CHRIS ZIYI YAO

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EDUCATION

Imperial College London Oct 2020 – Jun 2026 (Medical leave: Feb 2025 – Sept 2025)

MEng Aeronautical Engineering (First-Class Honours predicted)

- Core Modules: High-Performance Computing, Computing and Numerical Methods, Fundamentals of Scientific Machine Learning, Computational Fluid Dynamics, Aerodynamics, Fluid-Structure Interaction, Control Systems, Optimisation
- Electives: Introduction to Philosophy, Philosophy of Mind

RESEARCH EXPERIENCE

Undergraduate Researcher - HPC Oct 2023 – Present

Imperial College London, *Department of Aeronautics – Supervisor: Dr Chris Cantwell*

- Conducting MEng thesis project "*In-Memory Checkpointing to Achieve Performant Resilience of Time-Dependent Solvers.*"
- Tackling the lack of fault tolerance in large-scale time-dependent solvers – where node failures can cause complete computation loss – and mitigating I/O bottlenecks from expensive disk-based checkpointing on parallel filesystems at exascale.
- Developing a minimally intrusive in-memory checkpointing library in C with Open MPI's User-level Fault Mitigation (ULFM) to provide lightweight resilience and reduce disk I/O overheads.
- Implementing spare-process recovery that reconstructs distributed data structures from previous MPI communications, enabling restarts without full reruns.
- Integrating and benchmarking the library with the Nektar++ CFD framework (https://www.nektar.info) to quantify runtime overhead and scalability.

Undergraduate Research Intern - Scientific Machine Learning Jul 2023 – Sep 2023

Brown University, *Division of Applied Mathematics – Supervisor: Prof George Karniadakis*

- Investigated the spectral-bias limitation of conventional Physics-Informed Neural Networks (PINNs), which struggle to capture steep boundary layers in small-parameter PDEs ($\varepsilon \ll 1$).
- Co-developed and implemented Two-Scale Neural Networks that embedded ε directly into the network architecture to resolve multiscale features without using Fourier features or auxiliary equations.
- Validated the model on 1-D test cases down to $\varepsilon = 10^{-5}$; co-authored *"Two-Scale Neural Networks for PDEs with Small Parameters," Commun. Comput. Phys.*, 38(3), 2025 (doi:10.4208/cicp.OA-2024-0040).
- Analysed information flow during training using Information-Bottleneck metrics, quantifying signal-to-noise ratios in adaptive-weight and attention mechanisms to study feature compression and generalisation.
- Participated in Brown's Summer Bridge Program, attending graduate-level tutorials in Real Analysis alongside incoming Applied Maths PhD students.

Undergraduate Researcher - High-Order CFD Jun 2022 – Oct 2022

Imperial College London, *Department of Aeronautics – Supervisor: Prof Spencer Sherwin*

- Awarded Undergraduate Research Opportunities Program (UROP) bursary to work on high-order spectral/hp methods in Computational Fluid Dynamics.

- Contributed to development and testing of a linearised compressible flow solver in Nektar++, aiming to reduce the computational burden of nonlinear residual calculations and improve the stability of the algorithm.
- Optimised mesh partitioning approach for 1D vasculature Pulse Wave Solver to improve parallel scalability.

Research Assistant Aug 2021 – Sep 2021

Tsinghua Shenzhen International Graduate School, *Institute for Ocean Engineering*

- Completed a 5-week summer research placement on Electrical Capacitance Tomography (ECT) for multiphase flow diagnostics.
- Applied deep learning models to predict and reconstruct conductivity fields in two-phase flows using experimental phantom data, developing and testing ResNet- and U-Net-based architectures for image reconstruction and conductivity prediction.

ADDITIONAL EXPERIENCE

Teaching Assistant Oct 2023 – Jan 2024

Imperial College London

- Assisted in tutorial and computing sessions for first- and second-year Computing and Numerical Methods courses.
- Supported students by debugging code and answering conceptual questions on numerical methods for solving ODEs and PDEs in Python, MATLAB, and C++.

Year 3/4 Academic Representative Oct 2022 – Jan 2024

Department of Aeronautics, Imperial College London

- Elected by peers to represent student feedback at departmental Student-Staff Committee meetings.
- Coordinated academic and social events within the department.

Aeronautics UG Admissions Test Setter Jul 2021 –Aug 2021

Department of Aeronautics, Imperial College London

- Collaborated in a team of three to design and pilot the *Aeronautics Mathematics Aptitude Test* (AMAT) for undergraduate admissions

Aeronautics Student Code of Conduct Committee Jul 2021

Department of Aeronautics, Imperial College London

- Contributed to a Departmental Equality, Diversity, and Inclusivity (EDI) project.
- Created resources to raise awareness of microaggressions and unconscious bias among students.

TECHNICAL SKILLS

- Programming Languages: C/C++, Python, MATLAB, Fortran, Java, CUDA C/C++
- Parallel Libraries: MPI, OpenMP, BLAS, LAPACK
- Machine Learning: PyTorch, Tensorflow
- Tools & Environments: Unix/Linux, Git, LaTeX

INTERESTS

2nd Violin - Imperial College String Ensemble Oct 2022 - Present

Swimming - Imperial College Swimming and Water Polo Club Oct 2025 - Present

Tennis & Former ATP World Tour Ball Boy (2017 - 2019)