

Chunyi Gai

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Research Interests

Pattern formation in reaction-diffusion systems; Mathematical modeling in ecology and biology; Singular perturbations and asymptotic analysis; Numerical simulations and applications of mathematical modeling.

Education

PhD (Applied Mathematics)

Halifax, NS, Canada

Dalhousie University

Jan 2016 – August 2021

Supervisor : Theodore Kolokolnikov

PhD Thesis: Spike Dynamics in 2-component and 3-component Reaction Diffusion Systems

Visiting student

Vancouver, BC, Canada, Canada

The University of British Columbia

Sep 2015 – June 2016

Supervisor : Theodore Kolokolnikov

M.Sc. (Applied Mathematics)

Halifax, NS, Canada

Dalhousie University

Sep 2014 – Dec 2015

Supervisor : Theodore Kolokolnikov

Master Thesis: Delayed Bifurcation Onset of Turing Instability and the Effect of Noise

B.Sc. in Mathematics and Economics

Chengdu, China

Southwestern University of Finance and Economics

Sep 2010 – Jul 2014

Advisor : Qi Wang

Dissertation Topic: Qualitative analysis of some reaction-advection-diffusion systems

Employment

Postdoctoral fellowship (Sep 2021 - Present) Mathematics, The University of British Columbia, Canada

Papers

- [1] **Chunyi Gai**, Theodore Kolokolnikov, Jan Schrader, Vedant Sharma. *Recurrent and chaotic outbreaks in SIR model*. (To appear, European Journal of Applied Mathematics (12 pages))
- [2] **Chunyi Gai**, Michael Ward. *The Nucleation-Annihilation Behavior for Hotspot Patterns of Urban Crime with Police Deployment*. (To appear, SIAM Journal on Applied Dynamical Systems (SIADS) (37 pages))
- [3] Fahad Al Saadi, **Chunyi Gai**, Mark Nelson. *Localised pattern formation: Semi-strong interaction asymptotic analysis for three components model*. (Proceedings of the Royal Society A 2024 Jan 10; 480(2281) (23 pages))
- [4] **Chunyi Gai**, Theodore Kolokolnikov *Resource-mediated competition between two plant species with different rates of water intake*. (SIAM Journal on Applied Mathematics (SIAP), 2023, 83(2), 576-602.)
- [5] **Chunyi Gai**, Theodore Kolokolnikov, David Iron & John Rumsey *Spike dynamics in the presence of noise*. (SIAM Journal on Applied Dynamical Systems (SIADS), 2020, 19(4), 2783-2802)

- [6] Fahad Al Saadi, Alan Champneys, **Chunyi Gai**, Theodore Kolokolnikov *Semi-strong interaction, spikes and localised pattern formation in a Schnakenburg model*. (European Journal of Applied Mathematics, 2022, 30(1): 133-152)
- [7] **Chunyi Gai**, David Iron , Theodore Kolokolnikov *Localized outbreaks in SIR model with diffusion*. (Journal of Mathematical Biology, 2020, 80(5): 1389-1411.)
- [8] Yuxin Chen, Theodore Kolokolnikov, Justin Tzou & **Chunyi Gai** *Patterned vegetation, tipping points, and the rate of climate change*. (European Journal of Applied Mathematics, 2015, 26(06): 945-958.)
- [9] Qi Wang, Jingda Yan & **Chunyi Gai** *Qualitative analysis of stationary Keller-Segel chemotaxis models with logistic growth*. (Zeitschrift für angewandte Mathematik und Physik (ZAMP), 2016, 67(3): 51.)
- [10] **Chunyi Gai**, Qi Wang & Jingda Yan *Qualitative analysis of a Lotka-Volterra competition system with advection*. (Discrete Contin. Dyn. Syst., 2015, 35: 1239–1284.)

Talks and Presentations

- *Spike Dynamics in the Presence of Noise*. SFU Applied and Computational Math Seminar, Nov 21 2023.
- *The Nucleation-Annihilation Behavior for Hotspot Patterns of Urban Crime with Police Deployment*. Mathematical Biology Seminar at University of Alberta, Oct 29-31 2023.
- *The Nucleation-Annihilation Behavior for Hotspot Patterns of Urban Crime with Police Deployment*. SIAM PNW Conference 2023, Oct 13-15 2023.
- *Patterned Vegetation, Tipping Points and the Rate of Climate Change*. AMS Fall Central Sectional Meeting 2023, Oct 7-8 2023.
- *Localized outbreaks in SIR model with diffusion*. SMB Annual Meeting 2023, July 18 2023.
- *The Nucleation-Annihilation Behavior for Hotspot Patterns of Urban Crime with Police Deployment*. 2023 CAIMS Annual meeting, Fredericton, New Brunswick, Canada, June 12-15 2023.
- *Patterned Vegetation, Tipping Points and the Rate of Climate Change*. 2023 SSC Annual Meeting, Ottawa, Ontario, Canada, May 28-31 2023.
- *Competition between two plant species with different rates of water intake*. SIAM Conference on Applications of Dynamical: Patterns in Earth's Climate System minisymposium, Portland, Oregon, U.S. May 13-18 2023.
- *Competition between two plant species with different rates of water intake*. BIRS workshop: Theoretical and Applied Aspects for nonlocal Models, July 2022.
- *Competition between two plant species with different rates of water intake*. CMS Summer meeting, June 2022.
- *Competition between two plant species with different rates of water intake*. CAIMS Annual meeting, June 2021.
- *Competition between two plant species with different rates of water intake*. Presentation given at PIMS Workshop on New Trends in Localized Patterns in PDE, May 2021.
- *Spike dynamics in the presence of noise*. Presentation given at Dynamics Days Digital, August 2020.
- *Localized outbreaks in SIR model with diffusion*. Presentation given at virtual Joint SIAM/CAIMS Annual Meeting, *From PDE Solutions to Multi-Particle Interaction Systems: Reduction, Dynamics, and New Phenomena*, July 2020.
- *Localized outbreaks in SIR model with diffusion*. Presentation given at CAIMS - PIMS Coronavirus Modelling Conference, June 2020.
- *Localized outbreaks in SIR model with diffusion*. Presentation given at SIAM Conference on Applications

of Dynamical Systems, Snowbird, Utah, U.S. May 2019.

- *Localized outbreaks in SIR model with diffusion*. Presentation given at the BIRS workshop: Mathematical Criminology and Security, March 2019.

Conferences Organized

- Co-organized (with Jane Shaw MacDonald (Simon Fraser University)) a Mini-symposium, session title "Exploring Analytical and Numerical Developments in Social and Biological Applications", SIAM Pacific Northwest Section Annual meeting, Western Washington University, Bellingham, WA, Oct 13-15 2023.
- Co-organized (with Theodore Kolokolnikov (Dalhousie)) a Mini-symposium, session title "Exploring Complex Spatial-Temporal Dynamics with Applications", CAIMS Annual meeting, Fredericton, New Brunswick, Canada, June 12-15 2023.
- Co-organized (with Alan Lindsay (Notre Dame) and Theodore Kolokolnikov (Dalhousie)) a Mini-symposium, session title "Stochastic Processes in Biological Systems," SIAM Conference on Applications of Dynamical Systems, Portland, Oregon, USA, May 2023.

Teaching Experience

Instructor **2021 – 2023 Full, 2022 Winter (4 times)**
Math 307 (Applied Linear Algebra) *The University of British Columbia*

Facilitator **2022 Oct 4–18, 2023 Feb 14–28**
Responsible Conduct of Research (RCR) course *The University of British Columbia*

- Led a group discussion of two case studies for one hour in each class.

Instructor **2022 Summer Term 1**
Math 221 (Matrix Algebra) *The University of British Columbia*

Teaching Assistant **2020 Fall**
Math 2600 (Theory of Interest and Life) *Dalhousie University*

- Developed a set of five homework assignments on WebWork.

Instructor **2018 – 2021 Summer Term 1 (4 times)**
Math 2120 (Methods for ODE) *Dalhousie University*

Teaching Assistant **2017– 2019 Fall, Winter 2020 (4 times)**
Matrix Theory and Linear Algebra I *Dalhousie University*

- Led three weekly tutorials and had a weekly meeting with instructor, during which we discussed the new worksheets that students will do in the next tutorial.

Instructional Skills Workshops for Grad Students **April 2016 – May 2016, 4 weeks workshop**
The University of British Columbia

- Developed new teaching skills and enhanced existing skills by doing teaching practice and theory applications. A certificate is obtained after the workshop.

Math Learning Center Tutor **Sep 2015 – May 2016**
The University of British Columbia

- Helped students one by one with the material from their math courses.

Teaching Assistant **2014, 2016 Fall**
Engineering Calculus I *Dalhousie University*

- Led three weekly tutorials and graded quizzes every two weeks.

Teaching Assistant
Engineering Calculus II

2015, 2017, 2019 Winter
Dalhousie University

- Led three weekly tutorials and graded quizzes every two weeks.

Math Learning Center Tutor

2016 – 2020
Dalhousie University

- Helped students one by one with the material from their math courses.

Service

- Journal referee for: SIAM Journal on Applied Dynamical Systems, Journal of Dynamics and Differential Equations, Journal of Mathematical Analysis and Applications, Discrete and Continuous Dynamical Systems - B, Journal of Nonlinear Science.

Honors and Awards

- Nova Scotia Graduate Scholarship (\$15000/year from Jan. 2016 – Aug. 2019)
- Professor Michael Edelstein Memorial Graduate Prize (Dalhousie University, 2019 – 2020, value: \$1200)