ORIGINAL PAPERS

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Andrey Badanin and Evgeny L. Korotyaev

Asymptotics of determinants of 4-th order operators at zero

We consider fourth order ordinary differential operators on the half-line and on the line, where the perturbation has compactly supported coefficients. The Fredholm determinant for this operator is an analytic function in the whole complex plane without zero. We describe the determinant at zero. We show that in the generic case it has a pole of order 4 in the case of the line and of order 1 in the case of the half-line.

Page 226–243

D. Dragičević

Admissibility and nonuniform polynomial dichotomies

For a general one-sided nonautonomous dynamics defined by a sequence of linear operators, we consider the notion of a polynomial dichotomy with respect to a sequence of norms and we characterize it completely in terms of the admissibility of bounded solutions. As a nontrivial application, we establish the robustness of the notion of a nonuniform polynomial dichotomy.

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G. Filipuk and M. N. Rebocho

Classification of Laguerre–Hahn orthogonal polynomials of class one

We study orthogonal polynomials related to Stieltjes functions satisfying Riccati type differential equations with polynomial coefficients, \( A S' = B S^2 + C S + D, \) with \( \max\{\deg(A), \deg(B)\} \leq 3, \ \deg(C) \leq 2. \) We derive recurrences for the three-term recurrence relation coefficients of the orthogonal polynomials, including connections with some forms of discrete Painlevé equations.

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Daniel Galicer, Martín Mansilla, and Santiago Muro

The sup-norm vs. the norm of the coefficients: equivalence constants for homogeneous polynomials

Let \( A_{p,r}^m(n) \) be the best constant that fulfills the following inequality: for every \( m \)-homogeneous polynomial \( P(z) = \sum_{|\alpha|=m} a_\alpha z^\alpha \) in \( n \) complex variables,

\[
\left( \sum_{|\alpha|=m} |a_\alpha|^r \right)^{1/r} \leq A_{p,r}^m(n) \sup_{z \in B_{\rho^p}} |P(z)|.
\]

For every degree \( m \), and a wide range of values of \( p, r \in [1, \infty] \) (including any \( r \) in the case \( p \in [1, 2] \), and any \( r \) and \( p \) for the 2-homogeneous case), we give the correct asymptotic behavior of these constants as \( n \) (the number of variables) tends to infinity. Remarkably, in many cases, extremal polynomials for these inequalities are not (as traditionally expected) found using classical random unimodular polynomials, and special combinatorial configurations of monomials are needed. Namely, we show that Steiner polynomials (i.e., \( m \)-homogeneous polynomials such that the multi-indices corresponding to the nonzero coefficients form partial Steiner systems), do the work for certain range of values of \( p, r \). As a byproduct, we present some applications of these estimates to the interpolation of tensor products of Banach spaces, to the study of (mixed) unconditionality in spaces of polynomials and to the multivariable von Neumann’s inequality.
Yoshikazu Giga, Mathis Gries, Matthias Hieber, Amru Hussein, and Takahito Kashiwabara

Analyticity of solutions to the primitive equations

This article presents the maximal regularity approach to the primitive equations. It is proved that the 3D primitive equations on cylindrical domains admit a unique global strong solution for initial data lying in the critical solenoidal Besov space $B_{pq}^{2/p}$ for $p, q \in (1, \infty)$ with $1/p + 1/q \leq 1$. This solution regularize instantaneously and becomes even real analytic for $t > 0$.

Samir Kallel

Some results on generalized Dunkl–Lipschitz spaces

In this paper we study certain relations between the Dunkl–Sobolev classes of fractional order $\mathcal{L}^p_{\alpha,k}(\mathbb{R})$ and the generalized Dunkl–Lipschitz classes $\wedge^k_{a,g,q}(\mathbb{R})$. Next, we show a Dunkl–Hardy–Littlewood theorem for $k$-temperatures and its dual. Also, we give some theorems on Dunkl convolutions of Dunkl–Lipschitz functions. Finally, we establish some results concerning the Dunkl transforms of functions and distributions belonging to generalized Dunkl–Lipschitz spaces.

Daehong Kim and Masakuni Matsuura

On a scattering length for additive functionals and spectrum of fractional Laplacian with a non-local perturbation

In this paper we study the scattering length for positive additive functionals of symmetric stable processes on $\mathbb{R}^d$. The additive functionals considered here are not necessarily continuous. We prove that the semi-classical limit of the scattering length equals the capacity of the support of a certain measure potential, thus extend previous results for the case of positive continuous additive functionals. We also give an equivalent criterion for the fractional Laplacian with a measure valued non-local operator as a perturbation to have purely discrete spectrum in terms of the scattering length, by considering the connection between scattering length and the bottom of the spectrum of Schrödinger operator in our settings.

Dinh Van Le, Uwe Nagel, Hop D. Nguyen, and Tim Römer

Codimension and projective dimension up to symmetry

Symmetric ideals in increasingly larger polynomial rings that form an ascending chain are investigated. We focus on the asymptotic behavior of codimensions and projective dimensions of ideals in such a chain. If the ideals are graded it is known that the codimensions grow eventually linearly. Here this result is extended to chains of arbitrary symmetric ideals. Moreover, the slope of the linear function is explicitly determined. We conjecture that the projective dimensions also grow eventually linearly. As part of the evidence we establish two non-trivial lower linear bounds of the projective dimensions for chains of monomial ideals. As an application, this yields Cohen–Macaulayness obstructions.

Satbir Malhi and Milena Stanislavova

On the energy decay rates for the 1D damped fractional Klein–Gordon equation

We consider the fractional Klein–Gordon equation in one spatial dimension, subjected to a damping coefficient, which is non-trivial and periodic, or more generally strictly positive on a periodic set. We show that the energy of the solution decays at the polynomial rate $O\left(t^{-\frac{s}{4s-2}}\right)$ for $0 < s < 2$ and at some exponential rate when $s \geq 2$. Our approach is based on the asymptotic theory of $C_0$ semigroups in which one can relate the decay rate of the energy in terms of the resolvent growth of the semigroup generator. The main technical result is a new observability estimate for the fractional Laplacian, which may be of independent interest.
Ludmila Nikolova, Lars-Erik Persson, and Natasha Samko
Some new inequalities involving the Hardy operator

In this paper we derive some new inequalities involving the Hardy operator, using some estimates of the Jensen functional, continuous form generalization of the Bellman inequality and a Banach space variant of it. Some results are generalized to the case of Banach lattices on \((0, b], 0 < b \leq \infty\).

Hongwei Zhang, Qingying Hu, and Gongwei Liu
Global existence, asymptotic stability and blow-up of solutions for the generalized Boussinesq equation with nonlinear boundary condition

In this paper, we consider initial boundary value problem of the generalized Boussinesq equation with nonlinear interior source and boundary absorptive terms. We establish firstly the local existence of solutions by standard Galerkin method. Then we prove both the global existence of the solution and a general decay of the energy functions under some restrictions on the initial data. We also prove a blow-up result for solutions with positive and negative initial energy respectively.