# BRÅKET

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

**NR 18** **FREDAGEN DEN 9 MAJ 2003**



**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 15 maj kl. 13.00.


## SEMINARIER

**Fr 05–09 kl. 10.00–12.00. Högre seminariet i språkfilosofi och logik. Mattias Högström** presenterar en avhandlingsdel: *Quine on meaning and radical translation.* Rum D700, Filosofiska institutionen, SU, Universitetsvägen 10D, Frescati.

**Fr 05–09 kl. 14.00. Högre seminariet i vetenskapsteori. Johan Lindberg:** *Naturlagarnas modala status.* Rum D700, Filosofiska institutionen, SU, Universitetsvägen 10D, Frescati.

**Må 05–12 kl. 13.00. Seminarium i teoretisk datalogi. Jesper Fredriksson,** Nada, KTH: *Reproducerbarhetsanalys av funktionella hjärnbilder.* Rum 1537, Nada, KTH. Se sidan 6.

**Må 05–12 kl. 13.15–14.15. Seminar in Analysis and its Applications. Abdulhamid Dzhuraev,** Mathematical Institute of the Tajik Academy of Sciences: *On some elliptic equations degenerating on the boundary of considered domains.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 4.

**Fortsättning på nästa sida.**

### Kurs

*Massimo Giulietti:* Algebraic-geometric codes. Se sidorna 8 – 9.

### Besök

Professor Hal White besöker Handelshögskolan och håller en serie gästföreläsningar. Se sidan 12.

### Disputation i matematik

*Niklas Eriksen* disputerar på avhandlingen *Combinatorial methods in comparative genomics* fredagen den 9 maj kl. 10.15 i sal D3, KTH, Lindstedtsvägen 5, b.v. Se Bråket nr 17 sidan 9.

### Disputation i matematik

*Pelle Salomonsson* disputerar på avhandlingen *Contributions to the theory of operads* fredagen den 16 maj kl. 13.00 i sal 14, hus 5, Matematiska institutionen, SU, Kräftriket. Se Bråket nr 16 sidan 5.

**Seminarier (fortsättning)**

**Må 05–12 kl. 15.15 – 16.00. Seminarium i finansiell matematik. Katarina Åselius** presenterar sitt examensarbete: *Tidsserieanalys tillämpad på spreaden SHB-SEB med införande av autoregressiv heteroskedastisk process för variansen.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 8.

**Må 05–12 kl. 15.15. Mathematical Physics Seminar. Richard Szabo,** Heriot-Watt University, Edinburgh: *Quantum field theory on noncommutative phase spaces.* Seminarierummet, Roslagstullsbacken 11, Stockholms centrum för fysik, astronomi, bioteknik (SCFAB, AlbaNova), hus 11. Se sidan 5.

**Ti 05–13 kl. 10.15. Plurikomplexa seminariet.** *(Observera lokalen!)* **Evgeni Leinartas,** Krasnojarsk: *Multidimensional difference equations and amoebas of their characteristic polynomials.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 5.

**Ti 05–13 kl. 13.15. Plurikomplexa seminariet.** *(Observera lokalen!)* **Nguyen Quang Dieu,** Sundsvall: *Remarks on Jensen measures.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 4.

**Ti 05–13 kl. 14.00 – 15.00. Mittag-Leffler Seminar. James L. Massey,** Copenhagen, Denmark: *A simple system description of a class of stream ciphers.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 5.

**Ti 05–13 kl. 15.30 – 16.30. Mittag-Leffler Seminar. Joachim Rosenthal,** University of Notre Dame, Indiana, USA: *Convolutional codes with maximal or near-maximal distance.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 6.

**On 05–14 kl. 10.15 – 12.00. Kombinatorikseminarium. Olle Heden,** KTH: *Construction, classification and enumeration of perfect codes.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 6.

**On 05–14 kl. 13.00. Seminarium i statistik. Dr Fridtjof Thomas,** Väg- och transportforskningsinstitutet (VTI), Borlänge: *Hur teoretisk får en tillämpad statistiker vara?* Sal B705, Statistiska institutionen, SU, Universitetsvägen 10B, plan 7, Frescati. Se Bråket nr 17 sidan 10.

**On 05–14 kl. 13.15. Seminarium i analys och dynamiska system. Nail Ibragimov,** Karlskrona: *Lie group analysis of nonlinear problems.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

**On 05–14 kl. 13.15 – 15.00. Algebra and Geometry Seminar. Gert Almkvist,** Lund: *Four-parametric rational solutions to Painlevé VI.* Rum 306, hus 6, Matematiska institutionen, SU, Kräftriket. Se sidan 4.

**On 05–14 kl. 15.15. Doktorandseminarium. Alexej Schuplev:** *Toricity and multi-fans.* Sal 16, hus 5, Matematiska institutionen, SU, Kräftriket. Se sidan 7.

**To 05–15 kl. 10.15. Mathematical Physics Seminar. Walter Winter,** Technische Universität München: *Resolving degeneracies with future long-baseline-experiments.* Seminarierummet, Roslagstullsbacken 11, Stockholms centrum för fysik, astronomi, bioteknik (SCFAB, AlbaNova), hus 11.

**Fortsättning på nästa sida.**

**Seminarier (fortsättning)**

**To 05–15 kl. 13.00. Gästföreläsning hos Filosofienheten, KTH. Teddy Seidenfeld:** *Some indices of rates of incoherent betting.* Sal D3, KTH, Lindstedtsvägen 5, b.v.

*Teddy Seidenfeld är H. A. Simon Professor of Philosophy and Statistics vid Carnegie Mellon University.*

**To 05–15 kl. 14.00–15.00. Mittag-Leffler Seminar. Anthony Bloch,** University of Michigan, Ann Arbor, USA: *Measure preservation and asymptotic stability in Hamiltonian and nonholonomic mechanical systems.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 11.

**To 05–15 kl. 14.00–16.00. Högre seminariet i teoretisk filosofi. Alp Öktem:** *Formation of Scientific Problems.* Rum D255, Filosofiska institutionen, SU, Universitetsvägen 10D, Frescati.

*I seminariet presenterar Alp Öktem huvudpunkterna i sin färdiga avhandling inför disputationen lördagen den 24 maj kl. 10.00. Avhandlingen har underrubriken: "Towards a Critical Theory of Scientific Belief".*

**To 05–15 kl. 15.30–16.30. Mittag-Leffler Seminar. Arthur J. Krener,** University of California, Davis, USA: *The global convergence of the minimum energy estimator and the local convergence of the extended Kalman filter.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 4.

**To 05–15 kl. 16.00–17.00. Presentation av examensarbete i matematik. Martin Boberg:** *Principal Component Analysis for Value-at-Risk using Monte Carlo Simulation.* Handledare: **Erik Aurell.** Sal 31, hus 5, Matematiska institutionen, SU, Kräftriket. Se sidan 10.

**Fr 05–16 kl. 10.00–11.00. Presentation av examensarbete i matematik. Saad Ali:** *Variationskalkyl och variationsolikheter.* Handledare: **Andrzej Szulkin.** Sal 16, hus 5, Matematiska institutionen, SU, Kräftriket. Se sidan 11.

**Fr 05–16 kl. 10.00–12.00. Högre seminariet i språkfilosofi och logik. Karl Karlander** presenterar en avhandlingsdel: *Quine and meaning scepticism.* Rum D700, Filosofiska institutionen, SU, Universitetsvägen 10D, Frescati.

**Må 05–19 kl. 13.15–15.00. Seminar in Analysis and its Applications. Leopold Flatto:** *Poncelet's theorem, elliptic curves, and double queues.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 9.

**Ti 05–20 kl. 14.00–15.00. Mittag-Leffler Seminar. U. Helmke,** University of Würzburg, Germany: *Projection algorithms for convex and nonconvex feasibility problems.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 7.

**Ti 05–20 kl. 15.30–16.30. Mittag-Leffler Seminar. Hector J. Sussmann,** Rutgers University, Piscataway, New Jersey, USA: *Set-valued derivatives.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 10.

**To 05–22 kl. 14.00–15.00. Mittag-Leffler Seminar. Sergei Treil,** Brown University, Providence, Rhode Island, USA: *Control Theory methods in Harmonic Analysis and vice versa.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 11.

**To 05–22 kl. 15.30–16.30. Mittag-Leffler Seminar. Wolfgang Kliemann,** Iowa State University, Ames, USA: *Bifurcations in control systems.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 7.

## SEMINAR IN ANALYSIS AND ITS APPLICATIONS

### Abdulhamid Dzhuraev: On some elliptic equations degenerating on the boundary of considered domains

*Abstract:* We consider some elliptic equations and systems in a bounded domain, which degenerate on its whole boundary. In case when the boundary of degeneration is not a characteristic set, it is possible to treat usual boundary value problems for such equations and systems, but in general it is not possible if the boundary of degeneration is a characteristic set.

*Tid och plats:* Måndagen den 12 maj kl. 13.15 – 14.15 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

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## PLURIKOMPLEXA SEMINARIET

### Nguyen Quang Dieu: Remarks on Jensen measures

*Abstract:* Let $\Omega$ be a bounded domain in $\mathbb{C}^n$. For each point $z \in \Omega$ we consider the two classes of Jensen measures $J_z = \{\mu : u(z) \leq \int_{\overline{\Omega}} u(x)d\mu, \forall u \in \mathrm{PSH}(\Omega), \sup u < \infty\}$, and $J_z^c = \{\mu : u(z) \leq \int_{\overline{\Omega}} u(x)d\mu, \forall u \in \mathrm{PSH}(\Omega) \cap \mathcal{C}(\overline{\Omega})\}$. Sufficent conditions are given to ensure that $J_z = J_z^c$. This can be applied to get some results about approximation of plurisubharmonic functions on a given domain by a sequence of continuous plurisubharmonic functions. The work presented in this talk is inspired from a recent paper by Frank Wikström.

*Tid och plats:* Tisdagen den 13 maj kl. 13.15 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

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## ALGEBRA AND GEOMETRY SEMINAR

### Gert Almkvist: Four-parametric rational solutions to Painlevé VI

*Abstract:* Second order differential equations with the Painlevé property (the only movable singularities are poles) were classified 100 years ago. These equations are related to e.g. solitons. Recently there has been great interest in *rational* solutions to these equations. I will report about some new rational solutions.

*Tid och plats:* Onsdagen den 14 maj kl. 13.15 – 15.00 i rum 306, hus 6, Matematiska institutionen, SU, Kräftriket.

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## MITTAG-LEFFLER SEMINAR

### Arthur J. Krener: The global convergence of the minimum energy estimator and the local convergence of the extended Kalman filter

*Abstract:* We shall discuss the problem of constructing an observer for a nonlinear system and introduce the minimum energy estimator (MEE). From this we shall derive the Extended Kalman Filter (EKF). Then we discuss the global convergence of the MEE and the local convergence of the EKF.

*Tid och plats:* Torsdagen den 15 maj kl. 15.30 – 16.30 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

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## MATHEMATICAL PHYSICS SEMINAR

**Richard Szabo:**
**Quantum field theory on noncommutative phase spaces**

*Abstract:* A model is introduced which enables the non-perturbative study of the issue of renormalizability in noncommutative field theory. It describes non-locally interacting particles in a constant background magnetic field. The model is shown to possess, like other noncommutative field theories, many of the novel non-local effects from its reduction from string theory. It is an exactly solvable quantum field theory which has non-trivial interactions only when it is defined with a finite ultraviolet cutoff.

*Tid och plats:* Måndagen den 12 maj kl. 15.15 i seminarierummet, Roslagstullsbacken 11, Stockholms centrum för fysik, astronomi, bioteknik (SCFAB, AlbaNova), hus 11.

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## PLURIKOMPLEXA SEMINARIET

**Evgeni Leinartas:**
**Multidimensional difference equations**
**and amoebas of their characteristic polynomials**

*Abstract:* We study the linear difference equation

$$P[f] := \sum_{\alpha \in A} c_\alpha f(x+\alpha) = 0,\ x \in \mathbb{Z}_+^n,\ A \subset \mathbb{Z}_+^n,$$

with constant coefficients $c_\alpha$. It is well-known that in the case of a single variable ($n = 1$) the general solution can be written as a linear combination of the elementary solutions $f(x) = x^k \xi^x$, where $\xi$ is a root of the characteristic polynomial $P$.

To describe the solutions of the difference equation in the multidimensional case we make use of the notions of the Newton polytope $N_P$ and the amoeba $A_P$ of the characteristic polynomial $P(\lambda)$. An important role is played by the Laurent series expansions for the rational function $1/P(\lambda)$. More precisely, by means of the polytope $N_P$ we define a vector space $\{M(\lambda)\}$ of Laurent series with the property that any solution $f$ to the equation $P[f] = 0$ is equal to the inverse $\lambda$-transform of some element from $\{M(\lambda)\} \cdot 1/P(\lambda)$.

*Tid och plats:* Tisdagen den 13 maj kl. 10.15 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

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## MITTAG-LEFFLER SEMINAR

**James L. Massey:**
**A simple system description of a class of stream ciphers**

*Abstract:* The class of stream ciphers to be considered is that in which the running-key is produced by applying a nonlinear boolean function to the state of a binary maximum-length linear feedback shift register. A simple and novel theory of such stream ciphers will be presented. The system description reduces to that of encoders for the cyclic versions of the venerable Reed-Muller codes. The presentation will be self-contained — no previous knowledge of coding theory is required.

*Tid och plats:* Tisdagen den 13 maj kl. 14.00 – 15.00 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

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## SEMINARIUM I TEORETISK DATALOGI

**Jesper Fredriksson:**
**Reproducerbarhetsanalys av funktionella hjärnbilder**

*Sammanfattning:* Funktionell hjärnbildforskning har på relativt kort tid etablerats som ett stort forskningsområde med målet att skapa förståelse om det sista outforskade organet i människokroppen. Med hjälp av en PET- eller fMRI-scanner undersöker man mönster i förändringar av t.ex. blodets syresättning.

Men att dra slutsatser av den uppmätta signalen från scannern har visat sig svårt, av flera anledningar, och graden av reproducerbarhet mellan experiment är därför ofta dålig. I slutfasen av det europeiska databasprojektet NeuroGenerator (http://www.neurogenerator.org) försöker vi därför hitta statistiska metoder för att analysera graden av reproducerbarhet för insamlade PET- och fMRI-experiment.

Under seminariet kommer jag att presentera problemet och gå igenom metoder som används för analysen av enstaka experiment, samt hur vi inom projektet attackerar problemet att göra en sammantagen analys av flera experiment som borde uppvisa gemensamma funktionella komponenter.

*Tid och plats:* Måndagen den 12 maj kl. 13.00 i rum 1537, Nada, KTH.

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## MITTAG-LEFFLER SEMINAR

**Joachim Rosenthal:**
**Convolutional codes with maximal or near-maximal distance**

*Abstract:* MDS convolutional codes have the property that their free distance is maximal among all codes of the same rate and the same degree. In this talk we take a systems theoretic approach and explain the concepts of *MDS convolutional code* and *maximum distance profile.* It is shown that these codes can decode a maximum number of errors per time interval when compared with other convolutional codes of the same rate and degree. It has recently been shown by Hadjicostis that MDS convolutional codes have excellent applications when constructing fault-tolerant linear finite state machines.

The presented results constitute joint research with Heide Gluesing-Luerssen, Ryan Hutchinson and Roxana Smarandache.

*Tid och plats:* Tisdagen den 13 maj kl. 15.30 – 16.30 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

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## KOMBINATORIKSEMINARIUM

**Olle Heden: Construction,**
**classification and enumeration of perfect codes**

*Abstract:* There are now more than 20 constructions of perfect codes: Hamming, Golay, Vasil'ev, Zinov'ev, Heden, Solov'eva, Phelps, . . . , Krotov. By using the simplest version of the Vasil'ev construction one may construct more than $2^{2^{(n-1)/2-\log(n+1)+1}}$ different perfect codes of length $n$, where $n = 2^k - 1$ for some integer $k$. We will discuss if there is any hope for a general construction of perfect codes, if there is any hope for a classification and enumeration of perfect codes. Only perfect 1-error correcting binary codes will be considered.

*Tid och plats:* Onsdagen den 14 maj kl. 10.15 – 12.00 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

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## DOKTORANDSEMINARIUM

### Alexej Schuplev: Toricity and multi-fans

*Abstract:* The class of toric varieties is one of the most studied classes of varieties. By using the language of toric geometry many results in combinatorics, mirror symmetry, integration, and asymptotic theories were obtained. It seems quite natural to extend the notion of toric variety and try to apply the technique they give in more general cases.

I am going to talk about two approaches to generalization of toric varieties and associated combinatorial objects, i.e. multi-fans, and some results obtained in these directions. In fact, these two generalizations lead to different classes of varieties, they are even toric in different senses, and multi-fans in both cases are not the same.

*Tid och plats:* Onsdagen den 14 maj kl. 15.15 i sal 16, hus 5, Matematiska institutionen, SU, Kräftriket.

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## MITTAG-LEFFLER SEMINAR

### U. Helmke: Projection algorithms for convex and nonconvex feasibility problems

*Abstract:* We introduce a finite step algorithm that can be used to solve convex feasibility problems in a Hilbert space. This includes linear matrix inequality (LMI) feasibility problems and applies to linear programming with LMI constraints. A nonlinear extension of the method is developed towards LMI feasibility problems with rank constraints, or more generally, with spectral constraints. Applications to grasping problems in robotics and estimation of fundamental matrices in computer vision are given.

*Tid och plats:* Tisdagen den 20 maj kl. 14.00 – 15.00 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

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## MITTAG-LEFFLER SEMINAR

### Wolfgang Kliemann: Bifurcations in control systems

*Abstract:* The goal of this seminar is to discuss bifurcation problems for control systems, viewing them as dynamical systems, i.e. as control flows in the form of skew product flows where the shift along the control functions is part of the dynamics. As for differential equations, it is relevant to discuss qualitative changes when a system parameter is varied. Based on the concept of parameter-dependent control flows, bifurcations can be viewed in (at least) two different ways, as changes in the spectrum as spectral values cross the imaginary axis, or as changes in controllability behaviour. The spectral point of view leads to interesting connections with robust stability and stabilizability. From the controllability point of view it turns out that the difference between controllability and chain controllability is decisive. Since we discuss open loop systems with restricted control values, feedback transformations are not allowed. This is in contrast to classical concepts of normal forms in control theory, as developed, e.g., by Krener and Kang. We will discuss both concepts of the bifurcation behaviour from singular points and from invariant control sets.

*Tid och plats:* Torsdagen den 22 maj kl. 15.30 – 16.30 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

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## SEMINARIUM I FINANSIELL MATEMATIK

**Katarina Åselius**

presenterar sitt examensarbete:

**Tidsserieanalys tillämpad på spreaden SHB-SEB med införande av autoregressiv heteroskedastisk process för variansen**

*Sammanfattning:* Spreadhandel är en vanlig tradingstrategi i finansiella sammanhang, och att modellera detta är en viktig del av den kvantitativa analysen. I detta examensarbete modelleras spreaden mellan SHB och SEB med tidsserieanalys. Tidsserien uppvisar tecken på tidsberoende varians, varför ARCH-processen introduceras. Den slutliga modellen är en sammansättning av en AR-process och en ARCH-process, där den stokastiska delen modelleras som en $t$-fördelning för att ta hänsyn till de tunga svansarna.

*Tid och plats:* Måndagen den 12 maj kl. 15.15 – 16.00 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

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## MINICOURSE IN MATHEMATICS

**Massimo Giulietti (University of Perugia):**
**Algebraic-geometric codes**

*Time and place:* Thursday May 15 at 15.15 – 17.00 in room 3721. Friday May 16 at 10.15 – 12.00 in room 3721. Monday May 19 at 10.15 – 12.00 in room 3733. Rooms 3721 and 3733 are situated at the Department of Mathematics, KTH, Lindstedtsvägen 25, floor 7.

### Introduction

Ideas from algebraic geometry became useful in coding theory after Goppa's construction. He had the beautiful idea of associating linear codes to algebraic curves defined over $\mathbf{F}_q$, the finite field with $q$ elements. These codes are called *Algebraic-Geometric* (AG for short) codes.

The purpose of these lectures is not to survey the vast body of literature on AG codes but just to provide a short and hopefully plain introduction to the subject. Hence, most of all the underlying algebraic geometry will be bypassed. This has two major drawbacks: firstly we can deal only with a limited class of AG codes, secondly the deep theorems on which AG codes rely are presented without proof. Nonetheless, we believe that such a presentation is somehow more useful to the beginning student, and we hope that it may give some motivation for learning the subject in all its depth and beauty.

### Contents

**Linear codes.** We present basic material on linear codes. The minimum distance, the transmission rate and the relative distance of a linear code are defined, as well as the concepts of generator matrix and parity check matrix. The notion of Maximum Distance Separable (MDS for short) code is introduced. As an example of MDS codes, Reed-Solomon codes are presented.

**Algebraic curves.** A brief introduction to algebraic curves is given. According to the aim of these lectures, we limit ourselves to the most elementary case, i.e. to plane nonsingular curves. Nonetheless the concepts of algebraic functions, zeros and poles, divisors, and genus of a curve are introduced, and the celebrated Theorem of Riemann and Roch is stated and discussed.

(Continued on the next page.)

**Algebraic-Geometric codes.** The construction of Goppa is presented. As a corollary to the Riemann-Roch Theorem, a lower bound on the minimum distance of an AG code is proved. It is also discussed why AG codes are *good* in terms of transmission rate and relative distance. The so-called *one-point* Goppa codes are presented in more detail, and the decoding process for them is outlined.

**MDS codes and Near MDS codes.** MDS and Near MDS codes are equivalent to some configurations of points in projective spaces over finite fields, such as *arcs* and *tracks.* The Main Conjecture on MDS codes is presented and discussed in terms of arcs in projective spaces.

References


[1] V. D. Goppa, *Algebraic-Geometric Codes,* Math. USRR-Izv. Vol. 21 (1), pp. 75 – 93 (1983).

[2] V. D. Goppa, *Geometry and codes,* Kluwer Academic Publishers, 1988.

[3] T. Høholdt, J. H. van Lint and R. Pellikaan, *Algebraic geometry codes,* in Handbook of Coding Theory (V. S. Pless, W. C. Huffman and R. A. Brualdi, Editors), Vol. 1, pp. 871 – 961, Elsevier, Amsterdam 1998.

[4] T. Høholdt and R. Pellikaan, *On the decoding of algebraic-geometric codes,* IEEE Trans. Inform. Theory, Vol. 41, pp. 1589 – 1614 (1995).

[5] J. H. van Lint, *Introduction to coding theory,* Graduate Texts in Mathematics, Vol. 86, Springer-Verlag, New York-Heidelberg-Berlin, 1982.

[6] J. H. van Lint and G. van der Geer, *Introduction to coding theory and algebraic geometry,* DMV Seminar, Vol. 12, Birkhäuser, Basel-Boston-Berlin, 1988.

[7] F. J. MacWilliams and N. J. Sloane, *The theory of error-correcting codes,* North-Holland, Amsterdam, 1977.

[8] C. Moreno, *Algebraic curves over finite fields,* Cambridge Tracts in Mathematics, Vol. 97, Cambridge University Press, Cambridge, 1991.

[9] H. Stichtenoth, *Algebraic function fields and codes,* Universitex, Springer-Verlag, Berlin-Heidelberg, 1993.

[10] M. A. Tsfasman and S. G. Vladut, *Algebraic-geometric codes,* Kluwer Academic Publishers, Dordrecht-Boston-London, 1991.


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## SEMINAR IN ANALYSIS AND ITS APPLICATIONS

### Leopold Flatto:
### Poncelet's theorem, elliptic curves, and double queues


*Abstract:* The celebrated theorem of Poncelet states that if two conics are such that there exists an $n$-sided polygon inscribed in one of them, and simultaneously circumscribed about the other one, then there exists an infinity of such polygons. We show that the theorem relates to elliptic curves, and that the group structure of these curves can be used to prove the theorem. We also show that some other subjects relate to this theorem in a surprising way, such as double queues and billiard trajectories inside an ellipse.

The talk is a much scaled-down version of what was originally planned to be a mini-course, the compression being due to time limitations. If audience interest exists, a subsequent talk or two could be arranged to further develop aspects of this topic.


*Tid och plats:* Måndagen den 19 maj kl. 13.15 – 15.00 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

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## PRESENTATION AV EXAMENSARBETE I MATEMATIK

**Martin Boberg:**
**Principal Component Analysis for Value-at-Risk using Monte Carlo Simulation**

*Abstract:* Monte Carlo simulation plays an important role in financial applications, such as pricing exotic instruments, hedging, and Value at Risk (VaR) calculations. For VaR, the focus of this essay, the main drawback of Monte Carlo simulation is the large number of scenario simulations needed to obtain convergence due to high dimensionality.

Principal Component Analysis (PCA) is a method that transforms a set of correlated variables into a new set of uncorrelated variables called Principal Components (PC's) where the first few PC's describe as much variation as possible of the original variables. This enables us to work with a much smaller set of variables, still explaining most of the variance. PCA applied to Monte Carlo VaR could decrease the number of needed scenarios by lowering the dimensionality. However, caution must be taken in the choice of the PC's since the portfolio value has different sensitivities for different variables. This thesis presents a selection method based on weights for the PC's.

Quasi Monte Carlo methods use low discrepency simulation to obtain potentially faster convergence than standard Monte Carlo. In high-dimensional problems these methods may not give the desired improvement. Reduction of the dimensionality with PCA could overcome this problem.

*Tid och plats:* Torsdagen den 15 maj kl. 16.00 – 17.00 i sal 31, hus 5, Matematiska institutionen, SU, Kräftriket.

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## MITTAG-LEFFLER SEMINAR

**Hector J. Sussmann: Set-valued derivatives**

*Abstract:* The classical differential of maps of class $C^1$ assigns to each map $F$ of class $C^1$ from a manifold $M$ of class $C^1$ to another manifold $N$ of class $C^1$, and each point $p$ of $M$, a linear map $DF(p)$ from the tangent space of $M$ at $p$ to that of $N$ at $F(p)$. Furthermore, this correspondence has an open mapping property: If the differential of a map $F$ at a point $p$ is surjective, then the map itself sends neighbourhoods of $p$ to neighbourhoods of $F(p)$. Motivated by the search for extensions of the Pontryagin Maximum Principle, we study extensions of this correspondence to larger classes of maps (including Lipschitz maps, many continuous maps that are not Lipschitz, and many set-valued maps), taking values in a larger class of objects (namely, nonempty compact sets of linear maps), and still having the open mapping property in a suitable sense. These extensions are really "multivalued functors", and the functoriality property is the Chain Rule. A number of such extensions had been constructed in previous work by several authors, including the speaker, but they were not mutually comparable. We propose an extension, called "path-integral generalized differentials", that contains all the others and still obeys the chain rule and has an open mapping property. We also discuss the harder problem of working with a category with a larger class of objects, e.g. pairs $(C, p)$ where $C$ is a subset of a manifold $M$ of class $C^1$ which is, near $p$, $C^1$-diffeomorphic to a closed convex cone, and show how the theory of path-integral generalized differentials also works in this case, at least if one limits oneself to sets $C$ that are $C^1$-diffeomorphic to polyhedral cones.

*Tid och plats:* Tisdagen den 20 maj kl. 15.30 – 16.30 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

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**MITTAG-LEFFLER SEMINAR**

**Anthony Bloch:**
**Measure preservation and asymptotic stability in Hamiltonian and nonholonomic mechanical systems**

*Abstract:* In this talk I will discuss asymptotic stability in mechanical systems which preserve energy. I will consider measure preservation and the lack thereof for Hamiltonian systems and for nonholonomic mechanical systems (systems with nonintegrable constraints). I will analyse the role of Poisson and almost-Poisson structures in explaining the dynamics and illustrate the talk with mechanical examples. I will also discuss the role of momentum in such systems and its importance in stability and stabilization.

*Tid och plats:* Torsdagen den 15 maj kl. 14.00 – 15.00 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

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**PRESENTATION AV EXAMENSARBETE I MATEMATIK**

**Saad Ali:**
**Variationskalkyl och variationsolikheter**

*Sammanfattning:* Kapitel 1 ger en historisk överblick över variationskalkylens utveckling. I kapitel 2 härleds Euler-Lagranges ekvation och ett flertal exempel diskuteras, bl.a. brakistokronproblemet och problemet att bestämma en rotationsyta med så liten area som möjligt. I kapitel 3 diskuteras olika sätt att föreskriva randvärden. I kapitel 4 härleds ett nödvändigt och ett tillräckligt villkor för att en stationär punkt till en funktional skall vara ett minimum och i kapitel 5 studeras minimerande följder till en funktional. Kapitel 6 handlar om variationsolikheter i $\mathbb{R}^N$ och kapitel 7 om variationsolikheter i Hilbertrum. Bl.a. studeras ett så kallat hinderproblem.

*Tid och plats:* Fredagen den 16 maj kl. 10.00 – 11.00 i sal 16, hus 5, Matematiska institutionen, SU, Kräftriket.

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**MITTAG-LEFFLER SEMINAR**

**Sergei Treil:**
**Control Theory methods in Harmonic Analysis and vice versa**

*Abstract:* In the talk I am going to discuss some "non-classical" interaction between Control Theory and Harmonic Analysis. In the first part I will show how the method of Bellman function in Control Theory is applied to problems in Harmonic Analysis. I will discuss how to understand the solution of the corresponding "Bellman equation", how to cope with possible non-smoothness, what can be said about existence.

In the second part of the talk I will show how the theory of singular integral operators is applied to the problem of upper bound for the structured singular value $\mu$.

*Tid och plats:* Torsdagen den 22 maj kl. 14.00 – 15.00 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

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## GUEST LECTURES AT STOCKHOLM SCHOOL OF ECONOMICS

### Hal White:
### Causal, Predictive, and Explanatory Modelling in Economics: An Interpretive Guide

*Professor Hal White,* University of California, San Diego, visits the Department of Economic Statistics at Stockholm School of Economics (Handelshögskolan i Stockholm, Sveavägen 65) and will give a series of lectures on *Causal, Predictive, and Explanatory Modelling in Economics: An Interpretive Guide.* The lectures run from Monday, May 19, to Friday, May 23, at 10.15 – 12.00. See the department home page, http://www.hhs.se/stat/, for more information.

Attendance is free but registration is required. Register by sending an e-mail message to Pernilla Watson (Pernilla.Watson@hhs.se).