CURRICULUM VITAE
Dr Yidan Xue

Contact details

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Research Interests

Applied Mathematics: mathematical modelling, fluid mechanics, numerical analysis, mathematical biology

Biomedical Engineering: brain modelling, oxygen transport, microcirculation, biomechanics, tissue engineering, epidemic modelling

Employment

- (2024.01-date) Postdoctoral Research Associate, School of Mathematics, **Cardiff University**. Supervisors: Drs Thomas Woolley and Katerina Kaouri.

  Developing an agent-based model for indoor epidemic simulations to inform governments and stakeholders for better architecture designs, in collaboration with Professor Wassim Jabi.

- (2022.10-2023.12) EPSRC Postdoctoral Research Associate, Mathematical Institute, **University of Oxford**. Supervisor: Professor Sarah Waters.

  The LARS algorithm for computing 2D Stokes flow problems using rational approximation with Professor Nick Trefethen; Microparticle transport in micro-vessel bifurcations and investigate the effects of geometry and boundary conditions on flow and microparticle partition with Professors Stephen Payne, Alfonso Castrejon-Pita and Justin Sirignano.

- (2023.01-2023.09) Retained Lecturer in Mathematics, Jesus College, **University of Oxford**.

- (2018.07-2018.09) Research Intern, State Key Laboratory of High Temperature Gas Dynamics, **Chinese Academy of Sciences**. LES simulation of H_2-O_2 gaseous supercritical combustion. Supervisors: Professor Xuejun Fan and Dr Wei Yao.

- (2018.05-2018.07) Research Intern, School of Engineering, **The University of Edinburgh**. RANS simulation of split fuel injection inside internal combustion engines. Supervisor: Dr Dong-hyuk Shin.

Education

- (2019-2022) DPhil Engineering Science (Biomedical), **University of Oxford**. Thesis: Modelling oxygen transport and tissue damage in the human brain. Supervisor: Professor Stephen Payne.

  During my DPhil, I developed mathematical models of oxygen transport and tissue damage at multiple scales in the human brain. Through collaborations with biologists and clinicians (as part of the EU-funded INSIST project), the models have been validated against animal experiments and implemented in an *in silico* clinical trial for treatment of ischaemic stroke.

- (2017-2019) BEng (Hons) Mechanical Engineering, 1st class honours, **The University of Edinburgh**. Dissertation: Computational simulation and validation of flows in branching blood vessels. Supervisors: Drs Dong-hyuk Shin and Rudolf Hellmuth.

- (2015-2017) Two years of undergraduate study (credits transferred to Edinburgh), Propulsion Engineering, **Xiamen University**.

Teaching

- (2023-2024) Tutor, A1 Differential Equations 1, Oriel College, **University of Oxford**.

  Tutoring 2nd Year Undergraduates in small groups (class size: 1-2). 8 contact hours (1 contact hour usually requires 2 hours of preparation and markings). Undergraduate admission interviews (18 candidates in Maths or Maths & CS).

- (2022-2023) Tutor, A7 Numerical Analysis, Jesus College, **University of Oxford**.

  Tutoring 2nd Year Undergraduates in small groups (class size: 1-2); Marking example sheets and giving feedbacks; Marking collection paper; Giving revision classes and consultation sessions. 15 contact hours.

- (2022-2023) Tutor, C5.6 Applied Complex Variables, Mathematical Institute, **University of Oxford**.

  Teaching 4th Year Undergraduates in classes (class size: 10-12); Coordinating the classes and mentoring teaching assistants; Giving consultation sessions. 16 contact hours.

- (2021-2022) Lead Tutor, B17 Biomechanics, Department of Engineering Science, **University of Oxford**.

  Tutoring 3rd Year undergraduates in small groups (class size: 3-4); Marking example sheets and giving feedbacks; Coordinating tutorials for the entire course; Setting of a mock exam paper and giving revision classes. 13 contact hours.

Supervision

- (2023) Benjamin Nicholls-Mindlin, MSc MMSC project, *Rational Stokes Methods for Tissue Engineering Applications*, co-supervised with Professors Sarah Waters and Helen Byrne (Oxford) and Drs Rudolf Hellmuth, Yuan-Tsan Tseng and Najma Latif (Magdi Yacoub Institute). The thesis received the second highest distinction in the MSc programme.

Speaking invitations

- Computation of physiological flows and transport at low Reynolds numbers, Applied and Computational Mathematics Seminar, Cardiff University, Feb 2024.
- Computation of 2D Stokes flows via lightning and AAA rational approximation, Numerical Analysis Group Internal Seminar, University of Oxford, May 2023.
- Modelling oxygen transport in the human cerebral microvasculature, British Applied Mathematics Colloquium, Bristol, Apr 2023.

Awards and funding

- (2022) **EPSRC Postdoctoral Research Associate**, Mathematical Institute, University of Oxford. *One-year postdoctoral position awarded to up to 5 Oxford DPhil graduates*.
- (2019) **IMechE Best Student Prize**, The University of Edinburgh.
- (2018) **3rd Year Class Medal for Mechanical Engineering**, The University of Edinburgh.
- (2018) **Edinburgh Award**, The University of Edinburgh.
- (2018) **Summer Research Scholarship**, The University of Edinburgh.
- (2017/2018) **2+2 Student Scholarships**, The University of Edinburgh.
- (2016) **1st Prize Scholarship for Academic Excellence**, Xiamen University.

Major funding applications

- (2023) EPSRC Responsive Mode Grant, Researcher Co-Lead, under review.
- (2023) Schmidt AI in Science Postdoctoral Fellowship, shortlisted.
- (2022) EPSRC NFFDy Postdoctoral Fellowship (National Fellowships in Fluid Dynamics), extremely positive reviews (scoring a 6/6 with high confidence and a 5/6).

Service, community and professional development

- (2023.05-date) Member, **European Society of Biomechanics**.
- (2020.06-2021.06) Student Member, **VPH Institute**.
- (2019.11-2020.03) Non-Medical Support Worker, Disability Advisory Service, **University of Oxford**.
- (2023) Workshop on 'Mental Health Awareness in Higher Education', Mathematical Institute, **University of Oxford**.
- (2023) Undergraduate admissions in mathematics, Oriel College, **University of Oxford**.
- Reviewer for *Biotechnology and Bioengineering* (Wiley).
- Session chair for "Numerical Methods for Differential Equations" at Numerical Analysis in the 21st Century Conference, in honour of Nick Trefethen's retirement from Oxford.

Referees

Professor Stephen Payne, Institute of Applied Mechanics, National Taiwan University, stephenpayne@ntu.edu.tw

Professor Sarah Waters, Mathematical Institute, University of Oxford, waters@maths.ox.ac.uk

Professor Nick Trefethen, SEAS, Harvard University, trefethen@seas.harvard.edu

LIST OF PUBLICATIONS

Journal articles

1. **Xue, Y.**, Waters, S. L. and Trefethen, L. N. 2024. Computation of 2D Stokes flows via lightning and AAA rational approximation. *SIAM Journal on Scientific Computing*, to appear. Also available on arXiv: https://arxiv.org/abs/2306.13545
2. **Xue, Y.**‡, Georgakopoulou, T.‡, van der Wijk, A.-E., Józsa, T. I., van Bavel, E.‡ and Payne, S. J.‡ 2022. Quantification of hypoxic regions distant from occlusions in cerebral penetrating arteriole trees. *PLoS Computational Biology*. **18**(8), e1010166. ‡: co-first/co-senior authors.
3. Miller, C., Padmos, R. M., van der Kolk, M., Józsa T. I., Samuels, N., **Xue, Y.**, Payne, S. J. and Hoekstra, A. G. 2021. In Silico Trials for Treatment of Acute Ischemic Stroke: Design and Implementation. *Computers in Biology and Medicine*. **137**, 104802.
4. **Xue, Y.**, El-Bouri, W. K., Józsa, T. I. and Payne, S. J. 2021. Modelling the effects of cerebral microthrombi on tissue oxygenation and cell death. *Journal of Biomechanics*. **127**, 110705.
5. **Xue, Y.**, Hellmuth, R. and Shin, D. 2020. Formation of Vortices in Idealised Branching Vessels: A CFD Benchmark Study. *Cardiovascular Engineering and Technology*. **11**(5), pp.544-559.

Submitted articles/preprints

6. Padmos, R. M., Józsa T. I., **Xue, Y.**, Payne, S. J. and Hoekstra, A. G. 2023. A Multi-Scale Model for Perfusion-Based Infarct Estimation in Acute Ischaemic Stroke Patients. Submitted.

7. **Xue, Y.**, Payne, S. J. and Waters, S. L. 2023. Stokes flows in a 2D bifurcation. arXiv: https://arxiv.org/abs/2309.11230

Articles in preparation

8. Stokes flow through a channel obstructed by an angled plate, with S. G. Llewellyn Smith, E. Luca and S. L. Waters.

9. Computing 2D Stokes flows in singly periodic channels via rational approximation.

10. Modelling Cell Transport in 2D Porous Scaffolds, with B. Nicholls-Mindlin and S. L. Waters.

11. A new model of transit time distribution, with S. J. Payne, J.-F. Kuo and W. K. El-Bouri.

DPhil thesis

12. **Xue, Y.** 2022. *Modelling oxygen transport and tissue damage in the human brain*. DPhil thesis, University of Oxford.

Conference abstracts

13. **Xue, Y.** 2023. *Computation of 2D Stokes flows via lightning and AAA rational approximation*. Numerical Analysis in the 21st Century in honour of Nick Trefethen's retirement from Oxford, Oxford, UK. Presentation.

14. **Xue, Y.**, Payne, S. and Waters, S. 2023. *Modelling blood flow in a micro-vessel bifurcation*. ESB2023, Maastricht, The Netherlands. Presentation.

15. **Xue, Y.** and Payne, S. 2023. *Modelling oxygen transport in the human cerebral microvasculature*. British Applied Mathematics Colloquium, Bristol, UK. Presentation.

16. **Xue, Y.**, Józsa, T. I. and Payne, S. J. 2022. *Modelling human cerebral tissue damage caused by acute ischaemic stroke*. 9th World Congress of Biomechanics, Taipei (online). Presentation.

17. Payne, S. J., Józsa, T. I., **Xue, Y.**, Wang, J., Howman, J. C., Newsome, M. Wei, W., Bing, Y., Chen, X., Daher, A., Tong, Z., and El-Bouri, W. K. 2022. *Mathematical models of the cerebral microcirculation in health and pathophysiology*. 7th International Conference on Computational and Mathematical Biomedical Engineering (CMBE22), Milan, Italy. Presentation.

18. Padmos, R. M., Józsa, T. I., **Xue, Y.**, Payne, S. J. and Hoekstra, A. G. 2022. *A multi-scale tissue infarction model for modelling acute ischaemic stroke*. 7th International Conference on Computational and Mathematical Biomedical Engineering (CMBE22), Milan, Italy. Presentation.

19. Padmos, R. M., Józsa, T. I., **Xue, Y.**, Payne, S. J. and Hoekstra, A. G. 2022. *Modelling Infarct Growth During Acute Ischeamic Stroke*. The 17th International Symposium on Biomechanics in Vascular Biology and Cardiovascular Disease, Rotterdam, The Netherlands. Presentation.

20. **Xue, Y.**, Hellmuth, R. and Shin, D. 2020. *Formation of Vortices in Idealised Branching Vessels: A Parametric Validation Study with HELYX and Dakota*. VINAS Online Users Conference 2020, Tokyo (online), Japan. Presentation.

21. **Xue, Y.** and Payne, S. J. 2020. *Modelling brain metabolism in ischaemic stroke: oxygen consumption and energy budget*. VPH2020, Paris (online), France. Poster.

22. **Xue, Y.**, Hellmuth, R. and Shin, D. 2019. *Characteristics of Wakes in Branching Blood Vessels under Re = 500*. 32nd Scottish Fluid Mechanics Meeting, Dundee, UK. Poster.