Xin-Yang Liu

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EDUCATION

- **University of Notre Dame**   Notre Dame, IN, USA
  Ph.D. candidate - Computational Physics, Mechanical Engineering   *Jan 2020 - Present*

  - **Advisor**: Professor Wang, Jian-Xun

  - **Research interests**: Scientific Machine Learning, Dynamic Control, Computational Physics

- **Xi'an Jiaotong University**   Xi'an, Shannxi, China
  Bachelor of science - Energy & Power Engineering   *Aug 2015 - June 2019*

PUBLICATIONS — *Peer-reviewed paper*

- **Liu, X.Y.**, Zhu, M., Lu, L., Sun, H. and Wang, J.X., 2024. Multi-resolution partial differential equations preserved learning framework for spatiotemporal dynamics. *Communications Physics, 7*(1), p.31.

- **Liu, X.Y.**, Bodaghi, D., Xue, Q., Zheng, X. and Wang, J.X., 2024. Asynchronous parallel reinforcement learning for optimizing propulsive performance in fin ray control. *Engineering with Computers*, pp.1-18.

- **Liu, X.Y.** and Wang, J.X., 2021. Physics-informed Dyna-style model-based deep reinforcement learning for dynamic control. *Proceedings of the Royal Society A, 477*(2255), p.20210618.

- Movahhedi, M.*, **Liu, X.Y.***, Geng, B., Elemans, C., Xue, Q., Wang, J.X. and Zheng, X., 2023. Predicting 3D soft tissue dynamics from 2D imaging using physics informed neural networks. *Communications Biology*, 6(1), p.541.   *Equal Contribution

- Du, P., Parikh, M.H., Fan, X., **Liu, X.Y.** and Wang, J.X., 2024. Conditional neural field latent diffusion model for generating spatiotemporal turbulence. Conditional neural field latent diffusion model for generating spatiotemporal turbulence. *Nature Communications, 15*(1), pp.1-22.

- Wang, Q. , Ren, P., Zhou, H., **Liu, X.Y.**, Liu, Y., Deng, Z., Zhang Y., Chengze, R., Liu, H., Wang, Z., Wang, J.X., Wen, J.R., Sun, H., 2024. P^2C^2Net: PDE-Preserved Coarse Correction Network for efficient prediction of spatiotemporal dynamics. *Advances in Neural Information Processing Systems 38*

PREPRINTS UNDER REVIEW

- **Liu, X. Y.***, Parikh, M.H.*, Fan, X., Du, P., Wang, Q., Chen, Y.F. and Wang, J.X., 2024. CoNFiLD-inlet: Synthetic Turbulence Inflow Using Generative Latent Diffusion Models with Neural Fields. *arXiv preprint arXiv:2411.14378.*   *Equal Contribution

PREPRINTS IN PREPARATION

- **Liu, X.Y.**, Fan, X., and Wang, J.X., 2025. MuRFiV: A Multi-Resolution Finite-Volume Inspired Deep Learning Framework for Predicting Spatiotemporal Dynamics   Presented at Crunch seminar

- Fan, X., **Liu, X.Y.**, Wang, M., and Wang, J.X., 2025. Diff-FlowFSI: A JAX-Based Differentiable Solver for Turbulent Flow and Fluid-Structure Interactions

PROJECTS IN PROGRESS

- **Liu, X.Y.**, Wang, J.X., 2025. Flow Rate Calibrated Synthetic Turbulence Inlet for Improving Pressure Field.

- Akhare, D., **Liu, X.Y.**, Sun, L., Wang, J.X., 2025   Flexible Offline Reinforcement Learning for Varying Sensor Distribution.

- Parikh, D., **Liu, X.Y.**, Wang, J.X., 2025   Strategies for Alleviating Memorization in Training Diffusion Models for Spatiotemporal Dynamics Generation

CONFERENCE PRESENTATIONS

- **Liu, X.Y.**, Fan, X., Wang, M. and Wang, J.X. Diff-FlowFSI: A GPU-accelerated, JAX-based Differentiable CFD Solver for Turbulent Flow and Fluid-Structure Interactions
  American Physical Society Division of Fluid Dynamics (APS DFD), Nov. 2024

- **Liu, X.Y.**, Fan, X., Wang, J.X. Integrating PDE Operators into Neural Network Architecture in A Multi-Resolution Manner for Spatiotemporal Prediction
  USACM Thematic Conference on Uncertainty Quantification for Machine Learning Integrated Physics Modeling (UQ-MLIP), Aug. 2024

- **Liu, X.Y.**, Fan, X., Wang, J.X. MuRFiV-Net: A Multi-Resolution Finite-Volume Inspired Neural Network for Predicting Spatiotemporal Dynamics   APS DFD, Nov. 2023

- **Liu, X.Y.**, Wang, J.X. Multi-Resolution and Finite-Volume Method inspired Neural Network (MuRFiV-Net) for PDE prediction
  International Congress on Industrial and Applied Mathematics (ICIAM), Aug. 2023

- **Liu, X.Y.**, Wang, J.X. Predicting parametric spatiotemporal dynamics by multi-resolution pde structure-preserved deep learning   APS DFD, Nov. 2022

- **Liu, X.Y.**, Sun, H., Wang, J.X. Predicting parametric spatiotemporal dynamics by multi-resolution PDE structure-preserved deep learning   Society of Engineering and Science, Oct. 2022

- **Liu, X.Y.**, Bodaghi, D., Zheng, X., Xue, Q., Wang, J.X. Off-Policy Reinforcement Learning for Finsh-Fin-Ray Control Trained in an Asynchronous Parallel Manner   UQ-MLIP, Aug. 2022

- **Liu, X.Y.**, Bodaghi, D., Zheng, X., Xue, Q., Wang, J.X. Accelerating deep reinforcement learning with physics-informed models and asynchronous parallel training
  Society for Industrial and Applied Mathematics Uncertainty Quantification (SIAM UQ), Apr. 2022

- **Liu, X.Y.**, Bodaghi, D., Zheng, X., Xue, Q., Wang, J.X. Deep reinforcement learning for fish fin ray control   APS DFD, December 2021

- **Liu, X.Y.**, Wang, J.X. Physics-informed Dyna-Style Model-Based Deep Reinforcement Learning for Dynamic Control.   SIAM Annual Meeting, Jul. 2021

HONORS AND AWARDS

- USACM Thematic Conference on Uncertainty Quantification for Machine Learning Integrated Physics Modeling (UQ-MLIP) Travel Award   Aug., 2024

- Society of Engineering Science Annual Technical Meeting (SES2022) funding support   Oct., 2022

- USACM Thematic Conference on Uncertainty Quantification for Machine Learning Integrated Physics Modeling (UQ-MLIP) Travel Award   Aug., 2022

- 16th U.S. National Congress on Computational Mechanics Conference Award   May., 2021

SKILLS

- **Coding**: Python (Pytorch, Jax), Julia, Matlab, C++, CUDA