

INDRANIL GHOSH

School of Mathematical and Computational Sciences • Massey University • Palmerston North, 4442
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WORK EXPERIENCE

PDF, Applied Mathematics
Massey University

Feb 2024 – Present
Palmerston North, New Zealand-4442

EDUCATION

Ph.D., Applied Mathematics
Massey University

Jan 2021 – May 2024
Palmerston North, New Zealand-4442

M.Sc., Physics
Jadavpur University

2018 – 2020
Kolkata, India-700032

B.Sc., Physics
Jadavpur University

2015 – 2018
Kolkata, India-700032

AWARDS & HONORS

1. Postdoctoral fellowship contract (Marsden project) MAU2209, managed by Royal Society Te Apārangi, New Zealand [2024-2025].
2. Highly Commended Student Presentation award, NSW ANZIAM Mid Year Meeting [2023].
3. KiwiPycon Student Travel & Accomodation Grant [2023].
4. Prestigious **Red Sock** award for the best poster presentation, SIAM Conference on Applications of Dynamical Systems (DS23) [2023].
5. KiwiPycon Student Travel Grant [2022].
6. Marsden Ph.D. Grant contract MAU1809, managed by Royal Society Te Apārangi, New Zealand [2021-2023].
7. “Top 40” new CRAN packages under the category Computational Methods for the R package QGameTheory [June 2020]

THESIS

[T1] *Indranil Ghosh*, **Robust chaos in piecewise-linear maps**. *Ph.D. Thesis*, 2024. <https://mro.massey.ac.nz/handle/10179/69704>

JOURNAL PUBLICATIONS

[J1] Anjana S. Nair, *Indranil Ghosh**, Hammed Olawale Fatoyinbo, and Sishu Shankar Muni, **On the higher-order smallest ring-star network of Chialvo neurons under diffusive couplings**. *Chaos* 34:073135, 2024. <https://doi.org/10.1063/5.0217017>

[J2] *Indranil Ghosh**, Anjana S. Nair, Hammed Olawale Fatoyinbo, and Sishu Shankar Muni, **Dynamical properties of a small heterogeneous chain network of neurons in discrete time**. *Eur. Phys. J. Plus*, 139:545, 2024. <https://doi.org/10.1140/epjp/s13360-024-05363-0>

[J3] *Indranil Ghosh**, Robert I. McLachlan, and David J.W. Simpson, **The bifurcation structure within robust chaos for two-dimensional piecewise-linear maps**. *Commun. Nonlinear Sci. Numer. Simul.*, 134, 2024. <https://doi.org/10.1016/j.cnsns.2024.108025>

- [J4] **Indranil Ghosh***, Sishu Shankar Muni, and Hammed Olawale Fatoyinbo, **On the analysis of a heterogeneous coupled network of memristive Chialvo neurons.** *Nonlinear Dyn.*, 111:17499–17518, 2023. <https://doi.org/10.1007/s11071-023-08717-y>
- [J5] **Indranil Ghosh**, and David J. W. Simpson*, **Renormalisation of the two-dimensional border-collision normal form.** *Int. J. Bifurcation Chaos* 32(12):2250181, 2022. <https://doi.org/10.1142/S0218127422501814>
- [J6] Sishu Shankar Muni*, Hammed Olawale Fatoyinbo, and **Indranil Ghosh**, **Dynamical effects of electromagnetic flux on Chialvo neuron map: nodal and network behaviors.** *Int. J. Bifurcation Chaos* 32(09):2230020, 2022. <https://doi.org/10.1142/S0218127422300208>
- [J7] **Indranil Ghosh**, and David J. W. Simpson*, **Robust Devaney chaos in the two-dimensional border-collision normal form.** *Chaos* 32, 043120 (2022). <https://doi.org/10.1063/5.0079807>
- [J8] **Indranil Ghosh***, **Quantum Game Theory - I.** *Resonance* 26, 671–684 (2021). <https://doi.org/10.1007/s12045-021-1168-2> . **Quantum Game Theory - II.** *Resonance* 26, 791–812 (2021). <https://doi.org/10.1007/s12045-021-1180-6>. **Quantum Game Theory - III.** *Resonance* 26, 939–951 (2021). <https://doi.org/10.1007/s12045-021-1193-1>.

PUBLICATIONS IN CONFERENCE PROCEEDINGS

- [C1] Hammed Olawale Fatoyinbo*, Sishu Shankar Muni, **Indranil Ghosh**, Ibrahim Olatunji Sarumi, and Afeez Abidemi, **Numerical bifurcation analysis of improved denatured Morris-Lecar neuron model.** *2022 International Conference on Decision Aid Sciences and Applications (DASA)*. <https://doi.org/10.1109/DASA54658.2022.9765094>
- [C2] Sarath Babu*, **Indranil Ghosh**, and B. S. Manoj, **Effort: A New Metric for Roadside Unit Placement in 5G Enabled Vehicular Networks.** *5GWF'2020 Proceedings*. <https://doi.org/10.1109/5GWF49715.2020.9221228>

PREPRINTS

- [P1] **Indranil Ghosh***, Robert I. McLachlan, and David J.W. Simpson, **Robust chaos in orientation-reversing and non-invertible two-dimensional piecewise-linear maps.** <https://arxiv.org/abs/2307.05144>
- [P2] Costas J. Efthimiou*, Gregory DeCamillis, and **Indranil Ghosh**, **A physics-driven study of dominance space in soccer.** <https://arxiv.org/abs/2202.00414>

SOFTWARES

- [S1] **Indranil Ghosh**, **QGameTheory: Quantum Game Theory Simulator (v0.1.2).** *CRAN Repository*, 2020. <https://cran.r-project.org/web/packages/QGameTheory/index.html>

BLOGS

- Indranil Ghosh**, **Introduction to Mathematical Optimiztion (with Python).** <https://indrag49.github.io/Numerical-Optimization/>
- Indranil Ghosh**, **Introductory Football Data Analysis.** <https://realsoccerexpand.netlify.app/>

PAST WORK EXPERIENCE

Sirpi Products and Services Pvt. Ltd., Bangalore, India
Research Lead and SHEAR Project Lead (Remote)

August 2020–December 2020.

CONFERENCE PRESENTATIONS

Understanding the Topology of Chaotic Attractors for Piecewise-Linear Maps using Renormalisation. December 2023

New Zealand Mathematical Society Colloquium, 2023

Talk

Bifurcation structure of robust chaos in a generalised setting of piecewise-linear maps. December 2023

New Zealand Mathematical Society Colloquium, 2023

Poster

Understanding the Topology of Chaotic Attractors for Piecewise-Linear Maps using Renormalisation. December 2023

New Zealand Mathematics and Statistics Postgraduate Conference, 2023

Talk

Chaos, Robust Chaos and Applications.

October 2023

Café Scientifique

Talk

Python: A career changing/shaping language.

October 2023

PyGotham TV, 2023

Talk

Python: from the perspective of an applied mathematician.

September 2023

Kiwi Pycon XII, 2023

Talk

Understanding the bifurcation structure of robust chaos in piecewise-linear maps using renormalisation. July 2023

ICDEA 2023

Talk

The Bifurcation Structure Within Robust Chaos of Piecewise-Linear Maps

May 2023

SIAM Conference on Applications of Dynamical Systems (DS23)

Poster

Introduction to mathematical optimization using Python

February 2023

Python Delhi User Group Meetup, 2023

Tutorial

Bifurcation structure of robust chaos in two-dimensional piecewise-linear maps December 2022

New Zealand Mathematical Society Colloquium, 2022

Talk

Bifurcation structure of robust chaos in 2D piecewise-linear maps

November 2022

Dynamical Systems in NZ - Castaways, 2022

Invited Talk (E-poster)

Unconstrained Numerical Optimization using Python

August 2022

Kiwi Pycon XI, 2022

Tutorial

Dynamical Effects of Electromagnetic Flux on Chialvo Neuron Map: Nodal and Network Behaviors July 2022

SIAM Conference on the Life Sciences, 2022

Talk

Renormalisation of the Two-Dimensional Border-Collision Normal Form

July 2022

SIAM Annual Meeting, 2022

Talk

Renormalisation of the Two-Dimensional Border-Collision Normal Form NSW ANZIAM 2022 Mid-Year Conference, 2022	July 2022 <i>Talk</i>
Dynamical effects of electromagnetic flux on Chialvo neuron map: nodal and network behaviors BAMC, 2022	April 2022 <i>Talk</i>
Renormalisation of the Two-Dimensional Border-Collision Normal Form ANZIAM Annual Conference, 2022	February 2022 <i>Talk</i>
Learn Football Data Analysis with Python PyCode Conference, 2021	December 2021 <i>Talk</i>
Football (soccer) data analysis: A Pedagogic introduction PyCon Taiwan, 2021	October 2021 <i>Talk</i>
An introduction to hands-on football data analysis in Python PyCon Espana, 2021	October 2021 <i>Talk</i>
Football (soccer) data analysis: A pedagogic introduction PyConline AU, 2021	September 2021 <i>Talk</i>
Introduction to Soccer Pass Network Analysis with Python PyOhio, 2021	July 2021 <i>Thunder Talk</i>
Introducing a blog: Introductory Football Data Analysis EuroPython Conference, 2021	July 2021 <i>Lightning Talk</i>
Using Python to start learning Unconstrained Numerical Optimization Algorithms Pycon Colombia, 2021	June 2021 <i>Talk</i>
QGameTheory: An R package for teaching quantum computing and quantum game theory to students International Series of Online Research Software Events (SORSE)	April 2021 <i>Poster + Talk</i>
QGameTheory: A Quantum Game Theory Simulator written in R for teaching quantum computing and game theory to starting programmers and undergraduate students APS March Meeting 2021	March 2021 <i>Poster</i>
Develop and Document Your First R Package Sirpi Products and Services Pvt. Ltd.	December 2020 <i>Talk</i>
Learn Lambda Calculus with Python Pycode Conference 2020	December 2020 <i>Talk</i>
Teaching quantum computing and game theory with QGameTheory package Why R? 2020 Conference	September 2020 <i>Talk</i>
Introducing Lambda Calculus with Python Pycon Australia	September 2020 <i>Talk</i>

Quantum Game Theory with Julia: A computational analysis JuliaCon	July 2020 <i>Poster</i>
Build Your Own Quantum Simulator With R The European R Users Meeting	June 2020 <i>Lightning talk</i>
A Computational Study of Sequential Deposition: A Dynamic Monte Carlo Process in Statistical Physics Flatlands and beyond (2019) – A meet on 2D materials	September 2019 <i>Poster</i>
A Python implementation of Quantum Evolutionarily Stable Strategy Game, an interdisciplinary study of Quantum Computation and Game Theory in population biology February 2019 SLAS Conference	<i>Poster</i>
Analysis of Quantum Game Theoretic Models with a Python Simulator SciPy India	December 2018 <i>Talk</i>
Analysis of Chaos Game Simulator in Pygame International Conference on Complex Dynamical Networks, 2018	October 2018 <i>Poster</i>
Computation of Analytic Structure Factor for Macromolecules Research Topic of Statistical Physics to young Physicists, 2018	June 2018 <i>Poster</i>

TUTORING/MARKING

Tutor for Engineering Mathematics.
Marking assistant for Calculus.
Marking assistant for Linear Algebra.

JOURNAL REFEREE

- Chaos: An Interdisciplinary Journal of Nonlinear Science
- Nonlinear Dynamics: An International Journal of Nonlinear Dynamics and Chaos in Engineering Systems
- Communications in Theoretical Physics
- IEEE Transactions on Cybernetics
- Scientific Reports

SKILLS

Softwares	Expert: Python, MATLAB, R, Fortran, git, L ^A T _E X, HTML, Markdown
Social	Twitter: @indraghosh314, Github: https://github.com/indrag49 ,

REFERENCES

- [R1] *David J. W. Simpson* (Ph.D. Supervisor, Postdoc host). *Email: d.j.w.simpson@massey.ac.nz*
<https://www.massey.ac.nz/~djwsimps>
- [R3] *Tammy Lynch* (PDF Manager, Deputy Head of the School of Mathematical and Computational Sciences). *Email: t.a.lynch@massey.ac.nz*