Lu Zhu, Ph.D., Research Associate

Dept. of Applied Mathematics and Theoretical Physics, University of Cambridge
Email: lz447@cam.ac.uk **Phone:** +44 (752)2112769
Address: Wilberforce Road, Cambridge, CB3 0WA, the United Kingdom
ResearchGate, GoogleScholor

Research Interests

Computational fluid dynamics; Polymer materials; Stratified flows; Complex fluids and flows; Turbulence; Artificial Intelligent; Optimization; High performance computing.

Education

09/2015-08/2019 **Chemical Engineering, McMaster University**
Degree: Ph.D. **Supervisor:** Dr. Li Xi
Key Words: CFD, turbulence, polymer additives drag reduction, vortex tracking.
Focus:

— Studied drag reduction in polymeric turbulence using direct numerical simulation (DNS) and proposed theoretical explanation.
— Developed hybrid numerical methods to aid numerical oscillations in pseudo-spectral DNS.
— Designed advanced vortex tracking algorithms to analyze the formation and regeneration of vortices in polymeric turbulence.
— Investigated dynamics of elastic instabilities in highly elastic polymeric flows.

Main Courses: Introduction of Turbulent Flow, Parallel and High-Performance Computing, Polymer Physics, Optimization of Chemical Processes, Neural Network and Development Tool, Deep Learning and Applications.

09/2012-06/2015 **Fluid Machinery and Engineering, East China Univ. of Sci. and Tech.**
Degree: M. Sci. **Supervisor:** Dr. Huanxin Lai
Key words: Galvanizing zinc pot, multi-physics coupling, CFD, Ansys
Focus:

— Analyzed thermal and flow behaviors in a galvanizing zinc pot with commercial CFD tools.
— Designed multi-physics simulations coupling electromagnetic and flow fields.
— Explored operational conditions for the optimal solution for high quality coating.

Main Courses: Computational Fluid Dynamics, Advanced Thermodynamics, Advanced Fluid Mechanics.

09/2008-08/2012 **Mechanical and Power Engineering, East China Univ. of Sci. and Tech.**
Degree: B. Eng.
Majored in Progress Equipment and Control Engineering.
Main Courses: Engineering Fluid Mechanics, Mechanical Design, Machinery Principles.

Employment

05/2021-present	**Research Associate**, University of Cambridge, working with Prof. Paul F. Linden and Prof. Rich Kerswell, focusing on the modelling of stratified turbulent flows in a stratified inclined duct.
05/2020-05/2021	**Postdoctoral Fellow**, McMaster University, supervised by Dr. Prashant Mhaskar and Dr. Li Xi, aimed at industrial reactor design with CFD, crystallization kinetics, and machine learning techniques.
10/2019-05/2020	**Postdoctoral Research Assistant**, McMaster University, supervised by Dr. Li Xi, directed to elastoinertial turbulence in channel flows.
2015-2019 (Winter term)	**Graduate Teaching Assistant**, McMaster University, CHEMENG 2O04: Fluid Mechanics. Instructor: Dr. David Latulippe.
09/2015-08/2019	**Graduate Research Assistant**, McMaster University, supervised by Dr. Li Xi, targeted to understand polymer additive drag reduction in channel flows.
2016-2020 (Summer term)	**Undergraduate Student Mentoring**, McMaster University, mentor of undergraduate summer interns.

Publications

1. **Zhu, L.** & Xi, L. (2021). Non-asymptotic elastoinertial turbulence for asymptotic drag reduction. *Phys. Rev. Fluids*, 014601. (link)
2. **Zhu, L.** & Xi, L. (2020). Inertia-driven and elastoinertial viscoelastic turbulent channel flow simulated with a hybrid pseudo-spectral/finite-difference numerical scheme. *J. Non-Newton. Fluid Mech*, 286: 104410. (link)
3. **Zhu, L.** & Xi, L. (2019). Vortex dynamics in low- and high-extent polymer drag reduction regimes revealed by vortex tracking and conformation analysis. *Phys. Fluids*, 31(9), 095103. (link)
4. **Zhu, L.** & Xi, L. (2019). Vortex axis tracking by iterative propagation (VATIP): A method for analysing three-dimensional turbulent structures. *J. Fluid Mech.*, 866, 169-215. (link)
5. **Zhu, L.** Bai, X., Krushelnycky, E. & Xi, L. (2019). Transient dynamics of turbulence growth and bursting: Effects of drag-reducing polymers. *J. Non-Newton. Fluid Mech.*, 266, 127-142. (link)
6. **Zhu, L.**, Schrobsdorff, H., Schneider, T. M. & Xi, L. (2018). Distinct transition in flow statistics and vortex dynamics between low-and high-extent turbulent drag reduction in polymer fluids. *J. Non-Newton. Fluid Mech.*, 262, 115-130. (link)
7. **Zhu, L.** & Xi, L. (2018). Coherent structure dynamics and identification during the multistage transitions of polymeric turbulent channel flow. *J. Phys.: Conf. Ser.* 1001. (link)
8. Zhang, Q., Li, Z., **Zhu, L.**, et al. (2021). Real-time prediction of river chloride concentration using ensemble learning. *Environ. Pollut.*, 291, 118116. (link)
9. **Zhu, L.** & Xi, L. (2021). Understanding of multi-stage transition in polymeric turbulence: a

dynamical perspective. *Under preparation*.

10. **Zhu, L.** & Xi, L. (2021). Linear and nonlinear pathways to turbulence in viscoelastic channel flow. *Under preparation*.

Conferences and Presentations

1. **Zhu, L.** & Xi, L. Vortex axis tracking by iterative propagation (VATIP): analyzing three-dimensional vortex structures in viscous and viscoelastic turbulent flows. **2019 APS March Meeting,** Mar. 2019, Boston, MA, Unite States
2. **Zhu, L.** & Xi, L. Vortex dynamics for high levels of drag reduction: quantitative analysis enabled by a new vortex tracking algorithm. **2018 AIChE Annual Meeting,** Oct. 2018, Pittsburgh, PA, Unite States
3. **Zhu, L.** & Xi, L. Vortex dynamics for high levels of drag reduction: quantitative analysis enabled by a new vortex tracking algorithm. **The Society of Rheology 90th Annual Meeting,** Oct. 2018, Houston, TX, Unite States
4. **Zhu, L.** & Xi, L. Polymer-turbulence interactions and vortex dynamics in polymer additives turbulent channel flow. **67th Canadian Chemical Engineering Conf.,** Oct. 2017, Edmonton, AB, Canada
5. **Zhu, L.** & Xi, L. Polymer-turbulence interactions in high-extent drag-reducing polymer flows. **2nd Int. Conf. in Aerospace for Young Scientists** (invited), Sep. 2017, Beijing, China

Academic activities

07/2020-present	**Peer review**, Physics of Fluids, reviewed article on turbulent mechanism.
02/2019-present	**Peer review**, AIP Advances, reviewed article on turbulent dynamics.
02/2019-present	**Peer review**, Fluid Dynamics Research, reviewed article on computational fluid dynamics.
05/2017-06/2017	**Participant**, 3rd Madrid Turbulence Workshop, hosted by Dr. Javier Jiménez, Madrid, Spain.
05/2016-06/2016	**Participant**, Compute Ontario High Performance Computing Summer School, Hamilton, Canada.

Honor and Awards

- **Mitacs Postdoc Fellowship**, Chemical Engineering, McMaster Univ., since 2020
- **Graduate Student Scholarship**, Chemical Engineering, McMaster Univ., 2015-2019
- **Research Scholarship**, Chemical Engineering, McMaster Univ., 2015-2019
- **GSA Travel Award**, Graduate Students Association, McMaster Univ., 2017, 2019
- **Chinese National Graduate Scholarship**, Ministry of Education of China, 2014
- **Outstanding Student in Science and Engineering of ECUST**, ECUST, 2012