

Sören von der Gracht, born Schwenker

Contact Data

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WOS ResearcherID: AAU-9040-2020

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

Invitation by Christian Bick

Amsterdam, Netherlands

14/06/22–17/06/22

Vrije Universiteit Amsterdam

Invitation by Bob Rink

Amsterdam, Netherlands

14/01/19–01/02/19

Universidade do Porto

PPP Projekt Heterokline Dynamik: Stabilität und Bifurkationen

Porto, Portugal

19/06/18–23/06/18

Vrije Universiteit Amsterdam

Invitation by Bob Rink

Amsterdam, Netherlands

15/04/18–20/04/18

Vrije Universiteit Amsterdam

Invitation by Bob Rink and Eddie Nijholt

Amsterdam, Netherlands

21/08/17–25/08/17

Grants

ICIAM: Financial Support Grant for the 10th International Congress on Industrial and Applied Mathematics 2023

DAAD: Travel Award to the 10th International Congress on Industrial and Applied Mathematics 2023

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 <i>Technische Universität Hamburg</i>	11/21–02/22
Teaching Assistant Differential Equations I <i>Technische Universität Hamburg</i>	10/20–02/21
Development and TA of the MOOC Linear Algebra Driven by Data Science <i>HafenCity Universität Hamburg</i>	01/20–12/20
Teaching Assistant Differential Equations I <i>Technische Universität Hamburg</i>	10/19–02/20
Teaching Assistant Analysis III <i>Technische Universität Hamburg</i>	10/19–02/20
Teaching Assistant Analysis II <i>Technische Universität Hamburg</i>	04/19–09/19
Teaching Assistant Differential Equations I <i>Technische Universität Hamburg</i>	10/18–02/19
Teaching Assistant Analysis III <i>Technische Universität Hamburg</i>	10/17–02/18
Teaching Assistant Differential Equations I <i>Technische Universität Hamburg</i>	10/17–02/18
Teaching Assistant Ordinary Differential Equations and Dynamical Systems <i>Universität Hamburg</i>	04/17–09/17
Teaching Assistant Differential Equations I <i>Technische Universität Hamburg</i>	10/16–02/17
Teaching Assistant Analysis I <i>Technische Universität Hamburg</i>	10/15–02/16
Student Assistant Analysis I & II <i>Universität Hamburg</i>	10/14–08/15
Student Assistant Higher Analysis <i>Universität Hamburg</i>	10/13–03/14
Student Assistant Analysis I & II <i>Universität Hamburg</i>	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