

Tianyu Cheng

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Education

Ph.D. Applied Mathematics, Western University, London, ON, Canada, 2019-February 23, 2024

- Supervisor: Xingfu Zou
- Thesis: Study of Behaviour Change and Impact on Infectious Disease Dynamics by Mathematical Models

M.Sc. Computing Mathematics, Shaanxi Normal University, China, 2016-2019

- Supervisor: Sanyi Tang
- Threshold Dynamics and Bifurcation of a State Dependent Feedback Nonlinear Control Susceptible Infected Recovered Model

B.Sc. Mathematics and Applied Mathematics, South China Normal University, China, 2012-2016

Employment

Postdoctoral fellow, Laboratory for Industrial and Applied Mathematics, York University, Toronto, ON, Canada, Jan 2024-present

- Supervisor: Jianhong Wu
- Project: Epidemic modelling and dynamical systems

Research Interest

ODE, DDE, IDE, PDE etc., biomathematics, epidemiology, virology and ecology.

During my Ph.D., I focus on modelling epidemic disease, especially in non-pharmaceutical intervention impact and evolution from different perspectives. Further, I am trying to apply different mathematical tools, like delay/impulsive differential systems, bifurcation theory, and renewal equations.

During my postdoctoral research, I have focused on developing the theory of global Hopf bifurcation for a class of delay–algebraic systems. The theoretical framework for these delay–algebraic systems is both novel and technically challenging, requiring substantial work.

Publications

1. **T. Cheng**, and X. Zou, On final and peak sizes of an epidemic with latency and effect of behaviour change, *Journal of Mathematical Biology*, 91(2), (2025), 1-45.
2. **T. Cheng**, and J. Wu, Recurrent patterns of disease spread post the acute phase of a pandemic: insights from a coupled systems of differential equation for disease transmission and a delayed algebraic equation for behavioral adaptation, *Mathematical Biosciences*, 109480, (2025).
3. **T. Cheng**, and X. Zou, Modelling the impact of society precaution on disease dynamics and its evolution, *Journal of Mathematical Biology*, 89(1), (2024), 1.

4. **T. Cheng**, and X. Zou, A new perspective on infection forces with demonstration by a DDE infectious disease model. *Mathematical Biosciences and Engineering*, 19(5), (2022), 4856-4880.
5. **T. Cheng**, and X. Zou, Modeling the impact of vaccination strategies dependent on epidemic severity and vaccine efficacy on disease dynamics, preprint, 2023.
6. Q. Zhang, B. Tang, **T. Cheng** and S. Tang, Bifurcation Analysis of a Generalized Impulsive Kolmogorov Model With Applications to Pest and Disease Control, *SIAM Journal on Applied Mathematics*, 80(4), (2020), 1796–1819.
7. **T. Cheng**, S. Tang and R. A. Cheke, Threshold Dynamics and Bifurcation of a State Dependent Feedback Nonlinear Control Susceptible Infected Recovered Model, *Journal of Computational and Nonlinear Dynamics*, 14(7), (2019), 1-14.
8. Kim, S., S. Athar, Y. Li, Koumarianos, S., **T. Cheng**, ...& J. Wu. Assessing the epidemiological and economic impact of alternative vaccination strategies: a modelling study. *International Journal of Infectious Diseases*, 116, (2022), S60.

Presentations

Recent:

- Minisymposia Talk (Invited), The Third Joint SIAM/CAIMS Annual Meetings (AN25), Montréal, Québec, July 28-Aug 1, 2025.
- Poster, Workshop on Mathematical Ecology-2025 Theme: Phylodynamics, Queen's University, Kingston, July 24-25, 2025.
- Minisymposia Talk, Society for Mathematical Biology Annual Meeting-2025, Edmonton, Canada, July 13-18, 2025.
- Poster Session, "Modelling and Theory in Population Biology," National Institute for Theory and Mathematics in Biology — Travel Award Recipient, Chicago, USA, June 2-6, 2025.
- Invited Talk, Workshop on Differential Equations and Mathematical Biology, University of Miami, Coral Gables, Nov 23-26, 2024.
- Talk, 2024 MfPH International Collaborative Summer Program in Nonlinear Differential Equations with Application, York University, Toronto, Aug 21, 2024.
- Minisymposia Talk, 2024 Canadian Applied and Industrial Mathematics Society Annual Meeting (CAIIMS), Queen's University, June 24-27, 2024.
- Invited Talk, University of Nebraska-Lincoln, Mathbio seminar, Online, Nov 2, 2023.
- Minisymposia Talk, Society for Mathematical Biology Annual Meeting-2023, Ohio State University, July 16-21, 2023.
- Poster Session, Advance in Mathematical Ecology-2023, Pittsburgh University, June 1-3, 2023.
- Talk, Scientific Session, "Topics in Mathematical Biology: Theory, Applications and Future Perspectives," 2022 Canadian Mathematical Society Meeting, Toronto, Canada, Dec 2-5, 2022.

- Poster Session, Fields Workshop on Mathematical Ecology: Modeling Epidemics, Queen's University, Canada, Aug 10-13, 2022.
- Group Presentation, Fields CQAM Thematic Program on Integrative Modeling of Emerging Infectious Disease Outbreaks, Canada, May-June 2021.
- Dynamical Systems Seminar, Western University, every academic term, Sept 2019-present.

Teaching Experience

Organizer, Dynamical Systems Seminar, Western University, Fall 2022-Winter 2023

Research Assistant, Western University, Fall 2019-Summer 2023

Teaching Assistant, Western University, Fall 2019-Fall 2023

- Courses: Advanced Calculus I/II, Calculus and Probability with Biological Applications, Partial Differential Equation I/II, Special Topics in Mathematics (*Topic: Introduction to Mathematical Biology*), Dynamic Systems.
- Job Duties: marking assignments and exams, lecturing, running tutorials, office hours and help center, and proctoring.

Honours and Awards

- Western Graduate Research Scholarships, Western University (2019-2023)
- Excellent Graduate Student Scholarships, Shaanxi Normal University (2016-2019)

Research Experience

Conferences Attended

- Participant, 4th International Conference on Dynamics of Differential Equations, The Fields Institute, Toronto, August 14–17, 2023.

Relevant background

- **Graduate courses:**
Math Biology, Non-linear Dynamic Systems, Partial Differential Equations, Numerical Analysis, Computer Algebra, Impulsive Differential Equations, Stochastic Processes, Bayes Statistical Inference, Modern Analytics etc.
- **Skills:**
 - Familiar with Matlab, Maple, Mathematica, Latex
 - Programming ability in Mathematica, Python