Sören von der Gracht, born Schwenker

Contact Data

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Current Position

Postdoctoral Researcher with Prof. M. Dellnitz
Institute of Mathematics, Paderborn University *09/22–present*
Project: Algorithms for Swarm Robotics: Distributed Computing meets Dynamical Systems

Education

Dr. rer. nat.
Universität Hamburg, (magna cum laude) *10/15–12/19*
Mathematics

MSc
Universität Hamburg, (excellent with distinction) *10/13–09/15*
Mathematics

BSc
Universität Hamburg, (excellent) *10/10–09/13*
Mathematics

Employment

Postdoctoral Researcher with Prof. R. Lauterbach and Prof. I. Gasser
Department of Mathematics, Universität Hamburg *10/19–09/22*

Postdoctoral Researcher with Prof. T. Schramm
Department of Geodesy and Geoinformatics, HafenCity Universität Hamburg *01/20–12/20*
Project: Linear Algebra Driven by Data Science

Research Associate with Prof. R. Lauterbach
Department of Mathematics, Universität Hamburg *10/15–09/19*

Other

Parental Leave: 09/21–11/21 and 04/21–07/21

Research Interest

Network Dynamical Systems: Genericity, Bifurcation Theory, Application of Representation Theory, Connections to Equivariant Dynamics, Heteroclinic Dynamics, Higher-Order Interactions, Applications to Real-World Systems

Equivariant Dynamics: Genericity, Bifurcation Theory

Representation Theory: Decomposition of Representations, Monoid Representations, Quiver Representations, Connections to Networks

Publications*

Original Research Articles

von der Gracht, S., E. Nijholt, and B. Rink. "Amplified steady state bifurcations in feedforward networks". *Nonlinearity* 35.4 (2022), pp. 2073–2120.

E. Nijholt, B. Rink, and **Schwenker, S.** "A new algorithm for computing idempotents of $\mathcal{R}$-trivial monoids". *Journal of Algebra and its Applications* 20.12 (2021).

E. Nijholt, B. W. Rink, and **Schwenker, S.** "Quiver Representations and Dimension Reduction in Dynamical Systems". *SIAM Journal on Applied Dynamical Systems* 19.4 (2020), pp. 2428–2468.

Schwenker, S. "Generic Steady State Bifurcations in Monoid Equivariant Dynamics with Applications in Homogeneous Coupled Cell Systems". *SIAM Journal on Mathematical Analysis* 50 (3 2018), pp. 2466–2485.

R. Lauterbach and **Schwenker, S.** "Equivariant bifurcations in four-dimensional fixed point spaces". *Dynamical Systems* 32.1 (2017), pp. 117–147.

Submitted

von der Gracht, S., E. Nijholt, and B. Rink. "Hypernetworks: cluster synchronisation is a higher-order effect" (2023). arXiv: 2302.08974.

In Advanced State of Preparation

C. Bick and **von der Gracht, S.** "Heteroclinic dynamics in higher order networks". Preprint (2023).

M. Dellnitz, R. Gerlach, and **von der Gracht, S.** "On the Dynamical Hierarchy in Gathering Protocols with Circulant Topologies". Preprint (2023).

von der Gracht, S., E. Nijholt, and B. Rink. "A parametrisation method for high-order phase reduction in coupled oscillator networks". Preprint (2022).

von der Gracht, S., E. Nijholt, and B. Rink. "Homogeneous Coupled Cell Systems with High-dimensional Internal Dynamics". Preprint (2022).

von der Gracht, S., E. Nijholt, and B. Rink. "Structural and algebraic properties of feedforward networks". Preprint (2022).

Other publications

T. Schramm, I. Gasser, **S. Schwenker**, R. Seiler, A. Lohse, K. Zobel "Linear Algebra driven by Data Science". *Open Educational Resource at the Hamburg Open Online University* (2020), URL: `https://www.hoou.de/projects/linear-algebra-driven-by-data-science/`

E. Nijholt, B. Rink, **S. Schwenker** "Generalised Symmetry in Network Dynamics". *Popular*

*Family name changed from Schwenker to von der Gracht in 2020

Article in DS Web April (2020), URL: `https://dsweb.siam.org/The-Magazine/Article/generalised-symmetry-in-network-dynamics`

Theses

Dissertation: *Genericity in Network Dynamics*, Supervisor: Prof. R.Lauterbach

Master's Thesis: *Equivariant Bifurcations in $\mathbb{R}^8$ and the Ize Conjecture*, Supervisor: Prof. R. Lauterbach

Bachelor's Thesis: *Instabilität der "'logrolling"' Lösung in Flüssigkristallen unter Scherströmung (Instability of the "logrolling" solution in liquid crystals under shear flow)*, Supervisor: Prof. R. Lauterbach

Presentations

Invited Conference Presentations

TBA: Dynamical Systems in Porto (Porto, PT, 13/11/2023)

How higher order interactions shape the dynamics of hypernetworks: SIAM Conference on Applications of Dynamical Systems (Portland, OR, USA, 17/05/23)

Generalising Symmetry via Quiver Representations: Equivariant Dynamics and Applications: SIAM Conference on Nonlinear Waves and Coherent Structures (Bremen, D, 02/09/22)

Generalising Symmetry in Equivariant Dynamics using Quiver Representations: SIAM Conference on Applications of Dynamical Systems (virtual conference, 27/05/21)

Generalized Feedforward Networks: Algebraic Structure and Steady State Bifurcations: SIAM Conference on Applications of Dynamical Systems (Snowbird, UT, USA, 19/05/19)

Generic steady state bifurcations in monoid equivariant dynamical systems: Workshop on Emerging Topics in Network Dynamical Systems (Lorentz Center, Leiden, NL, 07/06/17)

Invited Seminar Talks

Amplification in feedforward networks: Applied Dynamics Seminar (Universität Hamburg, 22/11/22)

An introduction to dynamical networks and their symmetries: Oberseminar Angewandte Mathematik (Paderborn University, 10/11/22)

Amplification in general feedforward networks: Dynamics Seminar (Vrije Universiteit Amsterdam, 16/06/22)

Quiver representations as generalised symmetries in network dynamics: Lowlands Dynamics Seminar (joint virtual seminar of the Vrije Universiteit Amsterdam and the Universität Hamburg, 24/03/21)

Homogeneous coupled cell systems - Hidden symmetries and representation theory: Dynamics Seminar (Vrije Universiteit Amsterdam, 23/01/19)

Homogeneous coupled cell systems: unexpected symmetries and how to exploit them in bifurcation analysis: Dynamical Systems Seminar (Centro de Matemática da Universidade do Porto, 22/06/18)

Networks: Nonsymmetric, yet symmetric - An Introduction to Hidden Symmetries in Network Dynamical Systems: Lothar-Collatz-Seminar (Universität Hamburg, 20/12/17)

Generische Bifurkationen von Ruhelagen in Monoid-äquivarianten dynamischen Systemen: AG Dynamische Systeme (Universität Hamburg, 12/05/17)

Posters

Gathering a robot swarm using circulant communication strategies: 10th International Congress on Industrial and Applied Mathematics (Tokyo, JP, 08/23)

Generic steady state bifurcations in homogeneous coupled cell networks and related equivariant dynamics: SIAM Workshop on Network Dynamics (Pittsburgh, PA, USA, 14/07/17)

Generic Steady State Bifurcations in Homogeneous Coupled Cell Networks: SIAM Annual Meeting (Pittsburgh, PA, USA, 11/07/17)

Organized Events

Hypernetworks and their dynamics in theory and applications: Minisymposium at the 10th International Congress on Industrial and Applied Mathematics (08/23)

Novel approaches to networks with varying topologies: Minisymposium at the SIAM Conference on Applications of Dynamical Systems (17/05/23)

Dynamics of and on Networks: Minisymposium at the SIAM Conference on Applications of Dynamical Systems (24/05/21)

Novel Directions in Network Dynamical Systems: Minisymposium at the SIAM Conference on Applications of Dynamical Systems (19/05/19)

Conferences

Dynamical Systems in Porto: Porto, PT, 01/11/2023–17/11/2023

10th International Congress on Industrial and Applied Mathematics: Tokyo, JP, 20/08/23–25/08/23

SIAM Conference on Applications of Dynamical Systems: Portland, OR, USA, 14/05/23–18/05/23

SIAM Conference on Nonlinear Waves and Coherent Structures: Bremen, D, 30/08/22–02/09/22

SIAM Conference on Applications of Dynamical Systems: virtual conference, 23/05/21–27/05/21

Hamburg Shrinking Targets Workshop: Hamburg, D, 13/11/19–15/11/19

Hanseatic Dynamical Systems Days: Bremen, D, 21/06/19

SIAM Conference on Applications of Dynamical Systems: Snowbird, UT, USA, 19/05/19–23/05/19

Hanseatic Dynamical Systems Days: Lübeck, D, 23/11/18

Hanseatic Dynamical Systems Days: Hamburg, D, 29/06/18

SIAM Workshop on Network Dynamics: Pittsburgh, PA, USA, 13/07/17–14/07/17

SIAM Annual Meeting: Pittsburgh, PA, USA, 10/07/17–14/07/17

Workshop on Emerging Topics in Network Dynamical Systems: Leiden, NL, 06/06/17–09/06/17

SIAM Conference on Applications of Dynamical Systems: Snowbird, UT, USA, 21/05/17–25/05/17

Annual Meeting of the German Mathematical Society 2015: Hamburg, D, 21/09/15–25/09/15

Research Stays

Vrije Universiteit Amsterdam — **Amsterdam, Netherlands**
Invitation by Christian Bick — *14/06/22–17/06/22*

Vrije Universiteit Amsterdam — **Amsterdam, Netherlands**
Invitation by Bob Rink — *14/01/19–01/02/19*

Universidade do Porto — **Porto, Portugal**
PPP Projekt Heterokline Dynamik: Stabilität und Bifurkationen — *19/06/18–23/06/18*

Vrije Universiteit Amsterdam — **Amsterdam, Netherlands**
Invitation by Bob Rink — *15/04/18–20/04/18*

Vrije Universiteit Amsterdam — **Amsterdam, Netherlands**
Invitation by Bob Rink and Eddie Nijholt — *21/08/17–25/08/17*

Grants

DAAD: Travel Award to the SIAM Conference on Applications of Dynamical Systems 2019

SIAM Student Chapter Universität Hamburg: Travel Award to the SIAM Annual Meeting and the SIAM Workshop on Network Dynamics 2017

SIAM: Travel Award to the SIAM Annual Meeting 2017

Carl Christiansen-Gedächtnis-Stiftung: Travel Award to the SIAM Conference on Applications of Dynamical Systems 2017

MIN-Graduiertenschule der Universität Hamburg: Travel Award to the SIAM Conference on Applications of Dynamical Systems 2017

Deutsche Mathematiker-Vereinigung: DMV Student Grant for the Annual Meeting of the German Mathematical Society 2015

Professional Societies

Society for Industrial and Applied Mathematics

Referee

Journal of Dynamics and Differential Equations

Nonlinearity

SIAM Journal on Applied Dynamical Systems

Mathematical Reviews – MathSciNet

Teaching

Teaching Assistant Analysis III
Technische Universität Hamburg *11/21–02/22*

Teaching Assistant Differential Equations I
Technische Universität Hamburg *10/20–02/21*

Development and TA of the MOOC Linear Algebra Driven by Data Science
HafenCity Universität Hamburg *01/20–12/20*

Teaching Assistant Differential Equations I
Technische Universität Hamburg *10/19–02/20*

Teaching Assistant Analysis III
Technische Universität Hamburg *10/19–02/20*

Teaching Assistant Analysis II
Technische Universität Hamburg *04/19–09/19*

Teaching Assistant Differential Equations I
Technische Universität Hamburg *10/18–02/19*

Teaching Assistant Analysis III
Technische Universität Hamburg *10/17–02/18*

Teaching Assistant Differential Equations I
Technische Universität Hamburg *10/17–02/18*

Teaching Assistant Ordinary Differential Equations and Dynamical Systems
Universität Hamburg *04/17–09/17*

Teaching Assistant Differential Equations I
Technische Universität Hamburg *10/16–02/17*

Teaching Assistant Analysis I
Technische Universität Hamburg *10/15–02/16*

Student Assistant Analysis I & II
Universität Hamburg *10/14–08/15*

Student Assistant Higher Analysis
Universität Hamburg *10/13–03/14*

Student Assistant Analysis I & II
Universität Hamburg *10/12–09/13*

Committees

Selection Committee
Junior Professor Optimization and Approximation *07/16–06/17*

Selection Committee
Junior Professor Differential Equations and Dynamical Systems *07/16–01/17*

Other Qualifications and Skills

Language: German (native), English (fluent), French (advanced beginner)
OS: Windows
Text production: Word, LaTeX
Computer algebra systems: GAP, MAPLE
Machine Learning: Online courses of the Coursera specialisation Deep Learning
Programming: basic skills in Python