BRÅKET

Information om seminarier och högre undervisning i matematiska ämnen i Stockholmsområdet

NR 32 **FREDAGEN DEN 9 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 15 oktober kl. 13.00.

SEMINARIER

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, Osquldas väg 6, 1 tr. ned. Se Bråket nr 31 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 Bråket nr 31 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.* Häggsalen, Ångströmlaboratoriet, Uppsala universitet. Kaffe/te serveras utanför föreläsningssalen kl. 14.55. Se Bråket nr 31 sidan 6.

Må 10–12 kl. 13.15–14.15. Seminar in Analysis and its Applications. Yu-Lin Lin, Taipei, Taiwan: *Large-time rescaling behaviours to the Hele-Shaw problem driven by injection.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 4.

Fortsättning på nästa sida.

Disputation i optimeringslära och systemteori

Maja Karasalo skall disputera vid KTH på avhandlingen *Data Filtering and Control Design for Mobile Robots* torsdagen den 22 oktober kl. 10.00. Se sidan 8.

Disputation i matematisk statistik

Jens Svensson skall disputera vid KTH på avhandlingen *On Importance Sampling and Dependence Modeling* fredagen den 23 oktober kl. 13.00. Se sidan 6.

Seminarier (fortsättning)

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 Bråket nr 31 sidan 7.

Ti 10–13 kl. 13.15. DNA-seminariet Uppsala-KTH (Dynamical systems, Number theory, Analysis). Konstantin Khanin, Toronto: *Title to be announced.* Häggsalen, Ångströmlaboratoriet, Uppsala universitet.

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. 10.15 – 12.00. Kombinatorikseminarium. Jakob Jonsson, KTH: *On the topology of independence complexes of triangle-free graphs.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 4.

On 10–14 kl. 13.15 – 14.15. Seminarium i analys och dynamiska system. Konstantin Khanin, Toronto: *Lagrangian dynamics on shocks manifolds and the optimal transport problem.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 5.

On 10–14 kl. 13.15 – 15.00. Algebra and Geometry Seminar. David Eklund, KTH: *A method to compute the degrees of the Chern classes of a smooth variety.* Rum 306, hus 6, Matematiska institutionen, SU, Kräftriket. Se sidan 3.

On 10–14 kl. 14.00 – 15.00. Institut Mittag-Leffler Seminar. Boban Velickovic, Université Paris 7: *Universal countable Borel equivalence relations.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 3.

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 Bråket nr 31 sidan 5.

On 10–14 kl. 15.30 – 16.30. Institut Mittag-Leffler Seminar. Andrés Villaveces, Universidad Nacional-AK, Bogotá: *Dependence outside first order contexts.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 6.

To 10–15 kl. 14.00 – 15.00. Institut Mittag-Leffler Seminar. Tapani Hyttinen, Helsingfors universitet: *Model theory and metric structures.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 4.

To 10–15 kl. 15.30 – 16.30. Institut Mittag-Leffler Seminar. Vadim Kulikov, Helsingfors universitet: *Equivalence relations on a generalized Baire space.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 9.

Fr 10–16 kl. 11.00 – 12.00. 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 Bråket nr 31 sidan 7.

Fr 10–16 kl. 13.15 – 14.15. Graduate Student Seminar. David Eklund, KTH: *Classification of integral bilinear forms.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 5.

Fortsättning på nästa sida.

Seminarier (fortsättning)

Må 10–19 kl. 15.15. Seminarium i matematisk statistik. *(Observera dagen!)* **Tom Andersson,** SU: *Sensitivity analysis of firing dynamics of a nociceptor model.* Rum 306 (Cramérrummet), hus 6, Matematiska institutionen, SU, Kräftriket. Se sidan 7.

On 10–21 kl. 13.15–14.15. Seminarium i analys och dynamiska system. Anne-Maria Ernvall-Hytönen, KTH: *Title to be announced.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

On 10–21 kl. 13.15. Algebra and Geometry Seminar. Nicola Pagani: *Title to be announced.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

On 10–21 kl. 16.00. KTH/SU Mathematics Colloquium. Professor Peter Jagers, Chalmers tekniska högskola, Göteborg: *Extinction: how often, how soon, and in what way?* 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 5.

Fr 10–23 kl. 11.00. Optimization and Systems Theory Seminar. Professor Clyde F. Martin, Texas Tech University: *Control of Information: The Role of Information in New Markets.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 7.

ALGEBRA AND GEOMETRY SEMINAR

David Eklund:
A method to compute the degrees of the Chern classes of a smooth variety

Abstract: Let $Z \subset \mathbb{P}^r$ be a smooth connected variety. Suppose that Z is realized as a connected component of the intersection of r hypersurfaces. The contribution of Z to the Bezout number of the intersection is called the equivalence of Z. The equivalence may be computed with numerical homotopy methods, as well as computer algebra. An intersection theoretic result relates the equivalence of Z to the Chern classes of Z, which leads to a method to compute the degrees of the Chern classes. I will also discuss how this procedure generalizes to compute intersection numbers of Chern classes.

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

INSTITUT MITTAG-LEFFLER SEMINAR

Boban Velickovic:
Universal countable Borel equivalence relations

Abstract: We survey some recent results on countable Borel equivalence relations with the particular emphasis on techniques used to show that a given equivalence relation is universal among all countable Borel equivalence relations.

Tid och plats: Onsdagen den 14 oktober kl. 14.00–15.00 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

SEMINAR IN ANALYSIS AND ITS APPLICATIONS

Yu-Lin Lin:
Large-time rescaling behaviours to the Hele-Shaw problem driven by injection

Abstract: This talk addresses a large-time rescaling behaviour of Hele-Shaw cells for large data initial domains. The Polubarinova-Galin equation is the reformulation of zero surface tension Hele-Shaw flows with injection at the origin in two dimensions by considering the moving domain $\Omega(t) = f(B_1(0), t)$ for some Riemann mapping $f(\xi, t)$.

We give a sharp large-time rescaling behaviour of global strong polynomial solutions to this equation and the corresponding moving boundary in terms of the invariant complex moments. Furthermore, by proving a perturbation theorem of polynomial solutions, we also show that a small perturbation of the initial function of a global strong polynomial solution also gives rise to a global strong solution, and a large-time rescaling behaviour of the moving domain is shown as well.

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

KOMBINATORIKSEMINARIUM

Jakob Jonsson:
On the topology of independence complexes of triangle-free graphs

Abstract: For a graph G with vertex set V, the independence complex of G is the simplicial complex I_G on the vertex set V with the property that a set $\sigma \subseteq V$ is a face of I_G if and only if there are no edges in G between the vertices in σ. It is well-known that any simplicial complex is homotopy equivalent, even homeomorphic, to I_G for some graph G. The goal of the talk is to show that a simplicial complex Δ is homotopy equivalent to I_G for some bipartite graph G if and only if Δ is homotopy equivalent to the suspension of some simplicial complex. In particular, for any finitely generated abelian group A and any degree $d \geq 2$, we may find a bipartite graph G such that the homology of I_G in degree d is isomorphic to A. This answers a question by Engström regarding the existence of torsion in the homology of independence complexes of triangle-free graphs. We also examine independence complexes of graphs with a given girth and present some partial results about possible homotopy types of such complexes.

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

INSTITUT MITTAG-LEFFLER SEMINAR

Tapani Hyttinen:
Model theory and metric structures

Abstract: In metric structures there are other natural notions of isomorphism than the one used in model theory. I will discuss how these look like from the point of view of model theory.

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

SEMINARIUM I ANALYS OCH DYNAMISKA SYSTEM

Konstantin Khanin:
Lagrangian dynamics on shocks manifolds and the optimal transport problem

Abstract: Viscosity solutions of the Burgers equation and of the more general Hamilton-Jacobi equation are closely related to the dynamical properties of the minimizers for the corresponding Lagrangian action. However, most of the characteristics are merging with shocks. In this talk we shall discuss how the dynamics can be naturally defined after such a merger.

In the one-dimensional case the problem is simple since the shocks are isolated points. On the contrary, in the multi-dimensional case the shocks form submanifolds of finite codimension, which allows for a rather non-trivial dynamics. Although the velocity field has jump discontinuities on shocks, one can still determine, essentially in a unique way, the effective velocity field on the shock manifold. The effective dynamics has interesting connection with the optimal transport problem.

Tid och plats: Onsdagen den 14 oktober kl. 13.15 – 14.15 i seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

GRADUATE STUDENT SEMINAR

David Eklund:
Classification of integral bilinear forms

Abstract: Consider a free Abelian group of finite rank equipped with a symmetric bilinear form with values in the integers. Assume that the determinant of the form is 1 or -1. In the case where the form is indefinite there is a complete classification. It says that an indefinite integral form as above is determined up to isomorphism by three invariants: rank, index and parity. I will go through the proof of this structure theorem. The definite case is more complicated, and I will discuss it if time permits.

Tid och plats: Fredagen den 16 oktober kl. 13.15 – 14.15 i seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

KTH/SU MATHEMATICS COLLOQUIUM

Peter Jagers:
Extinction: how often, how soon, and in what way?

Abstract: Branching processes were born out of the observation that extinction (of separate families or subpopulations) is ubiquitous in nature and society. This lead to Galton's and Watson's famous error, as they claimed that all family lines must die out, even in exponentially growing populations. We look back at this discussion, and proceed to exhibiting the time and path to extinction.

Tid och plats: Onsdagen den 21 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.

INSTITUT MITTAG-LEFFLER SEMINAR

Andrés Villaveces:
Dependence outside first order contexts

Abstract: I will explore connections between First Order NIP (= dependent) theories, Shelah's Generic Pairs Conjecture, and (new) non-elementary versions of dependence. In particular, I will describe recent joint work with Grossberg and VanDieren on a new independence notion (splintering), provide examples, and (time-permitting) an application to a problem in AEC.

Tid och plats: Onsdagen den 14 oktober kl. 15.30 – 16.30 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

DISPUTATION I MATEMATISK STATISTIK

Jens Svensson

skall disputera på avhandlingen

On Importance Sampling and Dependence Modeling

fredagen den 23 oktober 2009 kl. 13.00 i sal D2, KTH, Lindstedtsvägen 5, b.v. Till opponent har utsetts *professor Thomas Mikosch,* Københavns Universitet, Danmark.

Abstract of the thesis

This thesis consists of four papers.

In the first paper, Monte Carlo simulation for tail probabilities of heavy-tailed random walks is considered. Importance sampling algorithms are constructed by using mixtures of the original distribution with some other, state-dependent, distributions. Sufficient conditions under which the relative error of such algorithms is bounded are found, and the bound is calculated. A new mixture algorithm based on scaling of the original distribution is presented and compared to existing algorithms.

In the second paper, Monte Carlo simulation of quantiles is treated. It is shown that by using importance sampling algorithms developed for tail probability estimation, efficient quantile estimators can be obtained. A functional limit of the quantile process under the importance sampling measure is found, and the variance of the limit process is calculated for regularly varying distributions. The procedure is also applied to the calculation of expected shortfall. The algorithms are illustrated numerically for a heavy-tailed random walk.

In the third paper, large deviation probabilities for a sum of dependent random variables are derived. The dependence stems from a few underlying random variables, so-called factors. Each summand is composed of two parts: an idiosyncratic part and a part given by the factors. Conditions under which both factors and idiosyncratic components contribute to the large deviation behavior are found, and the resulting approximation is evaluated in a simple example.

In the fourth paper, the asymptotic eigenvalue distribution of the exponentially weighted moving average covariance estimator is studied. Equations for the asymptotic spectral density and the boundaries of its support are found using the Marčenko-Pastur theorem.

SEMINARIUM I MATEMATISK STATISTIK

Tom Andersson:
Sensitivity analysis of firing dynamics of a nociceptor model

Abstract: In whole-cell studies of neuronal excitability, modelling of ionic conductances usually involves a large number of parameters assumed to be constant, e.g. maximal conductances, activation and inactivation midpoints, and activation and inactivation slopes (voltage sensitivity). In vivo, these parameters do not correspond to constant physiological correlates, but are regulated by other dynamic processes.

Here we show that sensitivity analysis of response effects due to parameter variation can reveal new mechanisms of firing other than the traditional one, i.e. "transduction induced firing" rather than stimulus-response. We take a closer look at a conduction model of nociceptors, i.e. primary sensory neurons involved in pain sensation.

The sensitivity analysis involves three parts: (I) defining response measures and sampling distributions, (II) regression analysis, and (III) remodelling and evaluation. It ends up in predictions to be further elaborated and tested by experimental research: two complementary mechanisms for inducing firing in nociceptors, i.e. inactivation shifts of the TTX-resistent sodium current Na+(TTX-R) and activation shifts of the delayed rectifier potassium current K+.

Tid och plats: Måndagen den 19 oktober kl. 15.15 i rum 306 (Cramérrummet), hus 6, Matematiska institutionen, SU, Kräftriket.

OPTIMIZATION AND SYSTEMS THEORY SEMINAR

Clyde F. Martin:
Control of Information: The Role of Information in New Markets

Abstract: New financial products are difficult to price. Often the products suffer through an initial period of price volatility as the market searches for an equilibrium value. Is this instability preventable (perhaps with more information or better financial regulation) or is it fundamental? Working within a canonical urn model, we show that this early-trading volatility is fundamental. We assume the existence of an urn with an unknown distribution of black and white balls. After each ball is drawn we adjust our guess by updating our beliefs. We show how our beliefs over the ratio of black to white draws exhibits excess volatility in the first few periods, even when our initial beliefs are centered at the true value. We prove that under very weak conditions the updated estimates converge to the true ratio. For special cases we show that the mode is a much more convenient measure than either the mean or the median.

This is work that is due in large measure to Robert Martin, FRB of Governors; Bo He, UTSPH; Jennifer Emerson, TTU; and the proof of convergence (on which all of this is based) is due to Kendall Gillies, TTU.

Tid och plats: Fredagen den 23 oktober kl. 11.00 i seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

DISPUTATION I OPTIMERINGSLÄRA OCH SYSTEMTEORI

Maja Karasalo

skall disputera på avhandlingen

Data Filtering and Control Design for Mobile Robots

torsdagen den 22 oktober 2009 kl. 10.00 i sal F3, KTH, Lindstedtsvägen 26, b.v. Till opponent har utsetts *professor John Baras,* University of Maryland, USA.

Abstract of the thesis

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.

In Paper A, we propose three cascaded, stabilizing formation controls for multi-agent systems. We consider platforms with non-holonomic kinematic constraints and directional range sensors. The resulting formation is a leader-follower system, where each follower agent tracks its leader agent at a specified angle and distance. No inter-agent communication is required to execute the controls. A switching Kalman filter is introduced for active sensing, and robustness is demonstrated in experiments and simulations with Khepera II robots.

In Paper B, an optimization-based adaptive Kalman filtering method is proposed. The method produces an estimate of the process noise covariance matrix Q by solving an optimization problem over a short window of data. The algorithm recovers the observations $h(x)$ from a system $\dot{x} = f(x)$, $y = h(x) + v$ without a priori knowledge of system dynamics. The algorithm is evaluated in simulations and a tracking example is included, for a target with coupled and nonlinear kinematics.

In Paper C, we consider the problem of estimating a closed curve in $\mathbb{R}^2$ 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 PowerBot 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.

INSTITUT MITTAG-LEFFLER SEMINAR

Vadim Kulikov:
Equivalence relations on a generalized Baire space

Abstract: Our aim is to study similar questions that are studied in descriptive set theory but in the setting, where the Baire space is replaced by the space of functions from an uncountable cardinal to itself. Specially we are interested in the complexity of isomorphism relations of structures of given theories. We also study Borel reducibility between isomorphism relations and set theoretical equivalence relations such as NS.

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