BRÅKET

Information om seminarier och högre undervisning i matematiska ämnen i Stockholmsområdet

NR 25 **FREDAGEN DEN 22 AUGUSTI 2008**

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 28 augusti kl. 13.00.

Miniworkshop in PDE and Potential Theory

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

Högre undervisning

Ett schema för högre kurser och seminarier i matematik vid SU under höstterminen 2008 finns på sidorna 4 – 5.

SEMINARIER

Fr 08 – 22 kl. 11.00 – 12.00. Optimization and Systems Theory Seminar. Amol Sasane, London School of Economics: *Completing to an isomorphism in a Wiener algebra used in control theory.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se Bråket nr 24 sidan 2.

Ti 08 – 26 kl. 13.15 – 14.15. DNA-seminariet Uppsala-KTH (Dynamical systems, Number theory, Analysis). Bertrand Deroin, Université de Paris-Sud, Orsay: *Polynomial ODEs in the complex domain; a probabilistic approach.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se Bråket nr 24 sidan 2.

Fortsättning på nästa sida.

Nordic-Russian Symposium in honour of Vladimir Maz'ya on the occasion of his 70th birthday

Detta skall äga rum i Stockholm den 25 – 27 augusti 2008. Se Bråket nr 24 sidan 5.

Geometry and Analysis

En konferens med denna titel skall äga rum vid KTH den 25 – 29 augusti 2008. Se Bråket nr 24 sidorna 6 – 7.

Kurser

Michael Benedicks: Kaotiska dynamiska system. Se sidan 7.

Torbjörn Kolsrud: Matematisk analys för doktorander. Se sidan 3.

Andrzej Szulkin: Elementary Differential Geometry. Se sidan 2.

Seminarier (fortsättning)

To 08–28 kl. 10.30. Seminar in Fluid Mechanics. Fulvio Martinelli, Politecnico di Milano: *Application of Wiener filtering theory to state estimation in wall bounded flows.* Seminarierummet, Institutionen för mekanik, KTH, Teknikringen 8. Se Bråket nr 24 sidan 8.

To 08–28 kl. 12.00–13.00. GRU-seminarium i matematik. Ruedi Seiler, Technische Universität Berlin: *E-learning in mathematics education at the university level. Experience and perspective with the learning environment MUMIE.* Sammanträdesrum 3424 (innanför pausrummet), Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 4. Se sidan 8.

To 08–28 kl. 14.15. Presentation av examensarbete i matematik. Dan Petersen: *Equivariant point counts of involutional hyperelliptic curves.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se Bråket nr 24 sidan 9.

Fr 08–29 kl. 11.00. Optimization and Systems Theory Seminar. Professor Chris Byrnes, Washington University in St. Louis, USA: *Analysis and design of nonlinear oscillations for complex systems.* Lokal meddelas senare.

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 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 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 sidan 3.

On 09–03 kl. 13.15. Algebra and Geometry Seminar. Tsachik Gelander: *Title to be announced.* Rum 306, hus 6, Matematiska institutionen, SU, Kräftriket.

COURSE IN MATHEMATICS

Andrzej Szulkin:
Elementary Differential Geometry

Time and place: Thursdays at 13.15–15.00 in room 306, house 6, Department of Mathematics, Stockholm University, Kräftriket. The course will start on Thursday, August 28.

Textbook: W. Kühnel, *Differential Geometry.* Curves – Surfaces – Manifolds, Chap. 1–5.

Preliminary list of topics: Curves in $\mathbb{R}^2$ and $\mathbb{R}^3$: curvature, torsion, Frenet's equations. Surfaces in $\mathbb{R}^3$ and $\mathbb{R}^n$: fundamental forms, curvature, covariant derivative, geodesics, the Gauss-Bonet formula. General manifolds: a brief introduction.

The course will be given in English unless all participants are Swedish-speaking.

Welcome!
Andrzej Szulkin

SEMINARIUM I FINANSIELL MATEMATIK

Martin Lillieroth

presenterar sitt examensarbete:

Optimal liquidation with a focus on the sample-path approach

Abstract: This report is about figuring out how to split a big sell order into chunks which are sold with some time in between them, with the purpose to minimize the cost incurred by moving the market due to the size of the order. After a general introduction, we focus on a recent method for optimizing the liquidation process. The method is based on a set of sample-paths describing possible scenarios, and it aims to address the poor scaling properties of tree methods. Similar approaches have been used for pricing American options (stochastic mesh). At the end of the report some tests are presented.

Tid och plats: Måndagen den 1 september kl. 15.15 – 16.00 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

SEMINAR IN FLUID MECHANICS

Riccardo Rossi:
Numerical simulation of scalar dispersion in complex flows

Abstract: The analysis of scalar dispersion in turbulent flows is relevant to a broad range of applications. In the last fifty years experimental and numerical investigations of canonical flows have dealt with the improvement of the theoretical background and subsequently with the development of reliable low-order models. However, although these techniques have been successfully employed in basic flow configurations, it is generally accepted that LES should provide a significant improvement in the framework of complex flows. The first part of the talk will give a short overview of scalar transport phenomena and the numerical challenges associated with high-fidelity simulations of turbulent scalar transport by presenting results from DNS of turbulent channel flows. In the second part the numerical simulation of the turbulent dispersion of a passive scalar from a line source downstream of a surface-mounted obstacle will be discussed.

Tid och plats: Tisdagen den 2 september kl. 13.30 i sal E52, KTH, Osquars Backe 14, 2 tr.

DOKTORANDKURS I MATEMATIK

Torbjörn Kolsrud:
Matematisk analys för doktorander, 5B5176, 5 p

Tid och plats: Tisdagar kl. 10.15 – 12.00 i seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Kursen startar den 2 september.

Kursbok: Lars Hörmander: *The Analysis of Linear Partial Differential Operators I, Distribution Theory and Fourier Analysis.* Springer-Verlag, 1983, . . . , 2003.

Välkomna!
Torbjörn Kolsrud

Schema för högre kurser och seminarier i matematik vid Stockholms universitet under höstterminen 2008

Kurser

Integrationsteori, 7,5 hp.
Lärare: Shimorin.
Tid och plats: Tisdagar kl. 13.15 – 15.00 i KTH:3733. Kursstart den 2 september.

Algebra 4, 7,5 hp.
Lärare: Backelin.
Tid och plats: Måndagar kl. 13.15 – 15.00 i SU:306. Kursstart den 1 september.

Analytiska funktioner 2, 7,5 hp.
Lärare: Axelsson.
Tid och plats: Tisdagar kl. 13.15 – 15.00 i SU:306. Kursstart den 2 september.

Elementär differentialgeometri, 7,5 hp.
Lärare: Szulkin.
Tid och plats: Torsdagar kl. 13.15 – 15.00 i SU:306. Kursstart den 28 augusti. Se sidan 2.

Matematisk analys för doktorander.
Lärare: Kolsrud.
Tid och plats: Tisdagar kl. 10.15 – 12.00 i KTH:3721. Kursstart den 2 september. Se sidan 3.

Ringar av differentialoperatorer.
Lärare: Björk.
Tid och plats: Fredagar kl. 13.15 – 15.00 i SU:306. Kursstart meddelas senare.

Elementär kategoriteori, seminariekurs.
Lärare: Ekedahl.
Tid och plats: Meddelas senare.

Seminarier

Algebra- och geometriseminarier.
Seminarieledare: Ekedahl, Faber, Fröberg, Merkulov, Di Rocco, Roos, Skjelnes.
Tid och plats: Onsdagar kl. 13.15 – 15.00. Varannan vecka i SU:306. Varannan vecka i KTH:3733.

Seminarier i analys och dynamiska system.
Seminarieledare: Benedicks, Boman, Carleson, Hedenmalm, Laptev, Smirnov.
Tid och plats: Onsdagar kl. 13.15 – 14.15 i KTH:3721.

Logikseminarier.
Seminarieledare: Martin-Löf, Palmgren, Stoltenberg-Hansen.
Tid och plats: Onsdagar kl. 10.00 – 11.45 i SU:16. Vissa veckor i Uppsala.

Plurikomplexa seminariet.
Seminarieledare: Filipsson, Jöricke, Kiselman, Passare.
Tid och plats: Tisdagar kl. 10.15 – 12.00 i SU:306.

Kollokvier.
Seminarieledare: Kurlberg, Shapiro.
Tid och plats: Onsdagar kl. 16.00 – 17.00. Plats anges vid varje tillfälle.

För kurserna vid SU gäller: Undervisningen börjar tidigast under vecka 35 (25 – 29 augusti).

(Fortsättning på nästa sida.)

Adresser: KTH:3721: Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.
KTH:3733: Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.
SU:16: Sal 16, hus 5, Matematiska institutionen, SU, Kräftriket.
SU:306: Rum 306, hus 6, Matematiska institutionen, SU, Kräftriket.

MINIWORKSHOP IN PDE AND POTENTIAL THEORY

The workshop will take place at the Department of Mathematics, Stockholm University, on Friday, September 5, 2008, in room 306, house 6, Kräftriket.

Schedule

10.00 – 10.50 **Georg S. Weiss,** University of Tokyo: *The non-degenerate singular set in an unstable free boundary problem.*

Abstract: We prove a regularity result for the singular set of the unstable free boundary problem

$$\Delta u = -\chi_{\{u>0\}}\,.$$

In the case of a second-order non-degenerate solution our result says that the set at which the second derivatives of u are unbounded can be decomposed into a subset of an $n-2$-dimensional C^1-manifold and a set of dimension $n-3$.

11.00 – 11.50 **Vladimir Kozlov,** Linköping University: *The Benjamin-Lighthill conjecture for near-critical values of Bernoulli's constant.*

Abstract: The so-called Benjamin-Lighthill conjecture will be discussed. The conjecture was formulated in 1954 for the classical nonlinear problem of steady two-dimensional waves on water of finite depth and concerns a possibility to characterize all such waves by means of two non-dimensional parameters located within a certain region. Along with a survey of results obtained since 1954, a new approach (proposed in a joint work with Professor Nikolay Kuznetsov) to this conjecture will be presented. This approach leads to proving the conjecture for near-critical values of Bernoulli's constant.

11.50 – 13.30 Lunch.

13.30 – 14.20 **Miguel Ramos,** University of Lisbon: *Nodal solutions for superlinear elliptic equations and systems.*

Abstract: Is is known that for a large class of semilinear elliptic equations with superlinear nonlinearities, an infinite sequence of solutions exists, while a long standing conjecture states that the corresponding number of nodal domains should be arbitrarily large. Liouville type theorems imply an a priori bound for the set of the positive solutions, and so sign-changing solutions should be easily obtained. We show that this is the case under mild assumptions on the nonlinearity, and that these solutions persist for not so small perturbations. We also cover the biharmonic operator as well as strongly coupled Hamiltonean systems.

(Continued on the next page.)

14.30 – 15.20 **Gunilla Kreiss,** Uppsala University: *Granular material modelled as two-phase stato-elastic composites.*

Abstract: In granular materials (gravel, sand, grain, etc.) stresses often propagate differently than predicted by standard elastic models. Recently a new macroscopic model was derived. It is based on the assumption that the grains are solid and in static balance, and considers average microscopic properties such as the average number of contacts each grain has. It is valid on a length-scale much larger than individual grains. The result is a hyperbolic system for the stresses. From this system we can derive various features observed in experiments: force chains, leakage and branching of force chains. However, in realistic cases one must include the possibility of two-phase composites, where part of the material is elastic, modelled by an elliptic system for the stresses, and other parts are in a statically determined state, modelled by the above-mentioned hyperbolic system. It is crucial to formulate correct coupling conditions at interfaces between such regions. In this talk we describe the basic features of the static model, and explore the well-posedness of a two-phase formulation.

Sara Maad Henrik Shahgholian Andrzej Szulkin

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

Viviane Baladi: Linear response for piecewise expanding and smooth unimodal maps

Abstract: If f_t is a smooth parametrized family of dynamical systems admitting a unique SRB measure (for all, or for many, values of the parameter t), it is natural to ask whether the SRB measure depends smoothly on the dynamics. In dimension one, SRB measures are absolutely continuous invariant measures with a positive exponent. With Daniel Smania, we showed that the SRB measure is differentiable at 0 if and only if the path f_t is tangent to the topological class of f_0 (horizontality), for piecewise expanding unimodal maps. In that case, we recover a resummation of Ruelle's divergent candidate for the value of the derivative of the SRB measure.

We will present this result (for which we have recently found a new proof, more suitable to higher-dimensional generalizations) and explain why our smooth deformations theory shows that horizontality is a codimension one condition. Then, we shall move to analytic unimodal maps and present Ruelle's result for Misiurewicz maps and our result on Collet-Eckmann maps. We shall end by some conjectures in the differentiable Collet-Eckmann setting and open questions in higher dimensions.

The talk is based on joint work with Daniel Smania.

Tid och plats: Tisdagen den 2 september kl. 13.15 – 14.15 i seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

FÖRDJUPNINGSKURS I MATEMATIK

Michael Benedicks:
Kaotiska dynamiska system, SF2720

Kursen är avsedd för teknologer i F4, D4 och E4 och för doktorander, m.fl.

Sedan ett antal år är kaotiska dynamiska system mycket uppmärksammade i vetenskapen. En aspekt är kaos, fraktaler, o.s.v., ofta illustrerat med de fantastiska bilder — Mandelbrotmängden, Juliamängder, etc. — som uppstår vid datorsimuleringar av iterationer av komplexa polynom.

En annan aspekt är s.k. "Strange attractors", som uppträder vid datorsimuleringar av ordinära differentialekvationer och differensekvationer. Några av de mest kända matematiska experimenten utfördes av meteorologen E. Lorentz (en förenklad modell för Navier-Stokes ekvationer) och astronomen M. Hénon, och här vid institutionen har vi studerat just dessa modeller rigoröst och bevisat kaotiskt beteende.

D. Ruelle och F. Takens har föreslagit att turbulenta fenomen — åtminstone delvis — skulle kunna förklaras via "Strange attractors".

En fundamental upptäckt inom området gjordes av fysikern M. Feigenbaum, som upptäckte hur många system genomgår en karakteristisk periodfördubbling för att sedan uppträda slumpmässigt (kaotiskt) trots att systemet är deterministiskt. Senare har man visat att dessa periodfördubblingar uppträder i vätskeflöde för flytande helium.

Kursen är ur matematisk synpunkt rätt speciell. Här får man på relativt elementär nivå inblick i fenomen som ligger rätt nära forskningsfronten. Vi räknar med att genomföra 1 – 2 datorlaborationer. Huvudvikten i kursen ligger dock vid den matematiska teorin, som i själva verket har en lång historia med namn som Poincaré, Fatou, Birkhoff, Smale, m.fl., och som under senare tid utvecklats snabbt, delvis i symbios med datorexperimenten.

Tid och plats: Kursen ges en gång per vecka under höstterminen med vissa extra undervisningstillfällen, totalt 36 timmar. Det första mötet äger rum tisdagen den 9 september kl. 10.15 – 12.00 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Preliminär tid för de fortsatta undervisningstillfällena är tisdagar, samma tid och plats, men jag är öppen för andra förslag. Fortsatt schema kommer att diskuteras vid det första undervisningstillfället.

Litteratur: Clark Robinsson: *An introduction to dynamical systems: continuous and discrete,* Pearson Prentice Hall, 2004, xiv + 652 pp., ISBN 0-13-143140-4. Även den tidigare kursboken: R. L. Devaney: *Introduction to Chaotic Dynamical Systems,* 2nd edition, Addison-Wesley, kan vara värdefull. Andra artiklar och relevant material kommer att utdelas.

Om du inte kan komma till det första mötet, kontakta mig.

Language: This course will be given in English if there is sufficient interest among the participants to do so. Do not hesitate to contact me if the proposed time does not suit you. A web-page with course information will appear on
http://www.math.kth.se/math/GRU/2008.2009/SF2720/.

Välkomna!

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GRU-SEMINARIUM I MATEMATIK

Ruedi Seiler:
E-learning in mathematics education at the university level. Experience and perspective with the learning environment MUMIE

Abstract: MUMIE is a multimedia platform for exploratory and interactive teaching and learning of mathematics. It promotes active engagement with mathematical content and has a wide spectrum of applications, for example, self-study, support of lectures or entire courses, math-labs, preparation for examinations, etc.

MUMIE is used at the Technische Universität Berlin and the ETH Zürich and to a lesser extent at the TU München, the RWTH Aachen and at the Georgia Institute of Technology (USA). At the Technische Universität Berlin, MUMIE is used as a platform for a self-assessment test for students about to enter the university and the multimedia-support of three regular courses for engineering and math-students where the number of students range up to 2000 for a single course. At the ETH Zürich, MUMIE is used for the complementary support of service lectures for first year engineering students with student numbers of about 200 in each course.

In my talk, I will focus on the course "Linear Algebra for Engineering Students" at the TU Berlin, where we use a blended learning approach called TUMULT. In an online-course students can explore and practice complex concepts through interactive visualizations. Homework problems are different for each student. Each problem involves a demonstration, a training and a problem environment. The student solutions are automatically corrected and evaluated; thus teachers are relieved from routine work and have much more time for individual contact with their students.

The MUMIE database includes fine-granular multimedia content and texts, such as mathematical definitions, theorems, and examples or visualizations through images or applets. These contents can be put together to compose worksheets, lectures, courses, labs, etc. The course content is displayed in a semantic network. Problem-types extend beyond multiple-choice and involve much more complex and dynamic types necessary for mathematics teaching at the university level.

MUMIE is based on web technology. Students access MUMIE via a web browser. Contents are stored on a server, from which websites are created dynamically. Special tools allow authors to create content and courses. The MUMIE is developed and supported by a newly created open source community.

Tid och plats: Torsdagen den 28 augusti kl. 12.00 – 13.00 i sammanträdesrum 3424 (innanför pausrummet), Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 4. Den som anmäler sitt deltagande i seminariet till Lars Filipsson (lfn@math.kth.se) senast kvällen före seminariet får en lunchsmörgås.