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: in silico trials, 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.

- (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

- A state-of-the-art epidemic simulator and web app for viral transmission in indoor spaces, SIAM Conference on the Life Sciences, Portland, Jun 2024.
- Computation of two-dimensional Stokes flows via lightning and AAA rational approximation, Computational and Applied Math Seminar, Peking University, May 2024.
- 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).

Media coverage

- Epidemic Simulator and Web App Models Viral Transmission in Indoor Spaces, *SIAM News*, Jun 2024

Service, community and professional development

- (2024-date) Member, **Society for Industrial and Applied Mathematics (SIAM)**.
- (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.
- Past memberships: **European Society of Biomechanics (ESB)** and **VPH Institute**.

Referees

Dr Katerina Kaouri, School of Mathematics, Cardiff University, KaouriK@cardiff.ac.uk

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

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

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

LIST OF PUBLICATIONS

Journal articles

1. **Xue, Y.**, Waters, S. L. and Trefethen, L. N. 2024. Computation of two-dimensional Stokes flows via lightning and AAA rational approximation. *SIAM Journal on Scientific Computing*. **46**(2), pp.A1214–A1234.
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 article/preprint

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

7. Payne, S. J., **Xue, Y.**, Kuo, J.-F. and El-Bouri, W. K. 2024. Transit time mean and variance are markers of vascular network structure, wall shear stress distribution and oxygen extraction fraction, submitted.

8. Padmos, R. M., Józsa T. I., **Xue, Y.**, Payne, S. J. and Hoekstra, A. G. 2024. A Multi-Scale Model for Perfusion-Based Infarct Estimation in Acute Ischaemic Stroke Patients. Submitted.

DPhil thesis

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

Conference abstracts

10. Payne, S. J., El-Bouri, W. K., **Xue, Y.** 2024. *What do transit time distributions tell us about the vascular structure of cerebral cortical columns?* ESB2024 (incoming), Edinburgh, UK. Poster.

11. **Xue, Y.**, Woolley, T., Jayathilake P. G., Jabi, W. and Kaouri, K. 2024. *A state-of-the-art epidemic simulator and web app for viral transmission in indoor spaces*. SIAM Conference on the Life Sciences (LS24), Portland, US. Presentation.

12. **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.

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

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

15. **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 (WCB), Taipei (online). Presentation.

16. 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.

17. 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.

18. 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.

19. **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.

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

21. **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.