Zhen ZHANG

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Work Experience

Postdoctoral Research Associate, Brown University **07/2024–Now**

Crunch group, Division of Applied Mathematics
Research topic: Scientific machine learning, data-driven turbulence modeling, PDE-constrained inverse problems
Supervisor: George Em Karniadakis

Postdoctoral Research Associate, Tsinghua University **07/2022–07/2024**

Gas Turbine Institute, Department of Energy and Power Engineering
Research topic: Fluid dynamics, thermal dynamics, data-driven turbulence modeling
Supervisor: Xin Yuan

Education

Ph.D., Tsinghua University, Beijing, China **09/2017–06/2022**

Department: Energy and Power Engineering
Dissertation: *Data-Driven Prediction of Film Cooling in Gas Turbines*
Supervisor: Xin Yuan, Ph.D.

B.S., Tsinghua University, Beijing, China **09/2013–06/2017**

Department: Thermal Engineering

Research Interest

1. Scientific machine learning
2. Data-driven turbulence modeling
3. PDE-constrained inverse problems

Publications

Journal Articles & Preprints

1. **Zhang, Z.**, Alla, A., & Karniadakis, G. E. (2026). Adjoint Method versus Physics-Informed Neural Networks in PDE-Constrained Inverse Problems. *Computer Methods in Applied Mechanics and Engineering*, 464, 119472.
2. **Zhang, Z.**, Shukla, K., Wang, Z., Morales, A., Käufer, T., Salauddin, S., Walters, N., et al. (2026). Turbulence closure in Reynolds-averaged Navier–Stokes and flow inference around a cylinder using physics-informed neural networks and sparse experimental data. *Journal of Fluid Mechanics*, 1034, A16.
3. **Zhang, Z.**, & Karniadakis, G. E. (2026). Effect of Turbulence-Closure Consistency on Airfoil Identification. *Computers & Fluids*, 315, 107155.
4. **Zhang, Z.**, & Karniadakis, G. E. (2026). Well-posedness of Neural Turbulence Closures and Tangent Dissipation. *arXiv preprint* arXiv:2609.19647.

5. **Zhang, Z.**, Käufer, T., Ronglan, L., Triantafyllou, M. S., & Karniadakis, G. E. (2026). Generalizable Turbulence Closures across Bluff-Body Shapes by PINN-Based Solver-Agnostic Training. *arXiv preprint* arXiv:2607.04491.
6. **Zhang, Z.**, Liu, S., Alla, A., Darbon, J., & Karniadakis, G. E. (2026). PINNs in PDE-constrained optimal control problems: Direct vs. indirect methods. *arXiv preprint* arXiv:2604.04920.
7. **Zhang, Z.**, Su, X., & Yuan, X. (2025). Physics-informed neural networks with coordinate transformation to solve high Reynolds number boundary layer flows. *Journal of Computational Physics*, 114338.
8. Hu, K., Yang, Y., **Zhang, Z.**, Su, X., & Yuan, X. (2025). Cooling performance measurement and layout optimization of full-coverage turbine vane considering the inlet swirl. *International Communications in Heat and Mass Transfer*, 162, 108623.
9. Oommen, V., Bora, A., **Zhang, Z.**, & Karniadakis, G. E. (2025). Integrating neural operators with diffusion models improves spectral representation in turbulence modelling. *Proceedings of the Royal Society A*, 481(2309), 20240819.
10. **Zhang, Z.**, Hu, T., Su, X., & Yuan, X. (2023). Optimization of the Double-Expansion Film-Cooling Hole Using CFD. *Entropy*, 25(3), 410.
11. **Zhang, Z.**, Mao, Y., Su, X., & Yuan, X. (2022). Inversion Learning of Turbulent Thermal Diffusion for Film Cooling. *Physics of Fluids*, 34(3), 035118.
12. **Zhang, Z.**, Mao, Y., Su, X., & Yuan, X. (2022). Adjoint-Based Boundary Condition Sensitivity Analysis. *AIAA Journal*, 60(6), 3517–3527.
13. **Zhang, Z.**, Li, H., Su, X., & Yuan, X. (2021). In-Hole Characteristic Interface and Film Cooling Interface Model. *Journal of Turbomachinery*, 143(10), 101012.
14. **Zhang, Z.**, Ma, C., Su, X., & Yuan, X. (2020). Accuracy and Efficiency Assessment of Harmonic Balance Method for Unsteady Flow in Multi-Stage Turbomachinery. *Journal of Thermal Science*, 29(6), 1569–1580.
15. Chen, Z., **Zhang, Z.**, Li, Y., Su, X., & Yuan, X. (2019). Vortex-dynamics-based analysis of internal crossflow effect on film cooling performance. *International Journal of Heat and Mass Transfer*, 145, 118757.

Conference Proceedings & Presentations

16. **Zhang, Z.**, Khodakarami, S., Shukla, K., Wang, Z., Ahmad, K., Morales, A., et al. (2025). Flow Inference and Turbulence Closure of Flow Past a Cylinder using PINNs and Data-Driven RANS Equations. *78th Annual Meeting of the APS Division of Fluid Dynamics*.
17. **Zhang, Z.**, Hu, K., Su, X., & Yuan, X. (2024, June). Data-Driven Turbulence Modeling for Film Cooling Heat Transport, Part I: Turbulent Heat Transport Property at Wide Flow Conditions. In *Turbo Expo: Power for Land, Sea, and Air*, V007T12A023. ASME.
18. **Zhang, Z.**, Zhang, W., Su, X., & Yuan, X. (2024, June). Data-Driven Turbulence Modeling for Film Cooling Heat Transport, Part II: Modeling and Evaluation. In *Turbo Expo: Power for Land, Sea, and Air*, V007T12A026. ASME.
19. **Zhang, Z.**, Chen, Z., Su, X., & Yuan, X. (2020). Non-Uniform Source Term Model for Film Cooling with the Internal Cross Flow. In *Turbo Expo: Power for Land, Sea, and Air*, V07BT12A014. ASME.