Chenghao DONG

Email: kell7125@ox.ac.uk | Tel: (+44) 7523119099 | GitHub: https://github.com/abaaba337
LinkedIn: https://www.linkedin.com/in/chenghao-dong-9115632a0/

EDUCATION

Mathematical Institute, University of Oxford **Oxford, UK**
DPhil in Mathematics (Numerical Analysis) **10/2025 – 04/2030**

- **Funding: China Scholarship Council – University of Oxford Scholarship**
- **Research Interests:** Numerical Analysis, Optimisation with Inequality Constraints (VIs), Finite Element Methods, DL in Scientific Computing, **etc.**

Mathematical Institute, University of Oxford **Oxford, UK**
*MSc in Mathematical Modelling and Scientific Computing (**Distinction**)* **10/2023 – 09/2024**

- **Thesis:** Least-Squares Finite Element Methods via Randomized Linear Algebra
- **Courses:** Numerical Linear Algebra, Continuous Optimization, Numerical Solution of PDEs, Finite Element Method for PDEs, Applied PDEs, Further PDEs, Nonlinear Dynamics, **etc.**

School of Physical Sciences, University of Liverpool **Liverpool, UK**
*BSc with Honours in Mathematics (**First-Class**)* **09/2021 – 07/2023**
School of Mathematics and Physics, Xi'an Jiaotong-Liverpool University **Suzhou, China**
*BSc in Applied Mathematics (**First-Class**)* **09/2019 – 06/2021**

- **GPA: 91/100 (Top 1%) | Frank Stanton Carey Prize & University Academic Excellence Award**
- **Courses:** Real Analysis, Complex Analysis, Measure Theory, Advanced Linear Algebra, Abstract Algebra, Methods of Applied Mathematics, Dynamic Systems, Statistics and Probabilities, Stochastic Processes, Numerical Methods, **etc.**

SCHOLARSHIP & AWARDS

- Brown University ICERM Workshop on Simulation-Based Optimisation with Applications Travel Grant **04/2026**
- China Scholarship Council – University of Oxford Scholarship (20 places in Oxford) **06/2025**
- Frank Stanton Carey Prize in Mathematics (20 places) **07/2023**
- 2+2 Scholarship in the University of Liverpool (50 places) **07/2021**
- Second prize in the East China Cup Invitational Mathematical Modelling Competition (top 3%) **06/2021**
- Finalist in the Interdisciplinary Contest for Modelling (top 2%) **04/2021**
- First prize in the Asia and Pacific Mathematical Contest in Modelling (top 5%) **12/2020**
- University Academic Excellence Award in XJTLU (top 5%) **07/2020**

PUBLICATION

Chenghao Dong*. "Solving Differential Equations with Physics-Informed Neural Networks". In: 4th International Conference on Computing Innovation and Applied Physics (CONF-CIAP 2025). Vol. 87. EWA Publishing: Theoretical and Natural Science, Jan. 15, 2025, pp. 137-146. doi: 10.54254/2753-8818/2025.20346.

RESEARCH EXPERIENCE

Latent Variable Proximal Point Algorithms with Adaptive Pointwise Regularizers | DPhil Research **Oxford, UK**
Supervisor: Prof. Patrick Farrell, Mathematical Institute, University of Oxford, UK **02/2026 – Present**

- Investigated adaptive choices of Bregman–Legendre kernels in the Bregman proximal point (BPP) algorithm for convex optimisation with inequality constraints to improve method convergence.
- Designed an ideal adaptive algorithm employing cubic-exponential Legendre kernels on strictly active components and quadratic regularisers on inactive/biactive components; implemented the scheme for the discretised obstacle problem via CG_1 finite elements.
- Improved the sublinear convergence of the original BPP method to global R-linear convergence and local Q-superlinear convergence. The manuscript is in preparation for submission to a SIAM journal.

Multiple Solutions for Variational Inequalities via LVPP with Deflation | DPhil Research **Oxford, UK**
Supervisor: Prof. Patrick Farrell, Mathematical Institute, University of Oxford, UK **10/2025 – Present**

- Studied the computation of multiple solutions to nonlinear variational inequalities (optimisation with inequality constraints).
- Introduced a Voronoi–Bregman distance to modify the latent variable proximal point (LVPP) framework and incorporate the deflation operator to guide multiple solution exploration in the space. Extensive numerical simulations were carried out using Firedrake to validate the proposed approach.
- This work fills the gap in the LVPP framework for computing multiple solutions, making feasible the mesh-independent computation of multiple solutions for large-scale variational inequalities. The manuscript is currently in preparation for publication.

Least-Squares Finite Element Methods via Randomized Linear Algebra | **MMSC Thesis** **Oxford, UK**
Supervisor: Prof. Yuji Nakatsukasa, Mathematical Institute, University of Oxford, UK **04/2024 – 09/2024**
& Dr. Carolina Urzúa-Torres, Delft Institute of Applied Mathematics, Netherlands

- Applied sketching, i.e., subspace embeddings, to solve over-determined algebraic systems derived from the oversampling least-squares finite element collocation method (LSFECM) and performed relevant convergence and error analyses.
- Built a MATLAB toolkit for the "oversampling LSFECM + sketching" framework to solve 1D/2D first-order linear BVPs and evaluated the effect of 12 sketches on LSFECMs in both 1D and 2D scenarios.
- Proved sufficient condition for oversampling LSFECMs to achieve quasi-optimal convergence for certain first-order linear BVPs and provided a rule of thumb to estimate method parameters in a more general case; discussed the possible impact sketching may have on the overall convergence rate via two example problems.

Buffer Size and Quality of Service | **Case Study** **Oxford, UK**
Supervisor: Dr. David Allwright, Mathematical Institute, University of Oxford, UK **01/2024 – 04/2024**

- Constructed a model to study the quality of service for various data transmission tasks; fully solved the model analytically for the system involving a single server, where redundant jobs were either partially or fully rejected; proposed a model based on neural networks to study the service quality of systems involving multiple servers.
- Found the steady-state solution for the model of systems with a single server via Laplace transform and the fixed-point iteration; proposed five quality-of-service measures to quantify the behavior of the assigned system settings; trained four grid-based neural networks to predict the service quality for multiple-server-models.
- Built a Python package for model solving and simulation with other team members; the analytical model and quality of service measures accurately predicted the simulation result with an error around O(1e-2); presented the result within the class and summarized the project in a group report.

CMIT Deep Learning for Mathematical Imaging | **Research Intern** **Liverpool, UK**
Supervisor: Dr. Andreas Alpers, University of Liverpool, UK **06/2023 – 09/2023**

- Participated as a research intern in Centre for Mathematical Imaging Techniques (CMIT), focusing on solving np-hard polynomial-based problems raised in discrete tomography via advanced machine learning and deep learning techniques.
- Studied the smallest number of switching components under fixed directions for its application in discrete tomography; applied heuristic methods including Simulated Annealing (SA) and Discrete Particle Swan Optimization (DPSO) to solve the problem; designed a Reinforcement Learning environment for the problem and applied DQN & CEM to solve the model.

TEACHING EXPERIENCE

Further Mathematical Methods | Teaching Assistant **Oxford, UK**
Tutor: Dr. Kathryn Gillow, Mathematical Institute, University of Oxford, UK **02/2026 – 04/2026**

- Assisted the tutor in weekly tutorial sessions for the MSc Mathematical Modelling and Scientific Computing course, focusing on partial differential equations, calculus of variations, and optimal control.
- Marked weekly problem sheets and provided feedback on students' mathematical reasoning, solution structure, and technical accuracy to support tutorial preparation.
- Identified common difficulties from submitted coursework and discussed them with the tutor.

Prelims in Computational Mathematics | Demonstrator **Oxford, UK**
Course Lecturer: Prof. Patrick Farrell, Mathematical Institute, University of Oxford, UK **10/2025 – Present**

- Led weekly two-hour demonstration sessions for undergraduates, **including Corpus Christi students**, on Python for computational mathematics, combining course review, code demonstrations, and Q&A on assignments and coursework.
- Marked weekly coding problem sheets and provided feedback on programming style and numerical implementation.

Private Mathematics Tutor and Postgraduate Application Adviser **Remote, China**
Remote Part-time Position **12/2024 – Present**

- Tutored undergraduate mathematics courses, including Linear Algebra at the University of Hong Kong and Mathematical Analysis and Linear Algebra at Xi'an Jiaotong-Liverpool University.
- Provided one-to-one academic planning for mathematics students applying to postgraduate programmes, supporting successful applications to funded PhD programmes at Nanyang Technological University, University College London, University of Warwick, University of Manchester, and master's programme at Cambridge.
- Mainly advised students on research preparation, programme selection, application materials, and mathematical study plans tailored to their future academic goals.

SKILLS & INTERESTS

Languages: Mandarin | English | Japanese
Computer: Python | Firedrake | PyTorch | Hugging Face Transformers | Git | MATLAB | R | Maple | Java | LaTex
Certificates: PRC MIIT Certificate in Mathematical Modelling | TOEFL iBT (total 110/120) | GRE General (total 328/346)
Interests: Tennis | Video Clips (PR) | Agent Mini Program Development.