



Qiang Liu

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🌐 <https://github.com/qiauil>

🎓 EDUCATION

- **Technical University of Munich, Germany** *Ph.D. candidate in Computer Science*
AI for PDEs/Science; Generative Modeling for Physics; Foundation Models for PDEs; 2022-present
Fine-tuning; Multi-task Optimization; Differentiable Simulations; PINNs
- **Harbin Institute of Technology, China** *Master of Power Engineering and Engineering Thermophysics*
Multi-physics Solver Development; OpenFOAM Coding; Electrohydrodynamics 2020-2022
- **Harbin Institute of Technology, China** *Bachelor of Energy and Power Engineering*
Fluid Dynamics; Heat Transfer; Thermodynamics; Computational Fluid Dynamics 2016-2020

📖 DOCTORAL PROJECTS

- **Generative Models for Physics**
*Investigated modern generative models (e.g., **diffusion models** and **flow matching**) for learning complex physical distributions. Developed **ConFIG**, a general multi-task optimization framework for incorporating physical constraints into generative models, and applied it to physics-informed diffusion and flow-matching methods for constrained generation and super-resolution. Resulted in **4 conference/journal publications** (including **2 first-author papers**) and 2 masters theses.*
- **Foundation Models for PDEs**
*Developed **PDE Transformer**, a novel neural architecture for complex PDE dynamics, and built a foundation model for large-scale 3D PDE systems. Proposed an online training framework that streams data directly from simulations, addressing storage and I/O bottlenecks in large-scale training. The model was pre-trained on **hundreds of terabytes of simulation data** and supports downstream tasks including autoencoding, dynamics prediction, and generative modeling. Resulted in **one first-author paper (under review)** and **one second-author paper**.*
- **Differentiable Simulations with PyTorch**
*Designed **TorchFSM** (<https://qiauil.github.io/torchfsm/>), an **open-source, GPU-accelerated, fully differentiable PDE solver** based on the Fourier Spectral Method. The framework provides modular, composable operators (e.g., gradients, divergence, convection) within a PyTorch backend, enabling rapid development of custom high-fidelity solvers. TorchFSM supports batched simulations and efficient **3D** execution, and seamlessly integrates with machine learning workflows for inverse problems and physics-informed neural operators.*

📄 ACADEMIC ACHIEVEMENTS

- **Selected Conference and Journal Papers:**
13 articles in total; 5 first author articles; Google Scholar h-index: 8; Full list: <https://qiauil.github.io/publications/>
 - **Q. Liu**, M. Chu, N. Thuerey. "ConFIG: Towards Conflict-free Training of Physics Informed Neural Networks," in International Conference on Learning Representations, 2025. **(Spotlight)**
 - **Q. Liu**, N. Thuerey. "Uncertainty-aware Surrogate Models for Airfoil Flow Simulations with Denoising Diffusion Probabilistic Models," in AIAA Journal, vol. 62, pp. 2192-2933, 2024.
 - B. Holzschuh, **Q. Liu**, G. Kohl, N. Thuerey. "PDE-Transformer: Efficient and Versatile Transformers for Physics Simulations," in International Conference on Machine Learning, 2025.
- **Book:** N. Thuerey, B. Holzschuh, P. Holl, G. Kohl, M. Lino, **Q. Liu**, P. Schnell, F. Trost. "Physics-based Deep Learning," Chapter 5: Probabilistic Learning, <https://physicsbaseddeeplearning.org/>.

🏆 HONORS

- **Outstanding Master's Thesis** *Harbin Institute of Technology* 2022
- **National Scholarship** *Ministry of Education of the P.R.China* 2021
- **Outstanding Graduate** *Harbin Institute of Technology* 2020
- **Outstanding Young Scientist Papers at NCFM** *Chinese Society of Fluid Mechanics* 2020
- **National Scholarship** *Ministry of Education of the P.R.China* 2018
- **Provincial-Level Merit Student** *Department of Education, Heilongjiang Province* 2018