Christoph Kawan

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Personal information

Date of birth	10/30/1980
Place of birth	Kempten (Germany)
Nationality	German

Main research interests

- Entropy and information measures for networked control systems
- Hyperbolic theory of dynamical and control systems
- Analysis and control of large-scale systems

Employment history

Since 5/2019   **Scientific employee**, *Ludwig Maximilian University of Munich (Germany)*, Institute of Informatics, Research group of Prof. Majid Zamani.

1/2015– 4/2019   **Scientific employee**, *University of Passau (Germany)*, Faculty of Computer Science and Mathematics, Chair of Dynamical Systems.

2/2014– 10/2014   **Research scholar**, *New York University (USA)*, Courant Institute of Mathematical Sciences, Financed by a DFG fellowship.

2/2012– 1/2014   **Scientific employee**, *University of Augsburg (Germany)*, Mathematical Institute, Chair of Applied Analysis.

9/2011– 12/2011   **FAPESP Fellow**, *University of Campinas (Brasil)*, Institute of Mathematics, Statistics and Computer Science, Financed by a FAPESP grant.

11/2006– 8/2011   **Scientific employee**, *University of Augsburg (Germany)*, Mathematical Institute, Chair of Applied Analysis.

Education and scientific career

5/2013– 10/2014   **Venia Legendi**, *Habilitation in mathematics at the University of Augsburg*, Date of the habilitation certificate: 10/29/2014, Title of the habilitation thesis: Invariance Entropy for Deterministic Control Systems - An Introduction (Lecture Notes in Mathematics 2089. Berlin: Springer 2013).

10/2006–5/2009	**Dr. rer. nat.**, *Doctorate at the Chair of Applied Analysis, Mathematical Institute of the University of Augsburg*, Date of doctoral defense: 11/17/2009; Grade: magna cum laude (1.0), Title of the thesis: Invariance Entropy for Control Systems. Advisor: Prof. Dr. Fritz Colonius; Second referee: Prof. Dr. Uwe Helmke	
10/2001–9/2006	**Dipl.-Math.**, *Studies of mathematics with physics as a minor subject at the University of Augsburg*, Diploma in mathematics on 9/29/2006 with grade 1.4, Title of the diploma thesis: Nachweis topologischer Konjugiertheit mittels Fixpunktmethoden (Analysis of Topological Conjugacy via Fixed Point Methods). Advisor: Prof. Dr. Fritz Colonius; Second referee: Prof. Dr. Jost Eschenburg	

Teaching experience

University of Passau

2018/19 WS	Lecturing	*Analysis II*
2018 SS	Seminar	*The data-rate theorem*
2017/18 WS	Lecturing	*Fundamentals of dynamical systems*
2017 SS	Lecturing	*Dynamical systems*
2016/17 WS	Tutoring	*Mathematical systems theory*
2016/17 WS	Tutoring	*Linear algebra I*
2016 SS	Co-organization of a seminar and lecturing	*Control of stochastic systems*
2016 SS	Lecturing	*Ordinary differential equations*
2015/16 WS	Lecturing	*Symbolic dynamics and coding*
2015 SS	Tutoring	*Fundamentals of dynamical systems*
2015 SS	Tutoring	*Analysis I*

University of Augsburg

2013/14 SS	Lecturing	*Dynamical systems*
2013 SS	Co-organization of a seminar and supervision	*Special topics in ordinary differential equations*
2012/13 WS	Tutoring	*Representation theory of compact Lie groups*
2011 SS	Administration of the tutorials	*Numerical mathematics II*
2010 SS	Tutoring	*Differential forms in algebraic topology*
2009/10 WS	Tutoring	*Ordinary differential equations*
2007/08 WS	Tutoring and administration of the tutorials	*Linear algebra II*
2007 SS	Administration of the tutorials	*Linear algebra I*
2006/07 WS	Tutoring	*Riemannian geometry*
2004/05 WS	Tutoring	*Analysis III*
2004 SS	Tutoring	*Complex analysis*

Research stays

9/2018	**Kingston (Canada)**, *Department of Mathematics and Statistics, Queen's University*, Research visit, on invitation of Prof. Serdar Yüksel.

10/2016	**Kingston (Canada)**, *Department of Mathematics and Statistics, Queen's University*, Research visit, on invitation of Prof. Serdar Yüksel.
7/2014	**Bonn (Germany)**, *Guest at the Max-Planck-Institut für Mathematik*, Participation in the activity 'Dynamics and Numbers', on invitation of Prof. Sergiy Kolyada.
2/2014– 10/2014	**New York (USA)**, *Visiting scholar at the Courant Institute of Mathematical Sciences, New York University*, Guest at the chair of Prof. Lai-Sang Young.
9/2013	**Louvain-la-neuve (Belgium)**, *University Catholique de Louvain, Louvain la-neuve*, Guest of Prof. Jean-Charles Delvenne.
9/2011– 12/2011	**Campinas (Brasil)**, *University of Campinas*, Guest at the chair of Prof. Luiz San Martin.
8/2010	**Campinas and Maringá (Brasil)**, *University of Campinas and University of Maringá*, Guest at the chairs of Prof. Luiz San Martin (Campinas) and Prof. Alexandre Santana (Maringá).

Fellowships and grants

2015	**DAAD Travel grant for visiting international conferences**, *789,00 Euro*.
2014	**DFG Fellowship KA 3893/1-1**, *Title of the project: Entropy of nonautonomous dynamical systems*, 24.889,95 Euro (2.765,55 Euro per month).
2014	**Fellowship of the Max-Planck-Institut für Mathematik Bonn**, *1.150,00 Euro*.
2011	**FAPESP Grant 11/03140-2**, *Title of the project: Invariance entropy of control systems on flag manifolds and homogeneous spaces*, Application together with Prof. Luiz San Martin, 21.333,60 Real (5.333,40 Real per month).
5/2007– 1/2014	**DFG Grants Co 124/17-1 and 17-2**, *within the DFG Priority Programme 1305 'Control theory of digitally networked systems' (except for the period from Sept. to Dec. 2011)*, Co-author of the proposals, Lead applicant: Prof. Dr. Fritz Colonius.

Invited talks

3/23/2021	**Control of chaos with minimal information transfer**, *DynamIC Seminar, Imperial College London*, London, Great Britain.
12/7/2020	**Remote state estimation: a variational formulation for the data-rate limit**, *Oberseminar Dynamische Systeme, University of Passau*, Passau, Germany.
10/3/2018	**Stabilization of nonlinear stochastic dynamical systems under information constraints: A geometric approach**, *Allerton Conference 2018*, Urbana-Champaign (USA).
9/28/2018	**Robust estimation under information constraints for deterministic non-linear systems**, *Queen's University, Control Seminar*, Kingston (Canada).
9/13/2017	**Towards a hyperbolic theory of control**, *19th ÖMG Congress and Annual DMV Meeting*, Salzburg (Austria).
8/29/2017	**Nonlinear control under communication constraints – results and challenges**, *Colloquium talk at the Institute for Systems Theory and Automatic Control; University of Stuttgart*, Stuttgart (Germany).

6/7/2017	**Entropy of nonautonomous dynamical systems**, *International Conference on Differential & Difference Equations and Applications 2017*, Amadora (Portugal).
5/22/2017	**Practical realization of control under minimal data rate requirements**, *TUM Workshop on Inf. and Comm. Theory in Control Systems*, München (Germany).
10/7/2016	**Towards a hyperbolic theory of control**, *Queen's University, Department of Mathematics and Statistics Colloquium*, Kingston (Canada).
7/3/2016	**Hyperbolic mixing sets in control-affine systems**, *11th AIMS Conference on Dynamical Systems, Differential Equations and Applications*, Orlando, Florida (USA).
1/22/2015	**Entropy for control problems and random escape rates**, *BIRS Workshop on Random Dynamical Systems and Multiplicative Ergodic Theorems*, Banff (Canada).
11/18/2014	**Minimal data rates and entropy for digitally networked control systems**, *Dynamical Systems Seminar*, University of Passau (Germany).
7/16/2014	**Minimal data rates and entropy for control problems**, *Lecture at the activity 'Dynamics and Numbers', Max-Planck-Institut für Mathematik*, Bonn (Germany).
9/20/2013	**Entropy in control theory and nonautonomous dynamics**, *Lecture at the* Workshop on Complexity and Dimension Theory of Skew Product Systems *(2nd workshop of the DFG scientific network 'Product Dynamics and Multifractal Analysis'), Erwin-Schrödinger-Institut*, Wien (Austria).
9/3/2013	**Minimal data rates and entropy for control problems**, *Seminar talk at the University of Louvain*, Louvain-la-neuve (Belgium).
7/22/2013	**Minimal data rates and entropy for control problems**, *Seminar talk at the Technical University München*, München (Germany).
7/11/2013	**Entropy for nonautonomous dynamical systems**, *Seminar talk at the Technical University Dresden*, Dresden (Germany).
10/2/2010	**New estimates for invariance entropy**, *International workshop 'The Dynamics of Control'*, Irsee (Germany).
8/13/2010	**Lower bounds for invariance entropy**, *Seminar talk, University of Maringá*, Maringá (Brasil).

Contributed talks

3/3/2021	**Remote state estimation: a variational formulation for the data-rate limit**, *GMA Fachausschuss 1.50; Online workshop*.
3/7/2018	**A general connection between channel capacity and dynamical entropy**, *Oberwolfach Mini-Workshop 'Entropy, information and control'*, Oberwolfach (Germany).
3/6/2018	**Tutorial talk on invariance entropy**, *Oberwolfach Mini-Workshop 'Entropy, information and control'*, Oberwolfach (Germany).
1/25/2018	**Partially hyperbolic sets for control-affine systems**, *Dynamical Systems Seminar*, University of Passau (Germany).
12/12/2017	**State estimation, entropy and Lyapunov exponents**, *IEEE Conference on Decision and Control (CDC 2017)*, Melbourne (Australia).

7/7/2017	**The elegance of mathematical proofs (Die Eleganz mathematischer Beweise)**, *Uni Live Day, University of Passau*, Passau (Germany).
6/27/2017	**Metric and topological entropy bounds on state estimation for stochastic non-linear systems**, *2017 IEEE Intern. Symp. on Inf. Theory*, Aachen (Germany).
2/8/2017	**Towards a uniformly hyperbolic control theory**, *Dynamical Systems Seminar*, University of Passau (Germany).
1/9/2017	**Towards a uniformly hyperbolic control theory**, *Differential Equations Seminar*, University of Augsburg (Germany).
12/14/2016	**Invariance and stationarity in non-linear networked control: deterministic and stochastic formulations**, *IEEE Conference on Decision and Control (CDC 2016)*, Las Vegas (USA).
10/13/2016	**State estimation under communication constraints**, *Dynamics Seminar at the Courant Institute*, New York (USA).
7/8/2015	**Minimal data rates and entropy in digitally networked systems**, *SIAM Conference on Control & Its Applications*, Paris (France).
3/27/2015	**Minimal data rates and entropy in digitally networked systems**, *GAMM 86th Annual Scientific Conference*, Lecce (Italy).
11/4/2015	**Entropy for nonautonomous dynamical systems**, *Dynamical Systems Seminar*, University of Passau (Germany).
5/14/2014	**Minimal data rates and entropy for control problems. Part II**, *Dynamics Seminar at the Courant Institute*, New York (USA).
5/2/2014	**Minimal data rates and entropy for control problems. Part I**, *Dynamics Seminar at the Courant Institute*, New York (USA).
2/21/2014	**A short introduction to control theory. Part II**, *Dynamics Seminar at the Courant Institute*, New York (USA).
2/14/2014	**A short introduction to control theory. Part I**, *Dynamics Seminar at the Courant Institute*, New York, (USA).
9/24/2013	**Minimal data rates and entropy**, *Closing workshop of the DFG Priority Programme 1305*, Koblenz (Germany).
5/7/2013	**Minimal data rates and entropy for control problems**, *Habilitation lecture*, University of Augsburg (Germany).
2/19/2012	**Invariance entropy of control sets**, *Workshop 'Information and control' of the DFG Priority Programme 1305*, University of Augsburg (Germany).
10/21/2011	**Invariance entropy**, *Dynamics Seminar*, University of Campinas (Brasil).
6/6/2011	**Methods for estimating invariance entropy (part 2)**, *Entropy workgroup*, University of Augsburg (Germany).
5/16/2011	**Methods for estimating invariance entropy (part 1)**, *Entropy workgroup*, University of Augsburg (Germany).
4/19/2011	**Invariance entropy**, *GAMM 82nd Annual Scientific Conference*, Graz (Austria).
2/10/2011	**Information measures and invariance for networked control systems**, *Workshop of the DFG Priority Programme 1305*, Bochum (Germany).

1/20/2011	**Dynamical systems and chaos**, *Adult education center (Volkshochschule)*, Kempten (Germany).
11/11/2010	**Topological conjugacy of real projective flows**, *Differential Equations Seminar*, University of Augsburg (Germany).
8/13/2010	**Lower bounds for invariance entropy**, *Dynamics Seminar*, University of Campinas (Brasil).
12/14/2009	**Invariance entropy and escape rates**, *Differential Equations Seminar*, University of Augsburg (Germany).
11/7/2009	**Invariance entropy of control systems**, *Workshop 'Mathematical Analysis of Nonlinear Problems'*, Oberwolfach (Germany).
10/9/2009	**Information measures and invariance for networked control systems**, *Colloquium of the DFG Priority Programme 1305*, Bochum (Germany).
2/18/2009	**Invariance entropy**, *Workshop of DFG Priority Programme 1305*, University of Augsburg (Germany).
6/20/2008	**Invariance entropy for control systems**, *Workshop of the DFG Priority Programme 1305*, Würzburg (Germany).
5/29/2008	**Invariance entropy**, *Workshop 'Set-oriented Numerics in Control Theory' of the DFG Priority Programme 1305*, Bayreuth (Germany).
2/13/2008	**Invariance entropy for control systems**, *Elgersburg Workshop in collaboration with the GAMM committee 'Dynamics and Control Theory'*, Elgersburg (Germany).
9/19/2007	**Lipschitz conjugacy of linear flows**, *International Conference 'Dynamical Methods and Mathematical Modelling'*, Valladolid (Spain).
5/3/2007	**Lipschitz conjugacy of linear flows**, *Differential Equations Seminar*, University of Augsburg (Germany).
5/15/2006	**Analysis of topological conjugacy via fixed point methods**, *Differential Equations Seminar*, University of Augsburg (Germany).

Work as a reviewer for peer-reviewed scientific journals

- Ergodic Theory Dynam. Systems
- J. Difference Equ. Appl.
- Entropy
- Math. Control Signals Systems
- IEEE Trans. Automat. Control
- Automatica
- Topol. Methods Nonlinear Anal.
- Bull. Aust. Math. Soc.
- Dyn. Syst.
- Discrete Contin. Dyn. Syst. A
- Chaos Solitons Fractals
- IMA J. Math. Control Inform.
- J. Dyn. Control Syst.
- Systems Control Lett.
- Math. Phys. Anal. Geom.
- Topology Appl.
- Appl. Math J. Chinese Univ.
- J. Math. Phys.

Further scientific activities

2021	Conception and organization of the Online Seminar on the Interaction of Control and Information (co-organizers: Prof. S. Yüksel, Prof. M. Franceschetti, Prof. A.S. Matveev)
2019–2020	Joint supervision of a PhD student with Prof. Majid Zamani (Computer Science Department, University of Colorado Boulder and Computer Science Department, Ludwig Maximilian University of Munich, Germany)
2018–2020	Joint supervision of a master thesis with Prof. Serdar Yüksel (Queen's University, Kingston, Canada); day of defence: Dec 4, 2020
2019	Organization of the Special Session 'Entropy, Information and Control 1' at the IEEE Information Theory Workshop 2019, Visby, Gotland, Sweden
2018	Guest Editor of the Special Issue 'Entropy in Networked Control' for the journal Entropy
2018	Organization of the Oberwolfach Mini-Workshop 'Entropy, Information and Control' (co-organizers: Fritz Colonius, Girish Nair, Tomasz Downarowicz)
2017	Successful application for the visit of Prof. Adriano Da Silva (University of Campinas, Campinas, Brasil) as a guest scientist at the University of Passau
2016–2018	Work as a regular reviewer for Mathematical Reviews
2016	Co-organization of the session 'Entropy in Information and Control' with Prof. Serdar Yüksel (Queen's University, Kingston) at the IEEE Conference on Decision and Control (CDC 2016), Las Vegas (USA)
2015/16	Successful application for the visit of Prof. Serdar Yüksel (Queen's University, Kingston, Canada) as a guest scientist at the University of Passau
2013–2015	Work as a regular reviewer for the Zentralblatt der Mathematik (ZMATH)
2013	Member of the appointment committee for the W1 Junior Professorship in Mathematics 'Analysis with relations to stochastics' (University of Augsburg)
2010/11	Participation in the 14th internet seminar 'Infinite-dimensional Linear Systems Theory', organized by Birgit Jacob and Hans Zwart

Administrative activities

10/2017–today	Member of the Faculty Council of the Faculty of Mathematics and Computer Science (Univ. Passau)
10/2017–today	Member of the Representative Council for the Academic and Artistic Staff (Univ. Passau)

Language skills

German	Mother tongue
English	Fluently
Portuguese	Basics

Programming and software skills

- Windows and Linux standard programs
- HTML, LaTeX, Maple, Matlab, C, C++

Munich, March 25, 2021