CMO-BIRS 2015

Applied Functional Analysis
Jun 28 - Jul 3, 2015

MEALS

*Breakfast: 7:00 – 9:00 am, Restaurant Hotel Hacienda Los Laureles, Monday – Friday
*Lunch: 13:30 am – 15:00 pm, Restaurant Hotel Hacienda Los Laureles, Monday – Friday
*Dinner: 19:00 – 21:00 pm, Restaurant Hotel Hacienda Los Laureles, Sunday – Thursday
*Continuous Coffee Breaks: Conference Room San Felipe, Hotel Hacienda Los Laureles

MEETING ROOMS

All lectures will be held in the Conference Room San Felipe at Hotel Hacienda Los Laureles. An LCD projector, laptop, document camera and blackboards are available for presentations.

Schedule

Sunday (June 28)

14:00 Check-in begins(front desk at your assigned hotel - open 24 hours).

19:00–21:00 Dinner, Restaurant Hotel Hacienda Los Laureles.

20:30 Informal gathering Hotel Hacienda Los Laureles (if desired).
A welcome drink will be served by the hotel.

Monday (June 29)

7:00-8:45 Breakfast

8:45-9:00 Introduction and welcome

9:00-9:30 Yuan Xu: Polynomial Approximation in the Sobolev Space.

9:40-10:10 András Kroó: On multivariate "needle" polynomials and their application to norming sets and cubature formulas.

10:10-10:50 Coffee break

10:50-11:20 Tamas Erdelyi: The Mahler measure of Littlewood polynomials.

11:30-12:00: Vladimir Andrievskii: Polynomial Approximation on Compact sets in the Plane.

13:20 Group photo

13:30–15:00 Lunch

15:00-15:30 Kirill Kopotun: Polynomial approximation with doubling weights.

15:40-16:10 Andriy Prymak: On Nikol'skii inequalities for domains in $\mathbb{R}^d$.

16:10-16:40 Coffee break

16:40-17:10 Sergey Tikhonov: Weighted Bernstein inequalities.

19:00-21:00 Dinner

Tuesday (June 30, 2015):

7:00-9:00 Breakfast

9:00-9:30 Ian H. Sloan: Needlet approximation on the sphere – a fully discrete version.

9:40-10:10 Bin Han: Optimal Estimates on Robustness Property of Gaussian Random Matrices under Corruptions.

10:10-10:45 Coffee break

10:45-11:15 Alexei Shadrin: Stable reconstruction from Fourier samples.

11:25-11:55 Dinh Dũng: Sampling recovery in high dimensions on sparse grids.

13:30-15:00 Lunch

15:00-15:30 Denka Kutzarova: An X-Greedy Algorithm with Weakness Parameters.

15:40-16:10 Igor Pritsker: Real zeros of random orthogonal polynomials.

16:10-16:40 Coffee break

16:40-17:10 Isaac Pesenson: Kolmogorov and linear widths of balls in Sobolev spaces on compact manifolds.

17:20-17:50 Han Feng: On the Nikol'skii type inequality for spherical harmonics.

19:00-21:00 Dinner

Wednesday (July 1)

7:00-9:00 Breakfast

Free afternoon

13:30-15:00 Lunch

16:40-17:10 Thomas Schlumprecht: Greedy Bases and Renormings of Banach spaces which have them.

17:10-17:40 Coffee break

17:40-18:10 Laura De Carli: From exponential bases to the discrete Hilbert transform.

18:20-18:50 Volodya Temlyakov: Greedy algorithms in numerical integration.

19:00-21:00 Dinner

Thursday (July 2)

7:00-9:00 Breakfast

9:00-9:30 Boris Kashin: Selecting large submatrices with small norm in a fixed matrix.

9:40-10:10 J. D. Ward: Local Bases on Spheres with Applications.

10:10-10:50 Coffee break

10:50-11:20 Heping Wang: Entropy numbers of weighted Sobolev classes on the unit sphere with respect to Dunkl weight.

11:30-12:00 Javad Mashreghi: Approximation in $H(b)$ spaces.

13:30-15:00 Lunch

15:00-15:30 Olga Holtz: Zonotopal algebra: approximation theory meets algebra and combinatorics.

15:40-16:10 Guiqiao Xu: Exponential convergence-tractability of general linear problems.

16:10-16:40 Coffee break

16:40-17:10 Jorge Bustamante B. Gonzalez: One-sided Approximation and Quadratures.

17:20-17:50 Moises Soto-Bajo: Anisotropic approximation with shift-invariant subspaces.

19:00–21:00 Dinner

Friday (July 3)

7:00 - 9:00 Breakfast

9:00 - 9:30 Martin Buhmann: Multiquadric Interpolation.

9:40 - 10:10 Akram Aldroubi: Dynamical Sampling, cyclical sets, cyclical frames and the spectral theory.

10:10 - 10:45 Coffee Break

10:45-11:15 Daniel Vera: Shearlets and Approximation.

11:25-11:45 Wenrui Ye: TBA

13:30-15:00 Lunch

Check-out by 12 noon.

** 5-day workshop participants are welcome to use Hotel Hacienda Los Laureles facilities until 3 pm on Friday, although participants are still required to checkout of the guest rooms by 12 noon. **

Applied Functional Analysis
Jun 28 - Jul 3, 2015

Abstracts

(in alphabetic order by speaker surname)

Speaker: Akram Aldroubi (Vanderbilt University)

Title: Dynamical Sampling, cyclical sets, cyclical frames and the spectral theory.

Abstract: Let f be a signal at time $t = 0$ of a dynamical process controlled by an operator A that produces the the signals $Af, A^2 f, \ldots$ at times $t = 1, 2, \ldots$. Let M be a measurements operator applied to the series $Af, A^2 f, \ldots$ at times $t = 1, 2, \ldots$. The problem is to recover f from the measurements $Y = \{Mf, MAf, MA^2 f, \ldots, MA^L f\}$. This is the so called Dynamical Sampling Problem. A prototypical example is when $f \in \ell^2(\mathbb{Z})$, X a proper subset of $\mathbb{Z}$ and $Y = \{f(X), Af(X), A^2 f(X), \ldots, A^L f(X)\}$. The problem is to find conditions on A, X, L, that are sufficient for the recovery of f. This problem has connection to many areas of mathematics including frames, and Banach algebras, and the recently solved Kadison-Singer/Feichtinger conjecture. We will discuss the problem, its applications, and some of the recent results obtained with in collaboration Carlos Cabrelli, Ursula Molter, Armenak Petrosyan, and Sui Tang.

Speaker: Vladimir Andrievskii (Kent State University).

Title: Polynomial Approximation on Compact sets in the Plane.

Abstract: We are going to discuss some results and open problems concerning the following topics.

- The Vasiliev-Totiks extension of the classical Bernstein theorem on polynomial approximation of piecewise analytic functions on a closed interval. The error of the best uniform approximation of such functions on a compact subset of the real line is studied.
- A conjecture on the rate of polynomial approximation on the compact set of the plane to a complex extension of the absolute value function. The conjecture was stated by Grothmann and Saff in 1988. Related to this is another conjecture, Gaiers conjecture, on the polynomial approximation of piecewise analytic functions on a compact set consisting of two touching discs.
- The estimates of the uniform norm of the Chebyshev polynomial associated with a compact set $K \subset \mathbb{C}$ consisting of a finite number of continua in the complex. These estimates are exact (up to a constant factor) in the case where the components of K are either quasiconformal arcs or closed Jordan domains bounded by a quasiconformal curve. The case where K is a uniformly perfect or a homogeneous subset of the real line is also of interest.
- A Jackson-Mergelyan type theorem on the uniform polynomial approximation of continuous polyharmonic functions on a set "without cusps on the boundary that point inside of the set". This theorem can be applied to derive a harmonic counterpart of a result by Mezhevich and Shirokov on the analytic polynomial approximation of continuous functions on a set consisting of two parallel segments.

Speaker: Martin Buhmann(Justus-Liebig University, Germany).

Title: Multiquadric Interpolation.

Abstract: In this talk we will provide new results on interpolation and quasi-interpolation by multiquadric radial basis functions and related classes of kernel functions, such as inverse and generalised mulltiquadrics, including existence and convergence estimates, and theorems on the function.

Speaker: Jorge Bustamante B. Gonzalez (Universidad Autnoma de Puebla).
Title: One-sided Approximation and Quadratures.
Abstract: We construct new operators which provide algebraic polynomials for one-sided approximation of differentiable functions in L_p $(1 \leq p < \infty)$ norms. If we look for the best selection associated to the construction, then we need to find the exact best one-sided approximants to a Heaviside function. We were able to solve this problem. The analysis of the best one-sided approximats of Heaviside function is related with the study of non classical quadrature formulas. Quasi-orthogonal polynomials should be considered.

Speaker: Laura De Carli (Florida International University).
Title: From exponential bases to the discrete Hilbert transform.
Abstract: The discrete Hilbert transform was first studied by D. Hilbert and H. Weil in 1908 and has generated interest among the mathematician ever since. In this talk I will show how a seemingly simple problem on exponential bases on L^2 lead to the investigation of a one-parameter semigroup of operators on l^2 whose infinitesimal generator is the discrete Hilbert transform. If time allows, I will also present other families of discrete operator that appear in connection with problems on exponential bases. Part of this work-in-progress is joint with my student Shaikh Gohin Samar.

Speaker: Dinh Dũng (Vietnam National University, Hanoi).
Title: Sampling recovery in high dimensions on sparse grids.
Abstract: Sparse grids are an efficient tool in some high-dimensional approximation and recovery problems involving a big number of variables, and especially, in applications in data mining, mathematical finance, learning theory, numerical solving of PDE and stochastic PDE, etc. We constructed linear algorithms of sampling recovery and cubature formulas on sparse Smolyak grids thickened by large parameter m, of d-variate periodic functions having Lipschitz-Hölder mixed smoothness $\alpha > 0$, and studied their optimality. Our construction is based on a function representation by the Faber series and more generally, high-order B-spline series which is generated from a quasi-interpolation. We established lower bounds (for $\alpha \leq 2$) and upper bounds of the error of optimal sampling recovery and optimal integration on Smolyak grids, explicitly in d, m and the number ν of active variables of functions when the dimension (the number of variables) d may be very large.

Speaker: Tamas Erdelyi (Texas A & M University).
Title: The Mahler measure of Littlewood polynomials.
Abstract: Littlewood polynomials are polynomials with each of their coefficients in -1, 1. In this talk we focus on the Mahler measure of Littlewood polynomials. A recent result establishes the expected value of the Mahler measure of Littlewood polynomials of degree n. A sequence of Littlewood polynomials that satisfies a remarkable flatness property on the unit circle of the complex plane is given by the Rudin-Shapiro polynomials. The Rudin-Shapiro polynomials appear in Harold Shapiro's 1951 thesis at MIT and are sometimes called just Shapiro polynomials. They also arise independently in a paper by Golay in 1951. They are

remarkably simple to construct and are a rich source of counterexamples to possible conjectures. Despite the simplicity of their definition not much is known about the Rudin-Shapiro polynomials. It is shown in this talk that the Mahler measure and the maximum modulus of the Rudin-Shapiro polynomials on the unit circle of the complex plane have the same size. This settles a longstanding conjecture of a number of experts. Some consequences of this result may also be mentioned. Another example of Littlewood polynomials are the Fekete polynomials whose coefficients are Legendre symbols. Analogous results on the Mahler measure of the Fekete polynomials are also discussed.

Speaker: Han Feng (University of Alberta).
Title: On the Nikol'skii type inequality for spherical harmonics.
Abstract: We consider the problem of determining the sharp asymptotic order of the following Nikolskii type inequality for spherical harmonics Y_n of degree n on the unit sphere $\mathbb{S}^{d-1}$ of $\mathbb{R}^d$ as $n \to \infty$:

$$\|Y_n\|_{L^q(\mathbb{S}^{d-1})} \leq Cn^{\alpha(p,q)} \|Y_n\|_{L^p(\mathbb{S}^{d-1})}, \quad 0 < p < q \leq \infty.$$

In many cases, these sharp estimates are better than the corresponding estimates in the Nilkolskii inequality for spherical polynomials. This is a joint work with F. Dai and S. Tikhonov.

Speaker: Bin Han (University of Alberta).
Title: Optimal Estimates on Robustness Property of Gaussian Random Matrices under Corruptions.
Abstract: JohnsonLindenstrauss Lemma is often used in dimensionality reduction and concerns low-distortion embedding of points from high-dimensional space into low-dimensional space. The existence of an ideal projection matrices in the JohnsonLindenstrauss Lemma is often proved using Gaussian random matrices. Gaussian random matrices under corruptions also play a key role in the establishment of the robust restricted isometry property in compressed sensing. In this talk, For arbitrary erasure of rows, we consider the almost norm preservation property of Gaussian random matrices and then use it to prove the robustness property of the JohnsonLindenstrauss Lemma and robust restricted isometry property in compressed sensing. When the ratio of missing/erased rows is small, we prove an optimal result on the robustness property of the almost norm preservation property of Gaussian random matrices and the robustness of JohnsonLindenstrauss Lemma under corruptions. When the ratio of missing/erased entries is large, we obtain an optimal result on the robust restricted isometry property in compressed sensing by using order statistics and Gaussian random matrices. This is joint work with Zhiqiang Xu.

Speaker: Olga Holtz (University of California-Berkeley and Technical University Berlin).
Title: Zonotopal algebra: approximation theory meets algebra and combinatorics.
Abstract: I'll give an overview of zonotopal algebra, a subject on the borderline between approximation theory, algebra and combinatorics. I'll discuss recent advances and challenges that lie ahead.

Speaker: Boris Kashin (Steklov Mathematics Institute).
Title: Selecting large submatrices with small norm in a fixed matrix.
Abstract: We consider $N \times n$ matrices defining linear operators with norm 1 from the space l_p^n into l_q^N. We give a survey of results on finding large submatrices of such matrices

which have a small norm.

Speaker: Kirill Kopotun (University of Manitoba).
Title: Polynomial approximation with doubling weights.
Abstract: In this talk, I'll discuss matching direct and inverse results for weighted approximation by algebraic polynomials in the L_p, $0 < p \leq \infty$, (quasi)norm weighted by doubling weights as well as various equivalence type results involving related K-functionals and realization type results (obtained as corollaries of our estimates). In particular, I'll attempt to shed some light on why A^* weights behave like constant weights in the inverse estimates, and why the general doubling weights do not. Among other things, we close a gap left in a 2001 paper by G. Mastroianni and V. Totik.

Speaker: András Kroó (Alfréd Rényi Institute of Mathematics, Hungarian Academy of Sciences, Budapest, Hungary).
Title: On multivariate "needle" polynomials and their application to norming sets and cubature formulas.
Abstract: Univariate needle polynomials p_n of degree n on the interval $[-1, 1]$ attain value 1 at some $x_0 \in [-1, 1]$ and are "exponentially small" $0 \leq p_n(x) \leq e^{-n\phi(h)}$ whenever $|x| = 1$, $|x - x_0| > h$ with $\phi(h) \downarrow 0$ being some positive function of $h > 0$ depending on the location of x_0. These polynomials which are widely applied in various areas can be viewed as the optimal polynomial Dirac delta functions.

In this talk we shall discuss properties of **multivariate** needle polynomials. Even in the univariate case there is an essential difference between the rate of decrease of the needle polynomials at the inner and boundary points of the interval. This phenomena becomes more intricate in the multivariate case. We will show how the decrease of the multivariate needle polynomials at the boundary points of convex bodies is related to the geometry of the boundary. This will be accomplished for both ordinary and homogeneous multivariate polynomials. Finally, we shall discuss how properties of needle polynomials can be applied in the study of norming sets (optimal meshes) and cubature formulas.

Speaker: Denka Kutzarova (University of Illinois at Urbana-Champaign).
Title: An X-Greedy Algorithm with Weakness Parameters.
Abstract: We prove that in the space $\left(\sum_{n=1}^{\infty} F_n\right)_{\ell_p}$, $1 < p < \infty$, where F_n are finite-dimensional smooth spaces, the X-Greedy Algorithm with weakness parameters converges for some special dictionaries. This is a joint work with S.J. Dilworth, S. Gogyan and R. Causey.

Speaker: Javad Mashreghi (Laval).
Title: Approximation in $H(b)$ spaces.
Abstract: Analytic polynomials are dense in most classical Banach spaces of analytic functions on the open unit disc, e.g. Hardy, Bergman and Dirichlet spaces. A usual demonstration is as follows: we approximate f by f_r. The latter function is defined on a larger disc which contains the open unit disc. Hence, naively speaking, it should be a nice function. Then we approximate f_r by the partial sums of its Taylor series. Polynomials are dense in the de Branges-Rovnyak space $H(b)$. However, the original proof is not constructive. We succeeded to show that the above mentioned technic actually fails! Contrary to our expectation, there is an explicit example such that $\|f_r\| \to \infty$. Nevertheless, despite this strange

behavior, we provide a constructive proof.

Speaker: Isaac Pesenson (Temple University).
Title: Kolmogorov and linear widths of balls in Sobolev spaces on compact manifolds.
Abstract: We determine upper asymptotic estimates of Kolmogorov and linear n-widths of unit balls in Sobolev norms in L_p-spaces on smooth compact Riemannian manifolds. For compact homogeneous manifolds, we establish estimates which are asymptotically exact, for the natural ranges of indices. The proofs heavily rely on our previous results such as: estimates for the near-diagonal localization of the kernels of elliptic operators, Plancherel-Polya inequalities on manifolds, cubature formulas with positive coefficients and uniform estimates on Clebsch-Gordon coefficients on general compact homogeneous manifolds. It is joint work with Daryl Geller.

Speaker: Igor Pritsker (Oklahoma State University).
Title: Real zeros of random orthogonal polynomials.
Abstract: We study the expected number of real zeros for random linear combinations of orthogonal polynomials. It is well known that Kac polynomials, spanned by monomials with i.i.d. Gaussian coefficients, have only $(2/\pi + o(1)) \log n$ expected real zeros in terms of the degree n. On the other hand, if the basis is given by Legendre (or more generally by Jacobi) polynomials, then random linear combinations have $n/\sqrt{3} + o(n)$ expected real zeros. We prove that the latter asymptotic relation holds universally for a large class of random orthogonal polynomials on the real line, and also give more general local results on the expected number of real zeros. (Joint work with D. S. Lubinsky and X. Xie.)

Speaker: Andriy Prymak (University of Manitoba).
Title: On Nikol'skii inequalities for domains in $\mathbb{R}^d$.
Abstract: Nikol'skii inequalities for various sets of functions, domains and weights will be discussed. Much of the work is dedicated to the class of algebraic polynomials of total degree n on a bounded convex domain D. That is, we study $\sigma := \sigma(D, d)$ for which

$$\|P\|_{L_q(D)} \leq c n^{\sigma(\frac{1}{p} - \frac{1}{q})} \|P\|_{L_p(D)}, \quad 0 < p \leq q \leq \infty,$$

where P is a polynomial of total degree n. We use geometric properties of the boundary of D to determine $\sigma(D, n)$ with the aid of comparison between domains. Computing the asymptotics of the Christoffel function of various domains is crucial in our investigation. The methods will be illustrated by the numerous examples in which the optimal $\sigma(D, n)$ will be computed explicitly. This is a joint work with Zeev Ditzian.

Speaker: Thomas Schlumprecht (Texas A & M University)
Title: Greedy Bases and Renormings of Banach spaces which have them.

Speaker: Alexei Shadrin (University of Cambridge)
Title: Stable reconstruction from Fourier samples.
Abstract: For an analytic and periodic function f, the m-th partial sums of its Fourier series converge exponentially fast in m, but such rapid convergence is destroyed once periodicity is no longer present (because of the Gibbs phenomenon at the end-points).

We can restore higher-order convergence, e.g., by reprojecting the slowly convergent Fourier series onto a suitable basis of orthogonal algebraic polynomials, however, all exponentially convergent methods appear to suffer from some sort of ill-conditioning, whereas methods that recover f in a stable manner have a much slower approximation rate.

We give to these observations a definite explanation in terms of the following fundamental stability barrier: the best possible convergence rate for a stable reconstruction from the first m Fourier coefficients is root-exponential in m.

Speaker: Ian H. Sloan (UNSW Australia – The University of New South Wales)

Title: Needlet approximation on the sphere – a fully discrete version.

Abstract: Spherical needlets are highly localized radial polynomials on the sphere $\mathbb{S}^d \subset \mathbb{R}^{d+1}$, $d \geq 2$, with centers at the nodes of a suitable quadrature rule. The original spherical needlet approximation as proposed by Narcowich, Petrushev and Ward has coefficients defined by inner product integrals. In this talk we first review the needlet construction, and then report on recent joint work with Yu Guang Wang, Q Thong Le Gia and Robert Womersley, which uses an appropriate quadrature rule to construct a fully discrete (and hence constructible) needlet approximation. We prove that the global fully discrete approximation is equivalent to filtered hyperinterpolation, that is to a filtered Fourier-Laplace series partial sum with inner products replaced by quadrature rules of appropriate polynomial accuracy . We establish $\mathbb{L}_p$-error bounds and rates of convergence, $2 \leq p \leq \infty$, for the fully discrete needlet approximation of functions in Sobolev spaces $\mathbb{W}_p^s(\mathbb{S}^d)$ for $s > d/p$. The value of the discrete needlet construction for local approximation is shown by a numerical experiment that uses low-level needlets globally together with high-level needlets in a local region.

Speaker: Moises Soto-Bajo (Instituto Tecnolgico Autnomo de Mxico)

Title: Anisotropic approximation with shift-invariant subspaces.

Abstract: Consider the Lebesgue space $L^2(\mathbb{R}^d)$ of square summable functions with norm $\|\cdot\|_2$. A shift-invariant subspace V is a closed subspace of $L^2(\mathbb{R}^d)$ such that if $f \in V$ and $k \in \mathbb{Z}^d$, then $f(-k) \in V$. Associated to a given dilation A on $\mathbb{R}^d$, consider the operator $\mathcal{D}_A f() = |\det(A)|^{1/2} f(A\cdot)$ ($f \in L^2(\mathbb{R}^d)$). The shift-invariant subspaces V, H are said to be A-refinable and A-reducing, respectively, if $V \subset \mathcal{D}_A V$ and $H = \mathcal{D}_A H$. We give several conditions equivalent to the completeness property ($\cup_{j\in\mathbb{Z}} \mathcal{D}^j V$ is dense in H) of an A-refinable subspace V .

Let P_V denote the orthogonal projection on V . We consider the anisotropic Sobolev space $W_A^{\alpha,2}$ given by the norm $\|f\|_{A,\alpha} = \|(1+\rho)^\alpha \widehat{f}\|_2$, where $\alpha \geq 0$, $\widehat{f}$ is the Fourier transform of f, and ρ is a pseudo-norm for A^* , conjugate of A. We say that V provides A-approximation order $\alpha > 0$ if there exists $C > 0$ such that

$$\|f - P_{\mathcal{D}_A^j V} f\|_2 \leq C|\det A|^{-j\alpha/d} \|f\|_{A,\alpha}, \quad f \in W_A^{\alpha,2}, \quad j \in \mathbb{Z}.$$

Also, we say that V provides A-density order $\alpha \geq 0$ if

$$|\det(A)|^{j\alpha/d} \|f - P_{\mathcal{D}_A^j V} f\|_2 \to 0, \quad \forall f \in W_A^{\alpha,2}, \quad j \to \infty.$$

We give a characterization of the anisotropic approximation and density orders of a shift-invariant subspace V . These results generalize several others recently appeared in the literature. All the provided conditions focus on the local behaviour at the origin of the spectral function of V , making use of the previously introduced notions of anisotropic density point of a set and anisotropic approximate continuity point of a measurable function. Joint work

with P. Cifuentes and A. San Antolin.

Speaker: Volodya Temlyakov (University of South Carolina and Steklov Institute of Mathematics).

Title: Greedy algorithms in numerical integration.

Abstract: The main goal of this talk is to demonstrate connections between the following three big areas of research: the theory of cubature formulas (numerical integration), the discrepancy theory, and nonlinear approximation. We discuss a relation between results on cubature formulas and on discrepancy. In particular, we show how standard in the theory of cubature formulas settings can be translated into the discrepancy problem and into a natural generalization of the discrepancy problem. This leads to a concept of the r-discrepancy. We present results on a relation between construction of an optimal cubature formula with m knots for a given function class and best nonlinear m-term approximation of a special function determined by the function class. The nonlinear m-term approximation is taken with regard to a redundant dictionary also determined by the function class. We demonstrate how greedy algorithms can be used for constructing such m-term approximations and the corresponding Quasi–Monte Carlo methods for numerical integration. One of the messages (well known in approximation theory) of this talk is that the theory of discrepancy is closely connected with the theory of cubature formulas for the classes of functions with bounded mixed derivative.

Speaker: Sergey Tikhonov (ICREA, CRM, and UAB).

Title: Weighted Bernstein inequalities.

Abstract: We discuss Bernstein's inequalities for trigonometric polynomials with nondoubling weights. Joint work with A. Bondarenko.

Speaker: Daniel Vera (Instituto Tecnologico Autonomo de Mexico)

Title: Shearlets and Approximation.

Abstract: Shearlets are a relatively new multi-scale and multi-directional representation systems. Several sequence and function spaces related to the shearlet system have been introduced. Moreover, there exist embeddings between shearlet-generated and classical spaces. Most of the approximation properties of the shearlets have been focused on the class of the so-called cartoon-like functions and the ℓ^2-norm. We show that shearlets are democratic in the spaces they generate. We apply these results to show embeddings between approximation spaces, Lorentz spaces and Besov-type spaces in the framework of shearlets.

Speaker: Heping Wang (Capital Normal University).

Title: Entropy numbers of weighted Sobolev classes on the unit sphere with respect to Dunkl weight.

Abstract: In this talk, we discuss the entropy numbers of weighted Sobolev spaces on the sphere with respect to Dunkl weight, which is invariant under a finite reflection group, and obtain the asymtotic orders. We use the discretion method to reduce the problem to the one of the entropy numbers of a finite-dimensional weight spaces, and obtain the upper estimates of the latter one.

Speaker: J. D. Ward (Texas A & M University).

Title: Local Bases on Spheres with Applications.

Abstract: In this talk, small footprint bases that are well-localized spatially for a variety of kernels defined on S^n and other manifolds will be discussed. Many of the attractive features of these bases, e.g. locality, fast decay and computational ease of implementation, are dependent on well-distributed point sets on the ambient manifold. The main part of the talk will focus on some recent applications related to these bases including quadrature, meshless Galerkin methods for numerically solving certain PDEs, inverse estimates and Nikolskii inequalities. The talk is based on a number of papers with various authors including E. Fuselier, T. Hangelbroek, F. J. Narcowich, C. Rieger, X. Sun and G. Wright.

Speaker: Guiqiao Xu (Tianjin Normal University).
Title: Exponential convergence-tractability of general linear problems.
Abstract: We consider d-variate general linear problems defined over Hilbert spaces. We study algorithms that use finitely many evaluations of arbitrary linear functional. We introduce the necessary and sufficient conditions for exponential convergence tractability. All results are in terms of the corresponding reproducing kernel operators.

Speaker: Yuan Xu (University of Oregon).
Title: Polynomial Approximation in the Sobolev Space.
Abstract: The talk considers approximation by polynomials in the Sobolev space on the unit ball and on the simplex. The main problem is to obtain sharp error estimates for the best approximation for both function and its derivatives.

Speaker: Wenrui Ye (University of Alberta).
Abstract: TBA.