Amir **Shahhosseini**

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Education

KU Leuven — *Leuven, Belgium*

PH.D. IN ENGINEERING SCIENCE — *Mar. 2023 - Present*

- Tentative Thesis Title: Spiking Dynamical Systems

Sharif University of Technology — *Tehran, Iran*

MASTER OF SCIENCE IN MECHANICAL ENGINEERING (COURSE-BASED) — *Sep. 2019 - Jan. 2022*

- GPA: 4.0/4.0

K.N. Toosi University of Technology — *Tehran, Iran*

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING — *Sep. 2015 - Sep. 2019*

- GPA: 4.0/4.0

Research Interests

Dynamical Systems Nonlinear Dynamics, Neuromorphic Systems, Numerical Methods for High-Dimensional Systems

Optimization Large-Scale Optimization Methods, Numerical Linear Algebra, Splitting Methods

Neuroscience Computational Neuroscience, Spiking Neural Networks, Geometric Deep Learning

Publications

Journal Publications

- *A Shahhosseini, MH Tien, K D'Souza*; Poincare Maps: A Modern Systematic Approach Toward Obtaining Effective Sections - *Nonlinear Dynamics*
- *A Shahhosseini, MH Tien, K D'Souza*; Efficient Hybrid Symbolic-Numeric Computational Method for Piecewise Linear Systems with Coulomb Friction - *Journal of Computational and Nonlinear Dynamics*
- *MR Homaeinezhad, A Shahhosseini*; High-performance modeling and discrete-time sliding mode control of uncertain non-commensurate linear time invariant MIMO fractional order dynamic systems - *Communications in Nonlinear Science and Numerical Simulation*
- *MR Homaeinezhad, A Shahhosseini*; Fractional order actuation systems: Theoretical foundation and application in feedback control of mechanical systems - *Applied Mathematical Modelling* -
- *MR Homaeinezhad, A Shahhosseini*; Parameter-disturbance-robust model predictive control of input-saturated MIMO fractional systems - *International Journal of Dynamics and Control* -

Conference Publications

- *A Shahhosseini, MH Tien, K D'Souza*; Analysis and Evaluation OF Piecewise Linear Systems with Coulomb Friction Using a Hybrid Symbolic-Numeric Computational Method - *ASME IDETC Conference 2021 - MSNDC Section*
- *A Shahhosseini, K D'Souza*; Abstract Dynamics: An alternative approach to local Lyapunov exponents in examining local unpredictability - *Third International Conference on nonlinear dynamics 2023*
- *A Shahhosseini, T Chaffey, R Sepulchre*; An Operator-Theoretic Framework to Simulate Neuromorphic Circuits - *2024 IEEE 63rd Conference on Decision and Control (CDC)*

Conference Posters/Abstracts

- *A Shahhosseini, Thomas Burger, R Sepulchre*; Simulating Neuromorphic Systems at Scale - *44th Benelux Meeting on Systems and Control* - (Abstract)
- *A Shahhosseini, R Sepulchre*; Time-Frequency Splitting Algorithms for Neuromorphic Circuits - *43rd Benelux Meeting on Systems and Control* - (Abstract)
- *A Shahhosseini, T Chaffey, R Sepulchre*; Splitting Algorithms for Nonlinear RLC Circuits - *26th International Symposium on Mathematical Theory of Networks and Systems* - (Extended Abstract)

Honors and Awards

2025	**Best Junior Presentation Award**, 44th Benelux Meeting	*Netherlands*
2022	**Harding Distinguished Postgraduate Scholarship**, University of Cambridge	*Cambridge, UK*
2022	**Cambridge International Scholarship**, University of Cambridge	*Cambridge, UK*
2022	**Merit-Based Departmental Fellowship**, University of Cambridge	*Cambridge, UK*
2021	**ASME Best Student Paper 2^{nd} place**, ASME IDETC Conference	*Virtual, USA*
2020	**Merit-Based Departmental Fellowship**, The Ohio State University	*Ohio, USA*
2019	**Ranked 1^{st} in a class of 117**, K.N.Toosi University of Technology	*Tehran, Iran*
2018	**Galamchi Scholarship for Outstanding Academic Performance**, Galamchi Foundation	*Tehran, Iran*
2017	**Acknowledged for outstanding contribution on writing the "lexicon of Acoustics and Vibration"**, Iran's Society of Acoustics and Vibration	*Tehran, Iran*
2014	**Golden Award Winner**, Sharif's Student Competition	*Tehran, Iran*

Research Positions

Graduate Research Associate at the KU Leuven [2023-Present] Focusing on the development of spiking dynamical systems from a system theoretic perspective. The research is under the supervision of Prof. Rodolphe Sepulchre.

Remote Graduate Research Associate at the University of Cambridge [2023-Present] Focusing on the compatibility of the developed spiking dynamical systems and their biophysical realizability. The research is under the supervision of Prof. Timothy O'Leary.

Remote Graduate Research Associate at the Ohio State University [2020-2022] Focused on the development of large-scale methods for piecewise-linear nonlinear dynamical systems. Additionally, the idea of the Poincare map method was revisited and made into an algorithmic approach. Finally, a novel approach for the numerical analysis of continuous nonlinear dynamical systems was proposed. The research was under the supervision of Prof. Kiran D'Souza.

Undergraduate Research Associate at K.N.Toosi University of Technology [2018-2020] Focused on the development of numerical methods for the simulation and control of fractional-order dynamical systems. The first-ever MIMO controller for fractional-order systems was introduced as a result of this research. Additionally, the systematic treatment of fractional actuators was explored.

Skills

Software Skills

- MATLAB: Expert
- Latex: Expert
- Julia: Intermediate
- Python: Intermediate

Hardware Skills

- High-Performance Computing

References

Rodolphe Sepulchre Supervisor at KU Leuven advising my research on the development of spiking dynamical systems with a focus on system theory and mathematical models.
email: rodolphe.sepulchre@kuleuven.be

Timothy O'Leary Co-supervisor at the University of Cambridge advising my research on the development of spiking dynamical systems with a focus on biological and computational neuroscience.
email: tso24@cam.ac.uk

Kiran D'Souza Advisor at Ohio State University supervising my research during my M.Sc. degree on the proposition of novel computationally efficient methods for piece-wise linear systems.
email: dsouza.60@osu.edu