



BRÅKET



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

NR 26

FREDAGEN DEN 29 AUGUSTI 2008

BRÅKET

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

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<http://www.math.kth.se/braket/>

Postadress:

Red. för Bråket
Institutionen för matematik
KTH
100 44 Stockholm

Sista manustid för nästa nummer:
Torsdagen den 4 september
kl. 13.00.

Miniworkshop in PDE and Potential Theory

Denna skall äga rum vid SU fredagen den 5 september 2008. Se Bråket nr 25 sidorna 5–6.

Ledig anställning

Mälardalens högskola söker en doktorand i matematik/tillämpad matematik. Se sidorna 7–8.

SEMINARIER

Fr 08–29 kl. 11.00. **Optimization and Systems Theory Seminar.** (*Observera lokalen!*) Professor Chris Byrnes, Washington University in St. Louis, USA: *Some results on optimal estimation and control for lossy networked control.* Sal D3, KTH, Lindstedtsvägen 5, b.v. Se sidan 4.

Må 09–01 kl. 15.15–16.00. **Seminarium i finansiell matematik.** Martin Lillieroth presenterar sitt examensarbete: *Optimal liquidation with a focus on the sample-path approach.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se Bråket nr 25 sidan 3.

Ti 09–02 kl. 13.15–14.15. **DNA-seminariet Uppsala-KTH (Dynamical systems, Number theory, Analysis).** Viviane Baladi, ENS, Paris: *Linear response for piecewise expanding and smooth unimodal maps.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se Bråket nr 25 sidan 6.

Ti 09–02 kl. 13.30. **Seminar in Fluid Mechanics.** Riccardo Rossi, Università di Bologna: *Numerical simulation of scalar dispersion in complex flows.* Sal E52, KTH, Osquars Backe 14, 2 tr. Se Bråket nr 25 sidan 3.

Ti 09–02 kl. 15.30–16.30. **Institut Mittag-Leffler Seminar.** Paul Tod, Oxford University: *On Mason's rigidity theorem.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 3.

Fortsättning på nästa sida.

Kurs

Jan-Erik Björk: Rings of differential operators. Se sidan 6.

Money, jobs: Se sidorna 8–9.

Seminarier (fortsättning)

- On 09–03 kl. 10.00. Licentiatseminarium i matematik. Shoyeb Waliullah:** *Minimizers and symmetric minimizers for problems with critical Sobolev exponent.* Rum 306, hus 6, Matematiska institutionen, SU, Kräftriket. Se sidan 3.
- On 09–03 kl. 10.15–12.00. Kombinatorikseminarium. Jakob Jonsson, KTH:** *Hard squares with negative activity on cylinders with odd circumference.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 7.
- On 09–03 kl. 13.15–15.00. Algebra and Geometry Seminar. Tsachik Gelander:** *On the number of generators of a lattice.* Rum 306, hus 6, Matematiska institutionen, SU, Kräftriket. Se sidan 5.
- To 09–04 kl. 14.00–15.00. Institut Mittag-Leffler Seminar. Richard Schoen, Stanford University:** *Ricci flow, minimal surfaces, and positive curvature.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 5.
- To 09–04 kl. 15.30–16.30. Institut Mittag-Leffler Seminar. Fabrice Planchon, Université Paris 13:** *Title to be announced.* Institut Mittag-Leffler, Auravägen 17, Djursholm.
- Fr 09–05 kl. 10.00–10.50. Miniworkshop in PDE and Potential Theory. Georg S. Weiss, University of Tokyo:** *The non-degenerate singular set in an unstable free boundary problem.* Rum 306, hus 6, Matematiska institutionen, SU, Kräftriket. Se Bråket nr 25 sidan 5.
- Fr 09–05 kl. 11.00–11.50. Miniworkshop in PDE and Potential Theory. Vladimir Kozlov, Linköpings universitet:** *The Benjamin-Lighthill conjecture for near-critical values of Bernoulli's constant.* Rum 306, hus 6, Matematiska institutionen, SU, Kräftriket. Se Bråket nr 25 sidan 5.
- Fr 09–05 kl. 13.30–14.20. Miniworkshop in PDE and Potential Theory. Miguel Ramos, University of Lisbon:** *Nodal solutions for superlinear elliptic equations and systems.* Rum 306, hus 6, Matematiska institutionen, SU, Kräftriket. Se Bråket nr 25 sidan 5.
- Fr 09–05 kl. 14.30–15.20. Miniworkshop in PDE and Potential Theory. Gunilla Kreiss, Uppsala universitet:** *Granular material modelled as two-phase stato-elastic composites.* Rum 306, hus 6, Matematiska institutionen, SU, Kräftriket. Se Bråket nr 25 sidan 6.
- On 09–10 kl. 13.15. Algebra and Geometry Seminar. Gilles Halbout:** *Title to be announced.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.
- On 09–10 kl. 15.15–16.00. Seminarium i numerisk analys. Eskil Hansen, Lunds universitet:** *Convergence and error propagation of splitting methods applied to parabolic equations.* Rum 4523, KTH CSC, Lindstedtsvägen 5, plan 5. Se sidan 7.
- On 09–10 kl. 16.00. KTH/SU Mathematics Colloquium. Roman Schubert, University of Bristol:** *Classical and quantum normal forms in the theory of chemical reaction.* 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.

Fortsättning på nästa sida.

Seminarier (fortsättning)

To 09–11 kl. 13.15–14.15. DNA-seminariet Uppsala-KTH (Dynamical systems, Number theory, Analysis). Roman Schubert, University of Bristol: *Semi-classics and long time evolution: how compatible?* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 8.

To 09–11 kl. 14.15–15.15. DNA-seminariet Uppsala-KTH (Dynamical systems, Number theory, Analysis). Oscar Marmon, Chalmers tekniska högskola och Göteborgs universitet: *On the density of solutions to Diophantine equations.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 4.

Fr 09–12 kl. 13.15–14.15. Graduate Student Seminar. Eric Nordenstam, Matematik, KTH: *Title to be announced.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

INSTITUT MITTAG-LEFFLER SEMINAR**Paul Tod:****On Mason's rigidity theorem**

Abstract: Following an argument proposed by Mason, we prove that there are no algebraically special asymptotically simple vacuum space-times with a smooth, shear-free, geodesic congruence of principal null directions extending transversally to a cross-section of Scri. Our analysis leaves the door open for escaping this conclusion if the congruence is not smooth, or not transverse to Scri. One of the elements of the proof is a new rigidity theorem for the Trautman-Bondi mass.

The talk is based on joint work with Piotr Chrusciel. See arXiv:0712.3846v1.

Tid och plats: Tisdagen den 2 september kl. 15.30–16.30 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

LICENTIATSEMINARIUM I MATEMATIK**Shoyeb Waliullah:****Minimizers and symmetric minimizers
for problems with critical Sobolev exponent**

Abstract: In this paper we will be concerned with the existence and non-existence of constrained minimizers in Sobolev spaces $D^{k,p}(\mathbb{R}^N)$, where the constraint involves the critical Sobolev exponent. Minimizing sequences are not, in general, relatively compact for the embedding $D^{k,p}(\mathbb{R}^N) \hookrightarrow L^{p^*}(\mathbb{R}^N, Q)$ when Q is a non-negative, continuous, bounded function. However, if Q has certain symmetry properties, then all minimizing sequences are relatively compact in the Sobolev space of appropriately symmetric functions. For Q which does not have the required symmetry, we give a condition under which an equivalent norm in $D^{k,p}(\mathbb{R}^N)$ exists so that all minimizing sequences are relatively compact. In fact we give an example of a Q and an equivalent norm in $D^{k,p}(\mathbb{R}^N)$ so that all minimizing sequences are relatively compact.

Tid och plats: Onsdagen den 3 september kl. 10.00 i rum 306, hus 6, Matematiska institutionen, SU, Kräftriket.

OPTIMIZATION AND SYSTEMS THEORY SEMINAR

Chris Byrnes:

**Some results on optimal estimation and control
for lossy networked control**

Abstract: A long term goal in the theory of systems and control is to develop a systematic methodology for the design of feedback control schemes capable of shaping the response of complex dynamical systems, in both an equilibrium and a nonequilibrium setting. The most classical example of a nonequilibrium attractor for a nonlinear dynamical system is a periodic orbit. In this talk, we present sufficient conditions for the existence of oscillations in a nonlinear dynamical system, e.g. a closed-loop control system. Just as in Liapunov theory, these conditions can be checked point-wise and therefore do not require the knowledge of the trajectories of the system, in marked contrast with existing criteria requiring the existence of cross-sections for the dynamics. Moreover, using the recent solution of the Poincaré Conjecture in all dimensions, we show that these same conditions are necessary for the existence of an asymptotically stable periodic orbit. These results are illustrated by showing the existence of an asymptotically stable oscillation in a three-dimensional, non-holonomic mathematical model of an AC controlled rotor, controlled to turn at a constant angular velocity. We also apply these results to show the existence of a periodic response of a dissipative nonlinear control system, when forced with a periodic input.

In this talk I will describe some problems related the effect of packets loss and random delay on the design and performance of networked control systems. In particular, I will try to show that communication and control are tightly coupled and they cannot be addressed independently. For example, where should we place my controller, near the sensors, near the actuators or somewhere in the middle? What is the impact of packet loss on the closed loop performance? Which features should communication protocols have to reduce performance degradation due to packet loss? If sensors and actuators are provided with computational resources, can we use them to improve performance? From a closed-loop performance perspective, is it better to have protocols with small packet delay and high packet loss or protocols with low packet loss and longer delay? If actuators have no computational resources, what should we do when a control packet is loss: use the previous control values (hold-input) or do nothing (zero-input)? These are some of the questions addressed in the presentation. I will propose some possible solutions and comment on their implications on the design of general networked control systems.

Tid och plats: Fredagen den 29 augusti kl. 11.00 i sal D3, KTH, Lindstedtsvägen 5, b.v.

**DNA-SEMINARIET UPPSALA-KTH
(DYNAMICAL SYSTEMS, NUMBER THEORY, ANALYSIS)**

Oscar Marmon:

On the density of solutions to Diophantine equations

Abstract: For Diophantine equations having infinitely many solutions, one can try to bound the number of solutions in large boxes. I will briefly discuss heuristics and survey some different results. Specifically, I will outline Heath-Brown's ' q -analogue' of van der Corput's method for exponential sums, and show some bounds that can be obtained.

Tid och plats: Torsdagen den 11 september kl. 14.15 – 15.15 i seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

ALGEBRA AND GEOMETRY SEMINAR

Tsachik Gelander:

On the number of generators of a lattice

Abstract: I will explain the following Theorem:

Let G be a simple Lie group. There is a constant $C = C(G)$ such that for any lattice L in G we have

$$d(L) < C \operatorname{Vol}(G/L),$$

where $d(L)$ is the minimal size of a generating set of L . Note that even the finiteness of $d(L)$ is in general non-trivial and was proved case by case by many different authors, notably by the work of Garland and Raghunathan for $\operatorname{rank}(G) = 1$ and of Kazhdan for $\operatorname{rank}(G) > 1$. Here, we obtain in particular a unified geometric proof for the finiteness of $d(L)$. Moreover, the theorem implies the classical Kazhdan-Margulis theorem, which states that there is a positive lower bound on the covolume of lattices, indeed $d(L) > 1$ implies $\operatorname{Vol}(G/L) > 1/C$. It also gives bounds on the first Betti number.

In a joint work with Belolipetsky, Lubotzky and Shalev we made use of this theorem to get estimates on the asymptotic growth of the number of arithmetic groups.

Tid och plats: Onsdagen den 3 september kl. 13.15–15.00 i rum 306, hus 6, Matematiska institutionen, SU, Kräftriket.

INSTITUT MITTAG-LEFFLER SEMINAR

Richard Schoen:

Ricci flow, minimal surfaces, and positive curvature

Abstract: We will describe the study of Riemannian manifolds of positive sectional curvature generally, and specifically discuss work with Simon Brendle on 1/4-pinching. We will discuss the outlook for further progress on the problem.

Tid och plats: Torsdagen den 4 september kl. 14.00–15.00 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

KTH/SU MATHEMATICS COLLOQUIUM

Roman Schubert:

Classical and quantum normal forms in the theory of chemical reaction

Abstract: The theory of chemical reactions provides many challenging and interesting mathematical problems. We will give a general introduction to the theory of chemical reactions from a mathematical point of view and then discuss some recent applications of methods from dynamical systems and microlocal analysis, namely the theory of normal forms, to chemical reactions.

Tid och plats: Onsdagen den 10 september 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.

GRADUATE COURSE IN MATHEMATICS

Jan-Erik Björk:

Rings of differential operators

This course is foremost addressed to Ph.D. students interested in “algebraic analysis” with special emphasis on problems dealing with complex analytic functions which in general are multi-valued. The first period — until middle of October — is devoted to the study of Cauchy transforms of Borel measures satisfying algebraic equations. A typical case is: Let $\rho(t)$ be an integrable and complex-valued function on the real interval $[0, 1]$. Set

$$\hat{\rho}(z) = \int_0^1 \frac{\rho(t) dt}{z - t}.$$

Assume that $\rho(z)$ satisfies an algebraic equation in $\mathbf{C} \setminus [0, 1]$:

$$p_m(z)\hat{\rho}^m(z) + \cdots + p_1(z)\hat{\rho}(z) + p_0(z) \quad \text{where } p_0(z), \dots, p_m(z) \text{ are polynomials.}$$

Given this algebraic equation, a central issue in the course is to recapture the ρ -function. To achieve this we are going to use the Weyl algebra $A_1(\mathbf{C})$ whose elements are differential operators with polynomial coefficients. To be precise, if one has found some differential operator $Q(z, \partial) \in A_1(\mathbf{C})$ such that $Q(\hat{\rho}) = 0$, then we shall show how to obtain another differential operator $P \in A_1(\mathbf{C})$ such that $P(t, \partial_t)(\rho) = 0$. From this we can determine ρ in many specific situations. This example illustrates the philosophy in \mathcal{D} -module theory, where one studies modules over non-commutative rings of differential operators and use these modules to identify certain classes of multi-valued analytic functions, single-valued globally defined differential operators. For example, inspired by the study of Cauchy transforms satisfying algebraic equations, we consider in general an algebraic function $y(z)$:

$$(*) \quad P(z, y) = p_m(z)y^m + \cdots + p_1(z)y + p_0(z),$$

where we assume that the polynomial $P(z, y)$ is irreducible in the polynomial ring $\mathbf{C}[z, y]$. Outside a finite discriminant set Σ of the complex z -plane we get an m -tuple of distinct roots, which means that $y(z)$ is a multi-valued analytic function in $\mathbf{C} \setminus \Sigma$, whose local branches are given by the m -tuple of root functions denoted by $\alpha_1(z), \dots, \alpha_m(z)$. With these notations a typical result during the course is to prove that there exists a differential operator $Q(z, \partial) = \sum q_\nu(z)\partial^\nu \in A_1(\mathbf{C})$ of degree m such that $Q(\alpha_\nu) = 0$ holds for every ν outside the discriminant set Σ . Moreover, Q is unique when we impose the condition that the leading polynomial $q_m(z)$ is monic and that the $m + 1$ -tuple of q -polynomials have no common zero. Of course, here the point is that Q essentially determines the m -tuple of roots. More precisely, if D is an arbitrary open disc in $\mathbf{C} \setminus \Sigma$ and $f(z)$ an analytic function in D such that $Q(f) = 0$, then f is a \mathbf{C} -linear combination of the single-valued branches of the root functions over D .

Final remark: Reasonable familiarity with analytic function theory in one variable will be assumed, while the necessary algebraic results are proved during the course. Suitable material from my two books *Rings of Differential Operators* and *Analytic \mathcal{D} -modules* will be delivered as references during the course.

Time and place: The seminars will take place every Wednesday at 10.15–12.00 with the first meeting on September 3 in room 306, house 6, at the Department of Mathematics at SU.

Welcome!
Jan-Erik Björk

KOMBINATORIKSEMINARIUM

Jakob Jonsson:

Hard squares with negative activity on cylinders with odd circumference

Abstract: Let $G_{m,n}$ be the graph on the vertex set $\{1, \dots, m\} \times \{1, \dots, n\}$ in which there is an edge between (a, b) and (c, d) if and only if either $(a, b) = (c, d \pm 1)$ or $(a, b) = (c \pm 1, d)$, where the second index is computed modulo n . One may view $G_{m,n}$ as a unit square grid on a cylinder with circumference n and height m . For odd n , we prove that the Euler characteristic of the simplicial complex $\Sigma_{m,n}$ of independent sets in $G_{m,n}$ is either 2 or -1 , depending on whether or not $\gcd(m-1, n)$ is divisible by 3. The proof builds on previous work due to Johan Thapper, who reduced the problem of computing the Euler characteristic of $\Sigma_{m,n}$ to that of analysing a certain subfamily of sets with attractive properties. The situation for even n remains unclear. In the language of statistical mechanics, the reduced Euler characteristic of $\Sigma_{m,n}$ coincides with minus the partition function of the corresponding hard square model with activity -1 .

Tid och plats: Onsdagen den 3 september kl. 10.15–12.00 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

SEMINARIUM I NUMERISK ANALYS

Eskil Hansen:

Convergence and error propagation of splitting methods applied to parabolic equations

Abstract: In this talk we are concerned with splitting methods applied to parabolic equations. We introduce an analytic framework which allows us to analyse various splitting methods, including the Lie and Peaceman-Rachford schemes in the context of dimension splittings. In particular, we derive optimal convergence orders for parabolic linear problems and prove convergence for the quasilinear case. We also illustrate the theoretical results with numerical experiments.

This is joint work with A. Ostermann.

Tid och plats: Onsdagen den 10 september kl. 15.15–16.00 i rum 4523, KTH CSC, Lindstedtsvägen 5, plan 5.

Mälardalens högskola söker en doktorand i matematik/tillämpad matematik

Anställningen är placerad vid Akademin för utbildning, kultur och kommunikation i Västerås. Sista ansökningsdag är den 1 oktober 2008, och anställningen beräknas vara tillträdd senast den 1 januari 2009.

En förutsättning för anställning är att man blir antagen till forskarutbildning i matematik/tillämpad matematik. Ange i ansökan vilket forskningsområde och vilken handledare som du skulle vara intresserad av. Vid akademien finns bland annat följande områden representerade:

- Stokastiska processer och tillämpningar inom finansanalys och försäkringsmatematik (professor Dmitrii Silvestrov).

(Fortsättning på nästa sida.)

- Optimering med tillämpningar inom bl.a. processtyrning och logistik (professor Kenneth Holmström).
- Spelteori och modellering av kulturella och evolutionära processer (professor Kimmo Eriksson).
- Matematikdidaktik (professor Kimmo Eriksson och dr Andreas Ryve).

Den fullständiga annonstexten finns på följande adress:

<http://www.mdh.se/jobb/VisaAnstallning?id=957>.

DNA-SEMINARIET UPPSALA-KTH (DYNAMICAL SYSTEMS, NUMBER THEORY, ANALYSIS)

Roman Schubert:

Semiclassics and long time evolution: how compatible?

Abstract: Semiclassical methods describe the transition from quantum to classical mechanics, and can be used to deduce information about a quantum system from the corresponding classical system. Many interesting dynamical properties, like ergodicity and mixing, unfold for large times, and in order to study their impact on the quantum system one needs semiclassical approximations which are uniform in time. The development of these methods poses one of the major challenges in semiclassics, and we will review the current state of the art and describe some new ideas, which have been recently implemented for the Schrödinger equation on a manifold of negative curvature.

Tid och plats: Torsdagen den 11 september kl. 13.15–14.15 i seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

MONEY, JOBS

Columnist: Johannes Lundqvist, Department of Mathematics, Stockholm University.
E-mail: johannes@math.su.se.

Info = information. This will be given and repeated until obsolete. Rely on other sources as well.

BBKTH = Bulletin Board at the Department of Mathematics, KTH.

BBSU = Bulletin Board at the Department of Mathematics, SU.

The following information, with links, is also available at <http://www2.math.su.se/~johannes/mj.html>.

Unless stated otherwise, a given date is the last date (e.g. for applications), and the year is 2008. A number without an explanation is a telephone number.

Standard information channels

1. A channel to information from Vetenskapsrådet: <http://www.vr.se/naturteknik/index.asp>.
2. A channel to information from the European Mathematical Society: <http://www.emis.de>.
3. A channel to information from the American Mathematical Society: <http://www.ams.org>.
4. KTH site for information on funds: <http://www.kth.se/aktuellt/stipendier>.
5. Stockholm University site for information on funds: <http://www2.su.se/forskning/stipendier/databas.php3>.
6. Umeå site for information on funds: http://www.umu.se/umu/aktuellt/stipendier_fond_anslag.html.
7. Job announcement site: <http://www.maths.lth.se/nordic/Euro-Math-Job.html>. This is run by the European Mathematical Society.
8. Stiftelsen för internationalisering av högre utbildning och forskning (STINT) site for information on funds: <http://www.stint.se>.
9. Nordisk Forskerutdanningsakademi (NorFA) site for information on funds: <http://www.norfa.no>.
10. Svenska institutet (SI) site for information on funds: <http://www.si.se>.

(Continued on the next page.)

New information

Jobs to apply for

11. Lunds universitet söker en professor i matematik med inriktning mot analys. Det är viktigt att den sökandes vetenskapliga inriktning förstärker någon av de forskningsinriktningar inom analys som redan är representerade vid avdelningen (differentialekvationer samt analytiska funktioner och operator teori, dessutom harmoniska avbildningar och vertexalgebror). Sista ansökningsdag är den 30 september. Web-info: http://www3.lu.se/info/lediga/admin/document/Professor_matematik_080630.pdf.
 12. Linköpings universitet söker en doktorand inom forskarskolan i tvärvetenskaplig matematik. Aktuella avhandlingsprojekt finns beskrivna på <http://www.mai.liu.se/tvarvetenskap/>. Sista ansökningsdag är den 9 september. Web-info: <http://www.liu.se/jobbdb/show.html?2593>.
 13. Mälardalens högskola söker en doktorand i matematik/tillämpad matematik med placering i Västerås. Sista ansökningsdag är den 1 oktober. Se detta nr av Bråket sidorna 7–8 och <http://www.mdh.se/jobb/VisaAnstallning?id=957>.
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