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.** 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
- 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.**, Bodaghi, D., Xue, Q., Zheng, X. and Wang, J.X., 2024. Asynchronous Parallel Reinforcement Learning for Optimizing Propulsive Performance in Fin Ray Control. arXiv preprint arXiv:2401.11349. Submitted to *Engineering with Computers*
- Du, P., Parikh, M.H., Fan, X., **Liu, X.Y.** and Wang, J.X., 2024. CoNFiLD: Conditional Neural Field Latent Diffusion Model Generating Spatiotemporal Turbulence. arXiv preprint arXiv:2403.05940. Submitted to *Nature Communication*

Preprints in Preparation

- **Liu, X.Y.***, Parikh, M.H.*, Fan, X., Du, P., Wang, Q., Chen, Y.F., Wang, J.X., 2024. CoNFiLD-inlet: Synthetic Inflow Turbulence Generation Based on Conditional Neural Field Encoded Latent Diffusion Model *Equal Contribution
- **Liu, X.Y.**, Fan, X., Wang, J.X., 2024. 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., Wang, J.X., 2024. Diff-FlowFSI: A JAX-Based Differentiable Solver for Turbulent Flow and Fluid-Structure Interactions

Projects in Progress

- **Liu, X.Y.**, Parikh, M.H., Fan, X., Wang, J.X., 2025. Denosing Diffusion in Fourier Space as Divergence-Free Turbulence Inlet Generator
- 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, 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
  American Physical Society Division of Fluid 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
- 16^{th} U.S. National Congress on Computational Mechanics Conference Award May., 2021

Skills

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