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

C. Bick and **von der Gracht, S.** "Heteroclinic Dynamics in Network Dynamical Systems with Higher-Order Interactions". *Journal of Complex Networks* accepted for publication (2024).

von der Gracht, S., E. Nijholt, and B. Rink. "Hypernetworks: Cluster Synchronization Is a Higher-Order Effect". *SIAM Journal on Applied Mathematics* 83.6 (2023), pp. 2329–2353.

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

R. Gerlach, **von der Gracht, S.**, and M. Dellnitz. "On the Dynamical Hierarchy in Gathering Protocols with Circulant Topologies" (2023). arXiv: 2305.06632.

von der Gracht, S., E. Nijholt, and B. Rink. "A parametrisation method for high-order phase reduction in coupled oscillator networks" (2023). arXiv: 2306.03320.

von der Gracht, S., E. Nijholt, and B. Rink. "Higher order interactions lead to "reluctant" synchrony breaking" (2023). arXiv: 2311.17186.

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

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

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

Strange symmetries and strange bifurcations in network dynamical systems: Dynamical Systems in Porto - Dynamics of singularities and networks (Porto, PT, 15/11/2023)

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

Higher order interactions shape dynamics differently than diadic interactions: Oberseminar Angewandte Mathematik (Paderborn University, 09/11/23)

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, 25/08/23)

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)

Grants and Funding

DFG: Conference Support Grant for the Workshop on Nonlinear Dynamics 2024 together with Dr. A. Lohse (€20,000)

ICIAM: Financial Support Grant for the 10th International Congress on Industrial and Applied Mathematics 2023 (approx. €300)

DAAD: Travel Award to the 10th International Congress on Industrial and Applied Mathematics 2023 (approx. €2,000)

DAAD: Travel Award to the SIAM Conference on Applications of Dynamical Systems 2019 (approx. €2,000)

SIAM Student Chapter Universität Hamburg: Travel Award to the SIAM Annual Meeting and the SIAM Workshop on Network Dynamics 2017 (approx. €2,100)

SIAM: Travel Award to the SIAM Annual Meeting 2017 (approx. €600)

MIN-Graduiertenschule der Universität Hamburg: Travel Award to the Workshop on Emerging Topics in Network Dynamical Systems 2017 (€100)

Carl Christiansen-Gedächtnis-Stiftung: Travel Award to the SIAM Conference on Applications of Dynamical Systems 2017 (€900)

MIN-Graduiertenschule der Universität Hamburg: Travel Award to the SIAM Conference on Applications of Dynamical Systems 2017 (€1,250)

Organized Events

Minisymposium *Realization of connection structures in phase space*: XLIV Dynamics Days Europe Bremen (08/23)

Workshop on Nonlinear Dynamics 2024: Universität Hamburg (24/07/24–26/07/24)

Minisymposium *Hypernetworks and their dynamics in theory and applications*: 10th International Congress on Industrial and Applied Mathematics (25/08/23)

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

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

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

Conferences

XLIV Dynamics Days Europe: Bremen, D, 29/07/24–02/08/24

Workshop on Nonlinear Dynamics: Hamburg, D, 24/07/24–26/07/24

International Workshop: Dynamics in Coupled Network Systems: Berlin, D, 20/11/23–22/11/23

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*

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*

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