

Miroslav Polách

Applied Mathematics | Dynamical Systems | Network Dynamics
(+421) 918 689 866 | miro.polach@gmail.com | linkedin.com/in/miroslav-polach

RESEARCH INTERESTS

Nonlinear dynamics and bifurcation theory, with a focus on network topology. Topology-induced bifurcations and synchrony-breaking in heterogeneous, randomly rewired graph ensembles. Reaction–diffusion models on graph ensembles (Watts–Strogatz, random graphs). Scientific computing: numerical continuation, finite element methods, and simulation of ODE/PDE systems.

WORK EXPERIENCE

- | | |
|---|-----------------------------|
| Numerical simulations of magnetic states of superparamagnetic nanoparticles | 2/2025 – Present |
| <i>Institute of Physics of Materials – Czech academy of sciences</i> | <i>Brno, Czech Republic</i> |
| | Part-time |
| <ul style="list-style-type: none">Simulate magnetic domains in superparamagnetic nanoparticles using MuMax³ and mumax⁺ for GPU-accelerated micromagnetic modeling, complemented by analytical techniques.Support applied research in Magnetic Fluid Hyperthermia (MFH) and biomedical engineering. | |
| Development of a statistical method to correct for batch effects in spatial transcriptomic data sets | 2/2024 – 9/2024 |
| <i>University Leipzig, Research Group – Biochemical Cell Technology</i> | <i>Leipzig, Germany</i> |
| | Internship |
| <ul style="list-style-type: none">Engineered a statistical framework in Python and R to correct for batch effects in spatial transcriptomic datasets.Implemented neural networks and clustering algorithms to improve data accuracy for the Biochemical Cell Technology research group.Collaborated across disciplines to integrate cell biology principles into computational data models. | |

EDUCATION

- | | |
|---|-------------------------|
| Masaryk University | Brno, Czech republic |
| <i>Master's degree programme, Applied Mathematics</i> | <i>9/2023 – Present</i> |
| <ul style="list-style-type: none">Dissertation: Numerical simulations of magnetic states of superparamagnetic nanoparticlesRelevant coursework: Bifurcation Theory, Chaos & Fractals, Partial Differential Equations, Dynamical Systems, Advanced Numerical Methods, Spectral Analysis, Stochastic Analysis, Markov Chains, Equations of Mathematical PhysicsPlacement abroad (Spring 2024): University of Leipzig, Germany | |
| Masaryk University | Brno, Czech republic |
| <i>Bachelor's degree programme, Statistics and data analysis</i> | <i>9/2020 – 6/2023</i> |
| <ul style="list-style-type: none">Dissertation: Visualization of geometric properties of functions of complex variablesRelevant coursework: Mathematical Analysis, Probability & Statistics, Topology, Ordinary Differential Equations, Numerical Methods, Optimization, Computational Statistics, Linear Statistical Models | |

PROFESSIONAL PUBLICATIONS

Přibyllová, L. et al. (incl. Polách, M.). "Chaos links dendritic calcium to bursting in hippocampal pyramidal cells." *Chaos, Solitons & Fractals*, vol. 197, Aug 2025. doi:10.1016/j.chaos.2025.116517

TECHNICAL SKILLS

Mathematics: Bifurcation theory, Dynamical systems, ODE, PDE, Numerical methods, Numerical continuation, Markov processes

Programming: Python, R, MATLAB / MatCont

Data & ML: Neural networks, Clustering, Statistical modeling, Time series, Spatial transcriptomics

ADDITIONAL INFORMATION

Languages: English (Fluent - IELTS C1 level), German (Conversational), Slovak (Native), Czech (Fluent)

Volunteering: Camp organizer (OZ Púpava, Slovakia) – logistics, budgeting, and planning daily agenda for 40–60 participant youth and family camps annually since 2017

Self-study: The Feynman Lectures on Physics (feynmanlectures.caltech.edu)