annual Meeting of the APS Division of Fluid Dynamics, Salt Lake City, Utah, November 24-26, 2024.
3. **Xiantao Fan**‡. Bayesian Conditional Diffusion Model for Synthesizing Spatio-temporal Turbulence, Invited talk at SIAM Conference on Mathematics of Data Science, Atlanta, Georgia, October 21-25, 2024.
4. **Xiantao Fan**‡. Neural Differentiable Modeling with Diffusion-based Super-resolution for Predicting Two-dimensional Turbulence, SIAM Conference on Mathematics of Data Science, Atlanta, Georgia, October 21-25, 2024.

5. **Xiantao Fan**†. Differentiable Hybrid Neural Models for Simulating Fluid-structure Interactions and Turbulence, Invited talk in the seminar of Pasteur Labs, December 15, 2023.
6. **Xiantao Fan**†, Xin-Yang Liu, Meng Wang, and Jian-Xun Wang. Diff-FSI: A JAX-Based Differentiable Solver for Fluid-structure Interactions and Turbulence Modeling, 76th Annual Meeting of the APS Division of Fluid Dynamics, Washington DC, November 19-21, 2023.
7. **Xiantao Fan**† and Jian-Xun Wang. Differentiable Hybrid Neural Modeling of Turbulence and Fluid-structure Interaction. 17th U.S. National Congress on Computational Mechanics, Albuquerque, New Mexico, July 23-27, 2023.
8. **Xiantao Fan**† and Jian-Xun Wang. A Neural Differentiable Solver for Efficient Simulation of Fluid-structure Interaction. 75th Annual Meeting of the APS Division of Fluid Dynamics, Indianapolis, Indiana, November 19-21, 2022.
9. **Xiantao Fan**† and Wei Tan. Flow-induced Vibration of Parallel Vertical Vessels under Different Vortex Structures. ISSI2021 International Symposium on Structural Integrity, Hangzhou, China, October 8-11, 2021.
10. **Xiantao Fan**† and Wei Tan. Study on the Flow-induced Vibration Characteristics and Prediction Model of Parallel Towers. The 10th National Pressure Vessel Academic Conference, Hangzhou, China, September 26-29, 2021.
11. **Xiantao Fan**†, Yian Du, and Wei Tan. Vibration Suppression in Frame-structural Tower with Fluid Viscous Dampers. ASME 2019 Pressure Vessels and Piping Conference, San Antonio, Texas, USA, July 14–19, 2019.
12. Wei Tan, **Xiantao Fan**†, Yian Du, Zhanbin Jia, and Liyan Liu. A Study on Damping Ratio in the Design Code of Vertical Vessels Supported by Skirt. ASME 2018 Pressure Vessels and Piping Conference, Prague, Czech Republic, July 15–20, 2018.

## PATENTS

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1. **Xiantao Fan**, Xin-Yang Liu, Meng Wang, Jian-Xun Wang. Diff-FlowFSI: A GPU-Accelerated, Differentiable Data-Model Fusion Framework for Turbulent Flow and Fluid-structure Interactions. US, submitted.
2. Wei Tan, **Xiantao Fan**, Le Xu, Yian Du. Natural Frequency Calculating Method for Jacketed Tower. China: ZL2016111033370.0.
3. Wei Tan, **Xiantao Fan**, Yian Du, Xiaoyu Chen. Anti-vibration Viscous Damper for Tower. China: ZL2018111350984.0.

## GRANTS

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1. *06/2022-06/2024* Wind Energy Harvesting based on Flow-induced Vibrations and Community Acceptance
  - Role: Postdoctoral Fellowship
  - Mentor: Prof. Jian-Xun Wang and Prof. Sisi Meng
  - Sponsor: ND Energy/ECI/CCI

## RESEARCH PROJECTS

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1. *12/2022-Present* Physics-Preserved Neural Differentiable Computing for Predictive Modeling of Rough-Wall Turbulence

- Role: Lead researcher, primarily responsible for developing a differentiable solver and advancing neural turbulence modeling, resulting in new capabilities for wall-bounded flow
  - PI: Prof. Jian-Xun Wang
  - Collaborator: Prof. Meng Wang at University of Notre Dame
  - Sponsor: ONR
2. *06/2023-Present* Cost Reduction for Electrochemical machining (ECM) through Hybrid Machine Learning Simulation
    - Role: Lead researcher, developing a hybrid ML–physics framework, and drafting follow-on funding proposals; this work has improved ECM process simulation efficiency and advanced applications in manufacturing
    - PI: Prof. Jian-Xun Wang
    - Collaborator: Voxel Innovations
    - Sponsor: ONR
  3. *03/2025-Present* Efficient Bio-inspired Soft Robotics in Aquatic Environments
    - Role: Lead researcher, focusing on shape design and hydrodynamics optimization of simple robots using differentiable physics, laying the groundwork for energy-efficient soft robotic locomotion
    - Collaborator: Prof. Jian-Xun Wang; Prof. Yasemin Ozkan-Aydin at University of Notre Dame
  4. *03/2025-Present* Flow Perception and Control of Flapping Wings
    - Role: Lead researcher, developing a computational framework for inverse flow perception, enabling new approaches to sensing and control
    - Collaborator: Prof. Jian-Xun Wang; Prof. Qiang Zhong at Iowa State University
  5. *01/2020-12/2023* Study on the Flow-induced Vibration and Control Mechanism of Parallel Cylinders based on Turbulent Coherent Structure
    - Role: Lead researcher, responsible for proposal preparation, design and execution of wind tunnel experiments, and development of validated models that advanced understanding of structural resilience in high Reynolds number flows
    - PI: Prof. Wei Tan at Tianjin University
    - Sponsor: NSFC
  6. *01/2021-06/2021* Stress Analysis of Bundled Structures in Large-scale Chemical Steel Stacks
    - Role: Lead researcher, performed finite element simulations to evaluate structural stresses under pressure, wind, and seismic loads; assessed safety margins and delivered the final technical report
    - PI: Prof. Wei Tan at Tianjin University
  7. *01/2019-12/2020* Experimental Study and Analysis Software Development on Flow-induced Vibration Mechanism and Fretting Wear of Intermediate Heat Exchangers for Nuclear Equipment
    - Role: Lead researcher for mid-scale flow-induced vibration experiments, clarifying vibration mechanisms in nuclear intermediate heat exchangers and informing safer design practices; contributing researcher on structural dynamics modules, assisting in the development of analysis software
    - PI: Prof. Wei Tan at Tianjin University
  8. *01/2019-12/2021* Risk Analysis of Flow-induced Vibration in Coal Gasification Process Units

- Role: Contributing researcher, prepared the proposal, conducted numerical simulations to characterize vibration features, and validated suppression strategies to improve safety and reliability of coal gasification units
  - PI: Prof. Wei Tan at Tianjin University
  - Sponsor: National Key Research and Development Program of China
9. *01/2016-12/2018* Research on Wind-induced Vibration Suppression Design and Industrial Application Technology of Large Chemical Tower
- Role: Lead researcher, carrying out small-scale laboratory experiments and large-scale field tests that led to practical vibration suppression strategies adopted in industry
  - PI: Prof. Wei Tan at Tianjin University

## HONORS & AWARDS

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- *2022* 17th USNCCM (U. S. National Congress on Computational Mechanics) Travel Award
- *2022 & 2023* ND Energy/ECI/CCI Postdoctoral Fellowship
- *2021* National Scholarship for Postgraduates by Ministry of Education of China
- *2019* Rudy Scavuzzo Student Paper Symposium Award (Ph. D Group) by ASME
- *2018* 93-Yinghua Scholarship by Tianjin University
- *2016* Tianjin Municipal People's Government Scholarship by Tianjin Government

## TEACHING & MENTORING EXPERIENCE

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### Cornell University, Sibley School of Mechanical and Aerospace Engineering

- Undergraduate student research mentor *06/2025 - Present*  
– *Differentiable geometry representation*
- Undergraduate student research mentor *06/2025 - Present*  
– *Neural operator-IBM framework for linear system with irregular boundaries*

### University of Notre Dame, Department of Aerospace and Mechanical Engineering

- Guest lecture: Introduction of CFD (Undergraduate course) *2024 Fall*
- Ph.D. Student Mentor *01/2025 - Present*
- Undergraduate student research mentor (iSURE Program) *06/2024 - 08/2024*
- Undergraduate student research mentor (iSURE Program) *06/2023 - 08/2023*

### Tianjin University, Department of Mechanical Engineering

- Master student research mentor *09/2019 - 01/2022*
- Fluid-induced Vibration in Pressure Vessels (TA) *08/2020 - 01/2020*

## PROFESSIONAL SERVICE ACTIVITIES

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### Reviewer

- Journal of Computational Physics, Ocean Engineering, International Journal of Mechanical Sciences, Physics of Fluids, Scientific Reports, Journal of Engineering and Applied Science, Engineering with Computers, Energy, Mechanical Systems and Signal Processing

### Member

- American Physics Society (APS), American Geophysical Union (AGU), Society for Industrial and Applied Mathematics (SIAM), U.S. Association for Computational Mechanics (USACM)