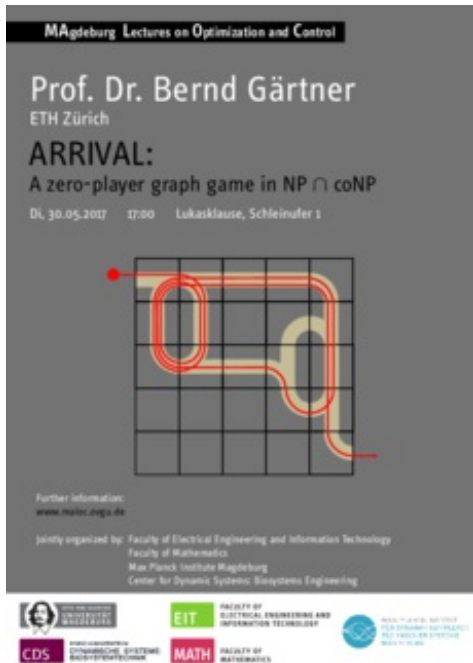


## MAGDEBURG LECTURES ON OPTIMIZATION AND CONTROL

### Past Events



### ARRIVAL: A zero-player graph game in $NP \cap coNP$

› Prof. Dr. Bernd Gärtner  
(<https://people.inf.ethz.ch/gaertner/index.html>)  
ETH Zürich, Schweiz

#### Time & Place

The presentation on May 30, 2017 will be given in the Lukasklausur › (Schleiufer 1, 39104 Magdeburg)  
(<http://ifatwww.et.uni-magdeburg.de/syst/maloc/seminars/Standort%20Lukas%20Klausur.pdf>)  
and starts at 5.00 p.m. (Historischer Raum).

#### Abstract

Suppose that a train is running along a railway network, starting from a designated origin, with the goal of reaching a designated destination. The network, however, is of a special nature: every time the train traverses a switch, the switch will change its position immediately afterwards. Hence, the next time the train traverses the same switch, the other direction will

be taken, so that directions alternate with each traversal of the switch.

Given a network with origin and destination, what is the complexity of deciding whether the train, starting at the origin, will eventually reach the destination?

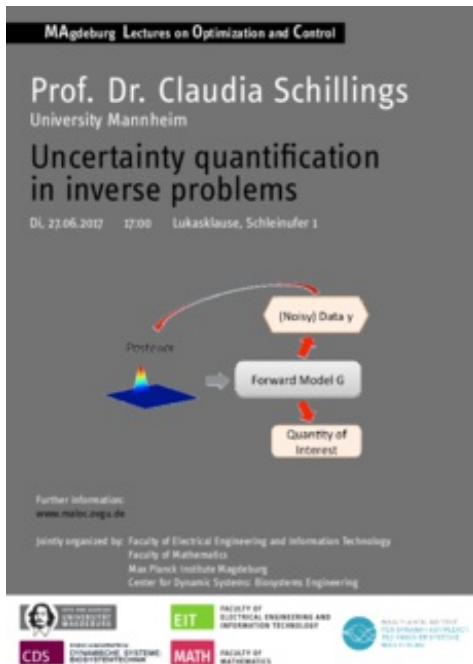
It is easy to see that this problem can be solved in exponential time, but we are not aware of any polynomial-time method. In this talk, I explain where the problem comes from and prove that it is in  $NP \cap coNP$ ; actually in  $UP \cap coUP$  (problems with unique  $NP/coNP$  certificates).

This raises the question whether people have so far just failed to find a (simple) polynomial-time solution, or whether the complexity status is more subtle, as for some other well-known (two-player) graph games.

Joint work with Jérôme Dohrau, Hagar Mosaad, Manuel Kohler, Jiří Matoušek, Emo Welzl

### Uncertainty quantification in inverse problems

› Prof. Dr. Claudia Schillings (<https://www.uni->



mannheim.de/ionas/uni/experten/Informatik%20und%20Mathematik/Wirtschaftsmathematik/Prof.%20Dr.%20Claudia%20Schillings/)

Universität Mannheim

### Time & Place

The presentation on June 27, 2017 will be given in the Lukasklausur (Schleifufer 1, 39104 Magdeburg) (<http://ifatwww.et.uni-magdeburg.de/syst/maloc/seminars/Standort%20Lukas%20Klausur.pdf>) and starts at 5.00 p.m. (Großer Saal).

### Abstract

Uncertainty quantification is an interesting, fast growing research area aiming at developing methods to address, characterize and minimize the impact of parameter, data and model uncertainty in complex systems. Applications of uncertainty quantification include all areas of engineering, environmental, physical and biological systems, e.g., groundwater flow problems, shape uncertainties in aerodynamic applications or nano-optics, biochemical networks and finance. The efficient treatment of uncertainties in mathematical models requires ideas and tools from various disciplines including numerical analysis, statistics, probability and computational science. In this talk, we will focus on the identification of parameters through observations of the response of the system - the inverse problem. The uncertainty in the solution of the inverse problem will be described via the Bayesian approach. We will discuss efficient methods to approximate the solution of the resulting high/ infinite dimensional systems.

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## Mirjam Dür

### Copositive programming: a framework for quadratic and combinatorial optimization

› Prof. Dr. Mirjam Dür

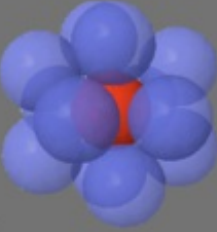
(<https://www.math.uni-trier.de/~duer/>) Department of Mathematics  
University of Trier

### Time & Place


The presentation on December 13, 2016 will be given in the Carnot-Gebäude G25 in Room 201 and starts at 5.00 p.m..

### Abstract

**MAGdeburg Lectures on Optimization and Control**  
**Prof. Dr. Mirjam Dür**  
 University of Trier  
**Copositive programming:**  
 a framework for quadratic and combinatorial optimization  
 Di, 13.12.2016 17:00 Carner-Gebäude (625-201)



Further information:  
[www.moc.ovgu.de](http://www.moc.ovgu.de)  
 jointly organized by: Faculty of Electrical Engineering and Information Technology  
 Faculty of Mathematics  
 Max-Planck-Institute Magdeburg  
 Center for Dynamic Systems, Robotics Engineering



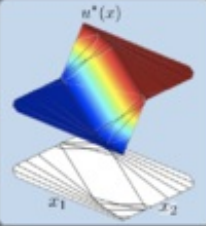
A copositive optimization problem is a problem in matrix variables with a constraint which requires that the matrix be in the copositive cone. This means that its quadratic form takes nonnegative values over the nonnegative orthant. Many combinatorial problems like for example the maximum clique problem can be equivalently formulated as a copositive problem. Burer (2009) showed that also any nonconvex quadratic problem with linear constraints and binary variables can be reformulated as such a copositive problem. This is remarkable, since by this approach, a nonconvex problem is reformulated equivalently as a convex problem. The complexity of the original problem is entirely shifted into the cone constraint. We review recent progress in this area, concerning both theoretical results and numerical issues. In particular, we show how this approach can be used to deal with the stable set problem for infinite graphs, an application of which is the famous kissing number problem.

The lecture is part of the >10th CDS anniversary


([http://www.cds.ovgu.de/News/Veranstaltungen/13\\_+Dezember+Festveranstaltung+10+Jahre+CDS-p-280.html](http://www.cds.ovgu.de/News/Veranstaltungen/13_+Dezember+Festveranstaltung+10+Jahre+CDS-p-280.html)).

## Manfred Morari

**MAGdeburg Lectures on Optimization and Control**  
**Prof. Dr. Manfred Morari**  
 University of Pennsylvania  
**Computation and uncertainty**  
 The past, present and future of control  
 Di, 18.10.2016 17:00-18:00 Lukasklausur, Schleiner 1



Further information:  
[www.moc.ovgu.de](http://www.moc.ovgu.de)  
 jointly organized by: Faculty of Electrical Engineering and Information Technology  
 Faculty of Mathematics  
 Max-Planck-Institute Magdeburg  
 Center for Dynamic Systems, Robotics Engineering



### Computation and uncertainty — The past, present and future of control

>Prof. Dr. Manfred Morari

([https://www.seas.upenn.edu/directory/profile.php?](https://www.seas.upenn.edu/directory/profile.php?ID=213)

ID=213) Distinguished Faculty Fellow

University of Pennsylvania

#### Time & Place

The presentation on October 18, 2016 will be given in the Lukasklausur >(Schleiner 1, 39104 Magdeburg)

(<http://ifatwww.et.uni->

magdeburg.de/syst/maloc/seminars/Standort%20Lukas%20Klausur.pdf

and starts at 5.00 p.m. (Historischer Raum).

#### Abstract

Reflecting on our work over the last 40 years I found that it was dominated by two themes: computation and uncertainty. I will describe how the rapidly increasing computational resources have affected our approaches to deal with uncertainty in feedback control. The talk will be illustrated by

examples from process control and other application areas like automotive and power systems.

#### Bio

Manfred Morari was head of the Department of Information Technology and Electrical Engineering at ETH Zurich from 2009 to 2012 and head of the Automatic Control Laboratory from 1994 to 2008. Before that he was the McCollum-Corcoran Professor of Chemical Engineering and Executive Officer for Control and Dynamical Systems at the California Institute of Technology. From 1977 to 1983 he was on the faculty of the University of Wisconsin. He obtained the diploma from ETH Zurich and the Ph.D. from the University of Minnesota, both in chemical engineering. His interests are in constrained and robust control. Morari's research is internationally recognized. The analysis techniques and

software developed in his group are used in universities and industry throughout the world. He has received numerous awards, including the Eckman Award, Ragazzini Award and Bellman Control Heritage Award from the American Automatic Control Council; the Colburn Award, Professional Progress Award and CAST Division Award from the American Institute of Chemical Engineers; the Control Systems Technical Field Award and the Bode Lecture Prize from IEEE. He is a Fellow of IEEE, AIChE and IFAC. In 1993 he was elected to the U.S. National Academy of Engineering and to the UK Royal Academy of Engineering in 2015. He served on the technical advisory boards of several major corporations.

## Britta Peis



### Matchings and Matroids in Algorithmic Game Theory

› Prof. Dr. Britta Peis (<http://www.wiwi.rwth-aachen.de/cms/Wirtschaftswissenschaften/Die-Fakultaet/Institute-und-Lehrstuehle/Professoren/~eikd/Peis-Britta/?lid=1>)

RWTH Aachen University  
Chair of Management Science

#### Time & Place

The presentation on October 25, 2016 will be given in the Lukasklausur › (Schleifufer 1, 39104 Magdeburg)

(<http://ifatwww.et.uni-magdeburg.de/syst/maloc/seminars/Standort%20Lukas%20Klausur.pdf>) and starts at 5.00 p.m. (Historischer Raum).

#### Abstract

Throughout the talk we will see that the theory of combinatorial optimization turns out to be extremely helpful when it comes to analyzing game-theoretic models. We focus on the important role of structures and algorithms known from matching- and matroid theory for network bargaining games and congestion

games. For example, we will see that congestion games are immune to Braess' paradox if (and only if) each player's strategy space forms the base set of a matroid.

## Zlatko Drmac

Magdeburg Lectures on Optimization and Control

Prof. Dr. Zlatko Drmac  
University of Zagreb

Accurate linear algebra in computational methods for system and control theory

**Tuesday, 05.07.2016 17:00**  
**Lukasklausur, Schleifufer 1**

Jointly organized by: Faculty of Electrical Engineering and Information Technology, Faculty of Mathematics, Max Planck Institute Magdeburg Center for Dynamic Systems: Biosystems Engineering

**MAGdeburg Lectures on Optimization and Control**

**Prof. Dr. Zlatko Drmač**  
University of Zagreb

**Accurate linear algebra in computational methods for system and control theory**

Di, 05.07.2016 17:00-18:00 Lukasklausur, Schleifufer 1

Further information:  
[www.maloc.ovgu.de](http://www.maloc.ovgu.de)

Jointly organized by: Faculty of Electrical Engineering and Information Technology  
Faculty of Mathematics  
Max Planck Institute Magdeburg  
Center for Dynamic Systems, Biosystems Engineering

**CDS** DYNAMISCHE SYSTEME BIOSYSTEMENGINEERING  
**EIT** FACULTY OF ELECTRICAL ENGINEERING AND INFORMATION TECHNOLOGY  
**MATH** FACULTY OF MATHEMATICS  
MAX-PLANCK-INSTITUT FÜR DYNAMISCHE KOMPLEXE TECHNOLOGISCHE SYSTEME MAGDEBURG

## Alexander Mitsos

### Global Optimization of Unconventional Formulations for Sustainable Energy Systems

> more ... (<https://www.maloc.ovgu.de/Past/Alexander+Mitsos.html>)

**MAGdeburg Lectures on Optimization and Control**

**Prof. Alexander Mitsos, Ph.D.**  
RWTH Aachen

**Global Optimization of Unconventional Formulations for Sustainable Energy Systems**

Do, 03.05.2016 17:00-18:00 Lukasklausur, Schleifufer 1

$$\begin{aligned} \min_{x \in X} f(x) \\ \text{s.t. } g(x, y) \leq 0, \forall y \in Y \\ |Y| = \infty \end{aligned}$$

Further information:  
[www.maloc.ovgu.de](http://www.maloc.ovgu.de)

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MAX-PLANCK-INSTITUT FÜR DYNAMISCHE KOMPLEXE TECHNOLOGISCHE SYSTEME MAGDEBURG

## Anton Schiela

### Concepts of Function Space Oriented Optimization

Prof. Dr. Anton Schiela  
University of Bayreuth

#### Time & Place

The presentation on January 12, 2016 will be given at the Lukasklausur, Schleifufer 1, Magdeburg and starts at 5.00 p.m.

> more ... (<https://www.maloc.ovgu.de/Past/Anton+Schiela.html>)

**MAGdeburg Lectures on Optimization and Control**

**Prof. Dr. Anton Schiela**  
University of Bayreuth

**Concepts of Function Space Oriented Optimization**

Tue, 12.05.2016 17:00-18:00 Lukasklausur, Schleinerufer 1

Further information:  
[www.maloc.ovgu.de](http://www.maloc.ovgu.de)

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Center for Dynamic Systems: Biosystems Engineering

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## Samuel Fiorini

**MAGdeburg Lectures on Optimization and Control**

**Prof. Dr. Samuel Fiorini**  
Université Libre de Bruxelles

**No Small Linear Program Approximates Vertex Cover within a Factor  $2 - \epsilon$**

Di, 08.12.2015 17:00-18:00 Lukasklausur, Schleinerufer 1

Further information:  
[www.maloc.ovgu.de](http://www.maloc.ovgu.de)

Jointly organized by: Faculty of Electrical Engineering and Information Technology  
Faculty of Mathematics  
Max Planck Institute Magdeburg  
Center for Dynamic Systems: Biosystems Engineering

**CDS** **EIT** **MATH**

No Small Linear Program Approximates Vertex Cover within a Factor  $2 - \epsilon$

Prof. Dr. Samuel Fiorini  
Université Libre de Bruxelles

### Time & Place

The presentation on December 8, 2015 will be given at the Lukasklausur, Schleinerufer 1, Magdeburg and starts at 5.00 p.m.

> more ... (<https://www.maloc.ovgu.de/Past/Samuel+Fiorini.html>)

## Greg Blekherman

**Nonnegative Polynomials and Sum of Squares**

Prof. Greg Blekherman, Ph.D.  
Georgia Tech

### Time & Place

The presentation on June 30, 2015 will be given in the Otto-von-Guericke-University Magdeburg G03-214 > (<http://ifatwww.et.uni-magdeburg.de/syst/maloc/seminars/Standort%20Lukas%20Klausur.pdf>) and starts at 5.00 p.m.

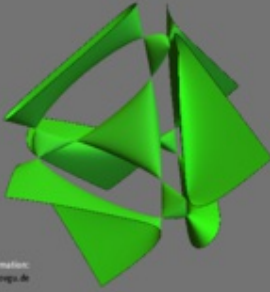
> more ... (<https://www.maloc.ovgu.de/Past/Greg+Blekherman.html>)

**MAGdeburg Lectures on Optimization and Control**

**Prof. Greg Blekherman, Ph.D.**  
Georgia Tech


**Nonnegative Polynomials and Sums of Squares**

Di, 30.06.2015 17:00-18:00 609-214



Further information:  
[www.maloc.ovgu.de](http://www.maloc.ovgu.de)

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Faculty of Mathematics  
Max Planck Institute Magdeburg  
Center for Dynamic Systems: Biosystems Engineering



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