



BRÅKET



*Information om seminarier och högre undervisning
i matematiska ämnen i Stockholmsområdet*

NR 31

FREDAGEN DEN 2 OKTOBER 2009

BRÅKET

Veckobladet från
Institutionen för matematik
vid Kungl Tekniska Högskolan
och Matematiska institutionen
vid Stockholms universitet

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Sista manustid för nästa nummer:
Torsdagen den 8 oktober kl. 13.00.

SEMINARIER

Fr 10-02 kl. 13.15-14.15. Graduate Student Seminar.
Douglas Lundholm: *Spectral theory of the Weighted Supermembrane Toy Model*. Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se Bråket nr 30 sidan 7.

Må 10-05 kl. 15.15-16.00. Seminarium i matematisk statistik. Filip Rudzki presenterar sitt examensarbete: *A Fault Isolation Model Utilising Weighted Information in Military Subsystems*. Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se Bråket nr 30 sidan 7.

Ti 10-06 kl. 15.15-16.15. AlbaNova and Nordita Colloquium in Physics. (*Observera dagen!*) Speaker to be announced: *The Nobel Prize in Physics 2009*. Oskar Kleins auditorium, Roslagstullsbacken 21, AlbaNova universitetscentrum.

On 10-07 kl. 10.15-12.00. Kombinatorikseminarium. Martin Tancer, Charles University, Prague: *Hardness of embedding simplicial complexes in $\mathbb{R}^d$* . Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 4.

Fortsättning på nästa sida.

KTH/SU MATHEMATICS COLLOQUIUM

Norbert Peyerimhoff:

Expander graphs — some background and new examples

Abstract: Expander graphs are exciting combinatorial objects which have both applications in theoretical computer science as well as beautiful connections to many branches of pure mathematics. In this talk we will introduce expander graphs, present some fundamental properties of them and explain the construction of new examples with certain nice properties.

Tid och plats: Onsdagen den 7 oktober kl. 16.00 i seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Kaffe/te serveras kl. 15.30 i pausrummet, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 4.

Seminarier (fortsättning)

- On 10–07 kl. 13.15–14.15. Seminarium i analys och dynamiska system.** Alfonso Montes Rodriguez, Sevilla: *Recent trends on the Volterra operator*. Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.
- On 10–07 kl. 13.15–15.00. Algebra and Geometry Seminar.** Carel Faber, KTH: *On the tautological ring of the moduli space of smooth curves*. Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 5.
- On 10–07 kl. 16.00. KTH/SU Mathematics Colloquium.** Norbert Peyerimhoff, University of Durham: *Expander graphs — some background and new examples*. Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Kaffe/te serveras kl. 15.30 i pausrummet, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 4. Se sidan 1.
- On 10–07 kl. 18.00–19.00. Offentlig föreläsning på Kungl. Vetenskapsakademien.** Professor Lene Westergaard Hau, Harvard University, USA: *Wizardry with light: freeze, teleport, and go!* Beijersalen, Kungl. Vetenskapsakademien, Lilla Frescativägen 4A, Stockholm. Se Bråket nr 30 sidorna 8–9.
- To 10–08 kl. 10.30. Seminar in Fluid Mechanics.** Florian von Stillfried: *Evaluation of a vortex generator model in adverse pressure gradient boundary layers*. Seminarierummet, Institutionen för mekanik, KTH, Teknikringen 8. Se sidan 3.
- To 10–08 kl. 14.00–15.00. Institut Mittag-Leffler Seminar.** Dag Normann, Universitetet i Oslo: *The sequential functionals are far from being algebraic domains*. Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 5.
- To 10–08 kl. 15.30–16.30. Institut Mittag-Leffler Seminar.** Jaap van Oosten, University of Utrecht: *Constructions of (order-) partial combinatory algebras*. Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 6.
- To 10–08 kl. 18.00–20.00. Offentlig föreläsning på Kungl. Vetenskapsakademien:** *Årets Nobelpris i fysik och kemi. Populärvetenskapliga presentationer av årets Nobelpris i fysik och kemi direkt från Nobelkommittéledamöterna själva*. Beijersalen, Kungl. Vetenskapsakademien, Lilla Frescativägen 4A, Stockholm.
- Fr 10–09 kl. 10.15. Licentiatseminarium i reglerteknik.** Erik Henriksson presenterar sin licentiatavhandling: *Compensating for Unreliable Communication Links in Networked Control Systems*. Opponent: Professor Bruno Sinopoli, Carnegie Mellon University. Sal Q21, KTH, Osquildas väg 6, 1 tr. ned. Se sidan 4.
- Fr 10–09 kl. 14.15–15.15. DNA-seminariet Uppsala-KTH (Dynamical systems, Number theory, Analysis).** John H. Hubbard, Department of Mathematics, Cornell University: *Pinched ball models for Hénon maps*. Sal Å2001, Ångströmlaboratoriet, Uppsala universitet. Se sidan 6.
- Fr 10–09 kl. 15.15–16.15. Matematiska kollokviet i Uppsala.** Bo-Göran Johansson, Högskolan på Gotland: *Polynomial equations and trigonometric tables*. Högssalen, Ångströmlaboratoriet, Uppsala universitet. Kaffe/te serveras utanför föreläsningssalen kl. 14.55. Se sidan 6.
- Må 10–12 kl. 15.15–17.00. Seminarium i matematisk statistik.** Michael Björklund, Matematik, KTH: *The ergodic theory of sumsets*. Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 7.

Fortsättning på nästa sida.

Seminarier (fortsättning)

- Ti 10–13 kl. 18.00–19.00. Offentlig föreläsning, anordnad av Kungl. Vetenskapsakademien:** *Årets Ekonomipris. Populärvetenskaplig presentation av årets Ekonomipris (Sveriges Riksbanks pris i ekonomisk vetenskap till Alfred Nobels minne) direkt från Ekonomipriskommitténs ledamöter.* Handelshögskolan i Stockholm, Sveavägen 65.
- On 10–14 kl. 13.15–14.15. Seminarium i analys och dynamiska system. Konstantin Khanin,** Toronto: *Title to be announced.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.
- On 10–14 kl. 13.15. Algebra and Geometry Seminar. David Eklund,** KTH: *Title to be announced.* Rum 306, hus 6, Matematiska institutionen, SU, Kräftriket.
- On 10–14 kl. 14.30–15.30. KCSE (KTH Computational Science and Engineering Centre) Seminar. Henrik Holst,** Numerisk analys, CSC, KTH: *Multi-scale methods for wave propagation in heterogeneous media.* PDC:s seminarierum, KTH, Teknikringen 14, plan 3. Se sidan 5.
- Fr 10–16 kl. 11.00. Optimization and Systems Theory Seminar. Maja Karasalo,** Optimeringslära och systemteori, KTH: *Data Filtering and Control Design for Mobile Robots.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 7.
- Fr 10–16 kl. 13.15–14.15. Graduate Student Seminar. David Eklund,** KTH: *Title to be announced.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

SEMINAR IN FLUID MECHANICS

Florian von Stillfried:

Evaluation of a vortex generator model in adverse pressure gradient boundary layers

Abstract: A statistical vortex generator (VG) model applied in the adverse pressure gradient (APG) flow on a flat plate is used in order to evaluate the sensitivity of this VG model approach qualitatively. The modelling of such passive VGs has the advantage to heavily reduce the complexity of including such flow separation devices in a computational mesh, giving the opportunity to carry out parameter studies rapidly. Stresses, originating from the VG model approach, are added as additional turbulent stresses to the mean governing equations instead of resolving vortex structures in the computational domain. The baseline setting is based on previous experiments at KTH, and APG flat plate results without VGs were compared to corresponding computations. In a further step, the VG model was applied as in experiments and a parameter variation of the VG model streamwise position was carried out. Wall pressure and skin friction coefficient distributions were used in order to judge the VG model. It could be shown that the VG model successfully prevents flow separation for the baseline case, leading to attached flow. Moreover, sensitivity on the flow separation prevention strength could be shown for different VG model streamwise positions by means of skin friction plots.

Tid och plats: Torsdagen den 8 oktober kl. 10.30 i seminarierummet, Institutionen för mekanik, KTH, Teknikringen 8.

KOMBINATORIKSEMINARIUM

Martin Tancer:

Hardness of embedding simplicial complexes in $\mathbb{R}^d$

Abstract: Let $\text{EMBED}_{k \rightarrow d}$ be the following algorithmic problem: Given a finite simplicial complex K of dimension at most k , does there exist a (piecewise linear) embedding of K into $\mathbb{R}^d$? Known results easily imply polynomiality of $\text{EMBED}_{k \rightarrow 2}$ ($k = 1, 2$; the case $k = 1$, $d = 2$ is graph planarity) and of $\text{EMBED}_{k \rightarrow 2k}$ for all $k > 2$ (even if k is not considered fixed).

The main result presented in the talk is NP-hardness of $\text{EMBED}_{2 \rightarrow 4}$ and, more generally, of $\text{EMBED}_{k \rightarrow d}$ for all k, d with $d > 3$ and $d + 1 > k > (2d - 3)/3$. We also show that the celebrated result of Novikov on the algorithmic unsolvability of recognizing the 5-sphere implies that $\text{EMBED}_{d \rightarrow d}$ and $\text{EMBED}_{(d-1) \rightarrow d}$ are undecidable for each $d > 4$.

This is joint work with Jiri Matousek and Uli Wagner.

Tid och plats: Onsdagen den 7 oktober kl. 10.15–12.00 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

LICENTIATSEMINARIUM I REGLERTEKNIK

Erik Henriksson

presenterar sin licentiatavhandling:

Compensating for Unreliable Communication Links in Networked Control Systems

Opponent: **Professor Bruno Sinopoli**, Carnegie Mellon University.

Abstract: Control systems utilizing wireless sensor and actuator networks can be severely affected by the properties of the communication links. Radio fading and interference may cause communication losses and outages in situations when the radio environment is noisy and low transmission power is desirable. This thesis proposes a method to compensate for such unpredictable losses of data in the feedback control loop by introducing a predictive outage compensator (POC). The POC is a filter to be implemented at the receiver sides of networked control systems, where it generates artificial samples when data are lost. If the receiver node does not receive the data, the POC suggests a command based on the history of past data. It is shown how to design, tune and implement a POC. Theoretical bounds and simulation results show that a POC can improve the closed-loop control performance under communication losses considerably. We provide a deterministic and a stochastic method to synthesize POCs. Worst-case performance bounds are given that relate the closed-loop performance with the complexity of the compensator. We also show that it is possible to achieve good performance with a low-order implementation based on Hankel norm approximation. Tradeoffs between achievable performance, communication loss length, and POC order are discussed. The results are illustrated on a simulated example of a multiple-tank process. The thesis is concluded by an experimental validation of wireless control of a physical lab process. Here the controller and the physical system are separated geographically and interfaced through a wireless medium. For the remote control we use a hybrid model predictive controller. The results reflect the difficulties in wireless control as well as they highlight the flexibility and possibilities one obtains by using wireless instead of a wired communication medium.

Tid och plats: Fredagen den 9 oktober kl. 10.15 i sal Q21, KTH, Osquidas väg 6, 1 tr. ned.

ALGEBRA AND GEOMETRY SEMINAR

Carel Faber:

On the tautological ring of the moduli space of smooth curves

Abstract: After recalling necessary background material, I will discuss unpublished results obtained with Zagier several years ago as well as recent results and ongoing work on the relations between tautological classes on the moduli space M_g of smooth curves of genus g .

Tid och plats: Onsdagen den 7 oktober kl. 13.15–15.00 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

INSTITUT MITTAG-LEFFLER SEMINAR

Dag Normann:

The sequential functionals are far from being algebraic domains

Abstract: In 2005 I proved that the sequential functionals of pure type 3 is not a dcpo, and thus does not coincide with the interpretation of pure type 3 in Milner's fully abstract model for PCF.

In two papers from 2007 and 2008, V. Sazonov formulated four conjectures, all expressing that the sequential functionals in general form different kinds of partial orderings than those studied in domain theory.

In this talk, I will report from a research project jointly with Sazonov, where his conjectures are verified in a strong sense.

We will characterize the set of types for which the sequential functionals form a dcpo, and show that sequential functionals in general do not commute with least upper bounds of directed sets.

We will give a brief introduction to the intentional finite sequential procedures leading to the extensional finite sequential functionals, prove one or two technical results and survey other results from this joint project.

Tid och plats: Torsdagen den 8 oktober kl. 14.00–15.00 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

KCSE SEMINAR

Henrik Holst:

Multi-scale methods for wave propagation in heterogeneous media

Abstract: Multi-scale wave propagation problems are computationally costly to solve by traditional techniques because the smallest scales must be represented over a domain determined by the largest scales of the problem. We have developed new numerical methods for multi-scale wave propagation in the framework of heterogeneous multi-scale methods. The numerical methods couple simulations on macro and micro scales with data exchange between models of different scales.

With the new method we are able to consider a general class of problems including some problems where a homogenized equation is unknown. We show that the complexity of the new method is significantly lower than that of traditional techniques. Numerical results are presented from problems in one, two and three dimensions. We also analyse the method, in one and several dimensions, using Fourier analysis.

Tid och plats: Onsdagen den 14 oktober kl. 14.30–15.30 i PDC:s seminarierum, KTH, Teknikringen 14, plan 3.

INSTITUT MITTAG-LEFFLER SEMINAR

Jaap van Oosten:

Constructions of (order-) partial combinatory algebras

Abstract: By looking at sequential functionals on spaces of functions, we can generalize Kleene's pca of functions N^N to sets of functions A^A for arbitrary infinite A . Substructures will be considered, and universal properties with respect to Longley's category of pcas and decidable applicative morphisms.

Tid och plats: Torsdagen den 8 oktober kl. 15.30–16.30 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

DNA-SEMINARIET UPPSALA-KTH

(DYNAMICAL SYSTEMS, NUMBER THEORY, ANALYSIS)

John H. Hubbard:

Pinched ball models for Hénon maps

Abstract: In complex dynamics in one complex variable, the pinched disk model has been the major tool in understanding connected Julia sets.

I will describe the pinched disk model. I will then construct the Bonnot model, which describes the geometry of the very simplest Hénon maps. I correspond to the polynomials $z \mapsto z^k$, but even it is pretty elaborate. I will then show how to pinch the Bonnot model to understand the 4-dimensional geometry of Hénon mappings in $\mathbb{C}^2$ in certain cases.

The talk is based on joint work with Remus Radu and Reluca Tanase.

Tid och plats: Fredagen den 9 oktober kl. 14.15–15.15 i sal Å2001, Ångströmlaboratoriet, Uppsala universitet.

MATEMATISKA KOLLOKVIET I UPPSALA

Bo-Göran Johansson:

Polynomial equations and trigonometric tables

Abstract: Attempts in Arabic mathematics to improve trigonometric tables led to third degree polynomial equations, corresponding to trisecting the angle. One very successful method was found by mathematicians in the Samarkand school in early 15th century. An analysis of the technique shows its dependence on earlier methods used for the extraction of cube roots and higher roots.

Tid och plats: Fredagen den 9 oktober kl. 15.15–16.15 i Högssalen, Ångströmlaboratoriet, Uppsala universitet. Kaffe/te serveras utanför föreläsningssalen kl. 14.55.

Belöning till Bo-Göran Johansson

Kungl. Vetenskapssamhället i Uppsala utdelar vid sin årshögtid den 8 oktober 2009 sitt pris för tvärvetenskapligt arbete till Bo-Göran Johansson för hans bok *Matematikens historia* baserad på hans forskning om medeltida arabisk och europeisk matematik utgående från primärkällor på arabiska, grekiska, sanskrit och latin. Hans forskning är tvärvetenskap av högsta kvalitet och bygger på en sällsynt kombination av matematisk och humanistisk bildning.

Christer Kiselman

SEMINARIUM I MATEMATISK STATISTIK

Michael Björklund:

The ergodic theory of sumsets

Abstract: Additive combinatorics is concerned with the structure of sumsets in countable abelian groups. In this talk I will try to sketch a recent approach to problems in additive combinatorics via ergodic theory. Our main result is an estimate of the size of the sum of two sets in a countable abelian group when one of the sets is open in the Bohr topology, along with sharp characterizations of the end cases. The proofs demand a very good understanding of return time ergodic theorems in the spirit of Bourgain.

The talk is based on joint work with A. Fish.

Tid och plats: Måndagen den 12 oktober kl. 15.15–17.00 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

OPTIMIZATION AND SYSTEMS THEORY SEMINAR

Maja Karasalo:

Data Filtering and Control Design for Mobile Robots

Abstract: In this thesis, we consider problems connected to navigation and tracking for autonomous robots under the assumption of constraints on sensors and kinematics. We study formation control as well as techniques for filtering and smoothing of noise contaminated input. The scientific contributions of the thesis comprise five papers.

The focus of the talk will be on papers C, D and E, in which we investigate theoretical properties and applications for control theoretic smoothing splines.

In Paper C, we consider the problem of estimating a closed curve in the plane based on noise contaminated samples. A recursive control theoretic smoothing spline approach is proposed, that yields an initial estimate of the curve and subsequently computes refinements of the estimate iteratively. Periodic splines are generated by minimizing a cost function subject to constraints imposed by a linear control system. The optimal control problem is shown to be proper, and sufficient optimality conditions are derived for a special case of the problem using Hamilton-Jacobi-Bellman theory.

Paper D continues the study of recursive control theoretic smoothing splines. A discretization of the problem is derived, yielding an unconstrained quadratic programming problem. A proof of convexity for the discretized problem is provided, and the recursive algorithm is evaluated in simulations and experiments using a SICK laser scanner mounted on a Power-Bot from ActivMedia Robotics.

Finally, in Paper E we explore the issue of optimal smoothing for control theoretic smoothing splines. The output of the control theoretic smoothing spline problem is essentially a tradeoff between faithfulness to measurement data and smoothness. This tradeoff is regulated by the so-called smoothing parameter. In Paper E, a method is developed for estimating the optimal value of this smoothing parameter. The procedure is based on general cross validation and requires no a priori information about the underlying curve or level of noise in the measurements.

Tid och plats: Fredagen den 16 oktober kl. 11.00 i seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

Disputation: Maja Karasalo skall disputerar på avhandlingen *Data Filtering and Control Design for Mobile Robots* torsdagen den 22 oktober kl. 10.00 i i sal F3, KTH, Lindstedtsvägen 26, b.v. Se nästa nummer av Bråket.