Christian Grussler

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Academic Degrees

February 2017	**Doctor of Philosophy in Engineering** Department of Automatic Control, Lund University, Sweden
February 2012	**Master of Science in Engineering, Engineering Mathematics** Faculty of Engineering, Lund University, Sweden
December 2011	**Diplom-Technomathematiker/Diploma in Industrial Mathematics** Department of Mathematics, University of Kaiserslautern, Germany

Academic Appointments

From March 2022	**Assistant Professor (Senior Lecturer),** Faculty of Mechanical Engineering, Technion – Israel Institute of Technology Limited research and no teaching activities due to war: since Oct 7, 2023
Dec – March 2022	**Administrative Appointment,** Faculty of Mechanical Engineering, Technion – Israel Institute of Technology
Jan 2020 – Jan 2021	**Postdoctoral Scholar,** Department of Computer Sciences and Electrical Engineering, University of California, Berkeley Research towards a systems-based approach of *online optimization/learning* through *total positivity*. Reduced working hours due to childcare during COVID-19 from March 2020. Afterwards: Stay at home father until Dec 2021.
Jan 2018 – Jan 2020	**Research Associate,** Department of Engineering, University of Cambridge Research in the areas of *totally positive systems* & *scalable midrange statistics*. Parental leave: 2019-11-21 –- 2019-12-05 Reduced work for childcare (50 %): 2019-12-06 -– 2020-01-04
Mar 2017 – Dec 2017	**Postdoc,** Department of Automatic Control, Lund University Research in *low-rank optimization* and *positive systems theory*.
Jan 2012 – Feb 2017	**Doctoral student,** Department of Automatic Control, Lund University Research in *model order reduction*, *positive systems* & *low-rank optimization*.

Research Grants

Jul 2023 – Jun 2024	**Jacobs Technion-Cornell Institute**, Travel Grant, Faculty of Mechanical Engineering, Technion – Israel Institute of Technology
Oct 2022 – Sep 2026	**Israel Science Foundation**, Personal Grant: 2406/22, Faculty of Mechanical Engineering, Technion – Israel Institute of Technology
Mar 2022 – Feb 2024	**Jane and Larry Sherman Faculty Fellowship**, Faculty of Mechanical Engineering, Technion – Israel Institute of Technology

Research Interests

Currently, I am interested in the interconnection of systems theory with algorithmic developments in learning and optimization under the framework of total positivity. I am broadly interested in topics including:

- monotone & positive systems
- system identification
- online optimization
- model order reduction
- sparse/low-rank optimization
- (non-)convex optimization
- harmonic analysis
- manifold optimization
- deep learning

Teaching Experience

Lecturer:

Course	Institute	Year	Language
Nonlinear Control Systems	Technion – Israel Institute of Technology	2022	English
Process Optimization	Technion – Israel Institute of Technology	2023	English

Course responsibilities included: development, project supervision, tutorials and home assignments.

Thesis/Project Supervision:

Topic	Student	Institute	Year	Deg.
Data-Driven Control: Analysis of DeePC Algorithm	Netanel Gnatt	Technion – IIT	2023	BSc
Certificates for External Positivity	Sara-Lea Dahan	Technion – IIT	ongoing	BSc
Total Positivity in Control and Machine Learning	Chaim Roth	Technion – IIT	ongoing	MSc
Sparse and Low-rank Optimization	Maya Marmary	Technion – IIT	ongoing	MSc
Data-Driven Control for Robotics	Nadav Barak	Technion – IIT	ongoing	MSc
Customized PID-Autotuning via Learning	Dan Kurulkar	Technion – IIT	ongoing	MSc
Deep Learning of sparsity-inducing Regularizers	Chen Zakaim	Technion – IIT	ongoing	MSc

Responsibilities include: definition and supervision of one-year final projects (BSc), two-year research projects (MSc) and three-year research projects (PhD).

Teaching training:

Course	Institute	Year	Publication
Introduction to Teaching and Learning in Higher Education	Lund University	2013	O1.
Communicating Science	Lund University	2013	O2.

Teaching assistant:

Course	Institute	Language
Mathematical Methods	University of Cambridge	English
Basic Course in Control	Lund University	Swedish & English
Control Theory	Lund University	Swedish
Systems Engineering & Process Control	Lund University	Swedish
International Project Course in Control	Lund University	Swedish & English
Nonlinear Control & Servo Systems	Lund University	Swedish & English
Praktische Mathematik – Numerik *(Numerical Linear Algebra & Analysis)*	University of Kaiserslautern	German

Teaching responsibilities included: laboratory & tutorial sessions, exam preparation, student paper grading.

Public Professional Activities

Seminar Series Organizer:

- Systems & Control Theory (CST) Seminar Series, Technion – Israel Institute of Technology (from Oct 2022)

Workshop Organizer:

- Algorithmic Nonlinear Control: The Circuit Approach, Israeli Association for Automatic Control (2023)

Guest Course Organizer:

- Secure control for networked cyber-physical systems, Technion – Israel Institute of Technology (2023)

Journal reviewer for:

- Algorithms
- Automatica
- East Asian Journal on Applied Mathematics
- European Journal of Control
- IEEE Control Systems Letters (L-CSS)
- IEEE Transactions on Automatic Control
- IEEE Transactions on Neural Networks and Learning Systems
- IEEE Transactions on Network Science and Engineering
- International Journal of Robust and Nonlinear Control

- Linear Algebra and its Applications
- Mathematics of Control, Signals and Systems
- SIAM Journal on Control and Optimization
- SIAM Journal on Matrix Analysis and Applications
- TOP

Conference reviewer for:

- European Control Conference (ECC)
- IEEE American Control Conference (ACC)
- IEEE Conference on Decision and Control (CDC)
- IEEE Indian Control Conference (ICC)
- IFAC World Congress
- Mediterranean Conference on Control and Automation (MED)

Conference session (co-)chair for:

- European Control Conference (ECC)
- IEEE Conference on Decision and Control (CDC)

Publications

Theses

T1. C. Grussler (2012). "Model Reduction of Positive Systems". MA thesis. Lund Institute of Technology, Lund University

T2. C. Grussler (2017). "Rank Reduction with Convex Constraints". PhD thesis. Department of Automatic Control, Lund Institute of Technology, Lund University

Refereed papers in professional journals

Published:

J1. **C. Grussler**, A. Rantzer, and P. Giselsson (2018). "Low-Rank Optimization With Convex Constraints". In: *IEEE Transactions on Automatic Control* 63.11, pp. 4000–4007

J2. **C. Grussler** and P. Giselsson (2018). "Low-Rank Inducing Norms with Optimality Interpretations". In: *SIAM Journal on Optimization* 28.4, pp. 3057–3078

J3. C. Mostajeran, **C. Grussler**, and R. Sepulchre (2020). "Geometric Matrix Midranges". In: *SIAM Journal on Matrix Analysis and Applications* 41.3, pp. 1347–1368

J4. **C. Grussler** and A. Rantzer (2021). "On Second-Order Cone Positive Systems". In: *SIAM Journal on Control and Optimization* 59.4, pp. 2717–2739

J5. **C. Grussler** and P. Giselsson (2021). "Efficient Proximal Mapping Computation for Unitarily Invariant Low-Rank Inducing Norms". In: *Journal of Optimization Theory and Applications*, pp. 1573–2878

J6. **C. Grussler** and R. Sepulchre (2022). "Variation diminishing linear time-invariant systems". In: *Automatica* 136, p. 109985. ISSN: 0005-1098

J7. **C. Grussler**, T. Damm, and R. Sepulchre (2022). "Balanced truncation of k-positive systems". In: *IEEE Transactions on Automatic Control* 67.1, pp. 526–531

J8. **C. Grussler** and A. Rantzer (2022). "On the similarity to nonnegative and Metzler Hessenberg forms". In: *Special Matrices* 10.1, pp. 1–8

J9. **C. Grussler**, T. Burghi, and S. Sojoudi (2022). "Internally Hankel k-Positive Systems". In: *SIAM Journal on Control and Optimization* 60.4, pp. 2373–2392

Refereed papers in conference proceedings

Published:

C1. **C. Grussler** and T. Damm (2012). "A symmetry approach for balanced truncation of positive linear systems". In: *51st IEEE Conference on Decision and Control (CDC)*. Maui, HI, USA, pp. 4308–4313

C2. **C. Grussler** and A. Rantzer (2014). "Modified balanced truncation preserving ellipsoidal cone-invariance". In: *53rd IEEE Conference on Decision and Control (CDC)*. Los Angeles, CA, USA, pp. 2365–2370

C3. **C. Grussler** and A. Rantzer (2015). "On optimal low-rank approximation of non-negative matrices". In: *54th IEEE Conference on Decision and Control (CDC)*. Osaka, Japan, pp. 5278–5283

C4. **C. Grussler**, A. Zare, M. R. Jovanović, and A. Rantzer (2016). "The Use of the $r*$ Heuristic in Covariance Completion Problems". In: *55th IEEE Conference on Decision and Control (CDC)*. Las Vegas, NV, USA, pp. 1978–1983

C5. **C. Grussler** and P. Giselsson (2017). "Local Convergence of Proximal Splitting Methods for Rank Constrained Problems". In: *56th IEEE Conference on Decision and Control (CDC)*. Melbourne, VIC, Australia, pp. 702–708

C6. **C. Grussler**, J. Umenberger, and I. R. Manchester (2017). "Identification of externally positive systems". In: *56th IEEE Conference on Decision and Control (CDC)*. Melbourne, VIC, Australia, pp. 6549–6554

C7. **C. Grussler** and P. Giselsson (2019). "Optimality Interpretations for Atomic Norms". In: *18th European Control Conference (ECC)*. Naples, Italy, pp. 1473–1477

C8. **C. Grussler** and R. Sepulchre (2019). "Strongly unimodal systems". In: *18th European Control Conference (ECC)*. Naples, Italy, pp. 3273–3278

C9. C. Mostajeran, **C. Grussler**, and R. Sepulchre (2019). "Affine-Invariant Midrange Statistics". In: *Geometric Science of Information – 4th International Conference*. Ed. by F. Nielsen and F. Barbaresco. Toulouse, France: Springer International Publishing, pp. 494–501

C10. **C. Grussler** and R. Sepulchre (2020). "Variation diminishing Hankel operators". In: *59th IEEE Conference on Decision and Control (CDC)*, pp. 4529–4534

Accepted:

C11. **C. Grussler** and T. Burghi (2023). *On the monotonicity of frequency response gains*. Presented at the 62nd IEEE Conference on Decision and Control (CDC)

Submitted:

C12. C. Roth and **C. Grussler** (2023). *On Variation Bounding System Operators*. Submitted to the 22nd European Control Conference (ECC)

Other publications

O1. F. Nada, **C. Grussler**, U. Mirza, H. Sina, and L. Wang (2013). "Communication between Educational and Industrial Enterprises: Industrial PhD Students, the Missing Link". In: *Lund University* (2013: Introduction to Teaching and Learning in Higher Education)

O2. **C. Grussler** (2013). "Positive systems – the future of control theory?" In: *Lund University* (2013: Communication Science – Popular Science Article)

Conferences

Invited Workshop Talks

W1. C. Grussler, P. Giselsson, and A. Rantzer (2017). *Low-Rank Inducing Norms with Optimality Interpretations*. LCCC Focus Period Workshop on Large-Scale and Distributed Optimization, Lund, Sweden

W2. C. Grussler, P. Giselsson, and A. Rantzer (2019). *Low-Rank Inducing Norms with Optimality Interpretations*. Workshop on Low-Rank Models and Applications (LRMA), Mons, Belgium

W3. C. Grussler and R. Sepulchre (2020). *The variation diminishing property*. Workshop on Control Across Scales, Cambridge, United Kingdom

W4. C. Grussler and R. Sepulchre (2020). *Variation diminishing in AI and Control*. Workshop on Control Across Scales, Cambridge, United Kingdom

W5. C. Grussler (2023). *Total Positivity – Brief Overview and Future Vision*. Workshop on Geometrically Guided Analysis and Design in Optimization and Control, Singapore

Contributed Talks

C1. C. Grussler and T. Damm (2012). *Symmetric Positivity Preserving Balanced Truncation*. 83rd Annual Meeting of the International Association of Applied Mathematics and Mechanics (GAMM), Darmstadt, Germany

C2. C. Grussler and T. Damm (2012). *A Symmetry Approach for Balanced Truncation of Positive Linear Systems*. 51st IEEE Conference on Decision and Control, Maui, HI, USA

C3. C. Grussler and A. Rantzer (2014). *Modified balanced truncation preserving ellipsoidal cone-invariance*. 53rd IEEE Conference on Decision and Control (CDC), Los Angeles, CA, USA

C4. C. Grussler and A. Rantzer (2015). *On optimal low-rank approximation of non-negative matrices*. 54th IEEE Conference on Decision and Control, Osaka, Japan

C5. C. Grussler, A. Zare, M. R. Jovanović, and A. Rantzer (2016). *The Use of the $r*$ Heuristic in Covariance Completion Problems*. 55th IEEE Conference on Decision and Control (CDC), Las Vegas, NV, USA

C6. C. Grussler, P. Giselsson, and A. Rantzer (2017). *Low-Rank Inducing Norms with Optimality Interpretations*. Southern California Control Workshop, California Institute of Technology, Pasadena, CA, USA

C7. C. Grussler and P. Giselsson (2017). *Local Convergence of Proximal Splitting Methods for Rank Constrained Problems*. 56th IEEE Conference on Decision and Control (CDC), Melbourne, VIC, Australia

C8. C. Grussler, J. Umenberger, and I. R. Manchester (2017). *Identification of externally positive systems*. 56th IEEE Conference on Decision and Control (CDC), Melbourne, VIC, Australia

C9. C. Grussler and R. Sepulchre (2019). *Strongly unimodal systems*. 18th European Control Conference (ECC), Naples, Italy

C10. C. Grussler and P. Giselsson (2019). *Optimality Interpretations for Atomic Norms*. 18th European Control Conference (ECC), Naples, Italy

C11. C. Mostajeran, C. Grussler, and R. Sepulchre (2019). *Affine-Invariant Midrange Statistics*. Geometric Science of Information – 4th International Conference, Toulouse, France

C12. C. Grussler and R. Sepulchre (2020). *Variation diminishing Hankel operators*. Virtual 59th IEEE Conference on Decision and Control (CDC)

C13. C. Grussler, T. Burghi, and S. Sojoudi (2022). *On internally k-positive linear time-invariant system operators*. International Symposium on Mathematical Theory of Networks and Systems

C14. C. Grussler and T.Burghi (2023). *On the monotonicity of frequency response gains*. 62nd IEEE Conference on Decision and Control (CDC), Singapore

Contributed Posters

P1. C. Grussler and A. Rantzer (2014). *Balanced truncation preserving ellipsoidal cone-invariance*. Reglermöte, Linköping, Sweden

P2. C. Grussler and A. Rantzer (2015). *On optimal low-rank approximation of non-negative matrices*. Workshop on Low-rank Optimization and Applications, Bonn, Germany

P3. C. Grussler and A. Rantzer (2015). *On optimal low-rank approximation of non-negative matrices*. IMA Workshop on Optimization and Parsimonious Modelling, Minneapolis, USA

P4. C. Grussler and A. Rantzer (2016). *Low-rank approximation with convex constraints*. Reglermöte, Stockholm, Sweden

Notes

Invited Seminar Talks

S1. C. Grussler and A. Rantzer (2016). *On optimal low-rank approximation of non-negative matrices*. Institute for Mathematics and its Applications, University of Minnesota, USA

S2. C. Grussler, P. Giselsson, and A. Rantzer (2017). *Low-Rank Inducing Norms with Optimality Interpretations*. Viterbi School of Engineering, CommNet Seminar, University of Southern California, Los Angeles, USA

S3. C. Grussler, P. Giselsson, and A. Rantzer (2017). *Low-Rank Inducing Norms with Optimality Interpretations*. Electrical & Computer Engineering Department, University of California, Los Angeles, USA

S4. C. Grussler, P. Giselsson, and A. Rantzer (2017). *Low-Rank Inducing Norms with Optimality Interpretations*. Department of Mechanical Engineering, University of California, Santa Barbara, USA

S5. C. Grussler, P. Giselsson, and A. Rantzer (2017). *Low-Rank Inducing Norms with Optimality Interpretations*. Department of Aeronautics and Astronautics, University of Washington, USA

S6. C. Grussler, P. Giselsson, and A. Rantzer (2017). *Low-Rank Inducing Norms with Optimality Interpretations*. Department of Mechanical & Aerospace Engineering, University of California, Irvine, USA

S7. C. Grussler, P. Giselsson, and A. Rantzer (2017). *Low-Rank Inducing Norms with Optimality Interpretations*. Department of Electrical Engineering, Royal Institute of Technology, Sweden

S8. C. Grussler, P. Giselsson, and A. Rantzer (2017). *Low-Rank Inducing Norms with Optimality Interpretations*. Department of Automatic Control, Linköping University, Sweden

S9. C. Grussler, P. Giselsson, and A. Rantzer (2017). *Low-Rank Inducing Norms with Optimality Interpretations*. Engineering Department, University of Cambridge, Cambridge, United Kingdom

S10. C. Grussler and R. Sepulchre (2020). *Variation Diminishing Systems*. KL-Regelungstechnik-Webinar, TU Kaiserslautern, Germany

S11. C. Grussler (2023). *Variation Diminishing Systems Operators*. Center for Control Science and Technology, CCST Seminar Series, The University of Texas at Dallas, USA

S12. C. Grussler (2023). *Variation Diminishing Systems Operators*. School of Mechanical Engineering, Universidade Estadual de Campinas, Brazil

Software Packages

R1. C. Grussler (2018). *LRINorm – A MATLAB package for rank constrained optimization by low-rank inducing norms and non-convex proximal splitting methods*. `https://github.com/LowRankOpt/LRINorm`

R2. C. Grussler (2018). *LRIPy – A Python package for rank constrained optimization by low-rank inducing norms and non-convex proximal splitting methods*. `https://github.com/LowRankOpt/LRIPy`