II-Encontro CEAFEL: Abstracts

Thursday, 15th of Septemper

2-Representations of Soergel bimodules in finite Coxeter type

Marco Mackaay, Universidade do Algarve, Faro, Portugal

In the last 10-15 years, various people for various reasons have defined and studied interesting examples of 2-categories and their 2-representations. On the Grothendieck group level the main ones correspond to quantum ground and their irreducible representations (or tensor products of those) and Hecke algebras and their cell representations (mostly not irreducible).

With these examples in mind, Mazorchuk and Miemietz set up a general framework for 2-representation theory of 2-categories. In this theory, the role of the simples is played by the so-called simple transitive 2-representations. Unlike the simples of a (finite-dimensional) algebra, the simple transitive 2-representations of a (finitary) 2-category are hard to classify in general.

For any Coveter type, the so called Soergel bimodules form a monoidal category (i.e. a 2-category with one object) whose split Grothendieck group is isomorphic to the corresponding Hecke algebra. In this talk, I will explain the classification of the simple transitive 2-representations of (the small quotient of) the 2-category of Soergel bimodules in any finite Coxeter type (joint with Kildetoft-Mazorchuk-Zimmermann and with Tubbenhauer).

Quadratic-phase Fourier transform

Luís Castro, Universidade de Aveiro, Portugal

We will introduce a generalization of the Fourier transform that can also be seen as a generalization of the so-called linear canonical transform. Some of its operational and fundamental properties will be studied. This includes a Riemann-Lebesgue type lemma, invertibility results, a Plancherel type theorem and a Parseval type identity. Moreover, several new convolutions associated with the introduced transform are obtained. The applicability of those convolutions (containing weight-functions related to some amplitude and Gaussian functions) will be briefly illustrated by solving a class of integral equations. In addition, the norm decay rate of the corresponding quadratic-phase Fourier oscillatory integral operator will be analysed. The talk is based on joint work with N.M. Tuan.

Supercharacters of Unitriangular Groups and Ramification Graphs

Filipe Gomes, Universidade de Lisboa, FCUL, Portugal

In this talk we shall construct a ramification graph associated to the supercharacter theory of the unitriangular groups. This will be a graded graph such that the vertices on the nth level will be the supercharacters of U_n and the edges will be given multiplicities using a form of restriction of supercharacters. We shall also examine how we can associate to this ramification graph a Riesz group and take a closer look at the possibility of defining on this group a product that makes in into a Riesz ring.

On the symmetrization of general Wiener-Hopf operators

Frank-Olme Speck, Universidade de Lisboa, IST, Portugal

This article focuses on general Wiener-Hopf operators given as $W = P_2 A|_{P_1 X}$ where X, Y are Banach spaces, $P_1 \in (X)$, $P_2 \in (Y)$ are any projectors and $A \in (X, Y)$ is boundedly invertible. It presents conditions for W to be equivalently reducible to a Wiener-Hopf operator in a symmetric space setting where $X = Y$ and $P_1 = P_2$. The results and methods are related to the so-called Wiener-Hopf factorization through an intermediate space and the construction of generalized inverses of W in terms of factorizations of A.

The talk is based upon joint work with Albrecht Böttcher, to appear in J. Operator Theory.

Friday, 16th of September

Kostka-Foulkes polynomials, raising operators and chip-firing game

Pasquale Petrullo, Universitàt degli Studi della Basilicata, Potenza, Italy

By means of the chip-firing game, an analogue of the Young raising operators can be defined for any connected simple graph. This gives in turn an analogue of the Hall-Littlewood symmetric functions for each of such graphs, then an analogue of the Kostka-Foulkes polynomials for any connected simple graph. Starting form this combinatorial approach, a subset of Kostka-Foulkes polynomials is considered which is closed under mutiplication. The elements of this semigroup are indexed by vectors of nonnegative integers and satisfy an interesting recursive formula.

Index formula for convolution type operators with piecewise continuous, slowly oscillating coefficients

Catarina Carvalho, Universidade de Lisboa, IST, Portugal

We establish an index formula for Fredholm convolution type operators on $L^2(\mathbb{R})$ of the form

$$A = \sum_{k=1}^{m} a_k W^0(b_k), \quad a_k, b_k \in \mathrm{alg}(\mathrm{SO}, \mathrm{PC})$$

where $\mathrm{alg}(\mathrm{SO}, \mathrm{PC})$ is the C^*-algebra of piecewise continuous functions on $\mathbb{R}$ that admit finite sets of discontinuities and slowly oscillate at $\pm\infty$. First we consider the case where all a_k or all b_k are continuous on $\mathbb{R}$ and slowly oscillating at $\pm\infty$; then we assume that $a_k, b_k \in \mathrm{alg}(\mathrm{SO}, \mathrm{PC})$ satisfy an extra Fredholm type condition to reduce to the above.

The study is based on a number of reductions to operators with smaller classes of coefficients, which include applying a technique of separation of discontinuities and eventually lead to the so-called truncated operators A_r, for sufficiently large $r > 0$, with PC coefficients. We prove that $\mathrm{ind}\, A = \lim_{r\to\infty} \mathrm{ind}\, A_r$, which can be computed by classical results of Duduchava.

The talk is based on joint work with M. Amélia Bastos and Yuri I. Karlovich.

γ-numbers

José Agapito Ruiz, Universidade de Lisboa, FCUL, Portugal

Given a polynomial $f(t) = a_0 + a_1 t + \cdots + a_n t \in \mathcal{R}[t]$, the γ-numbers of f are the coefficients of this polynomial in its expansion with respect to the basis

$$\Big\{(1+t)^n, t(1+t)^{n-2}, \ldots, t^{\lfloor n/2\rfloor}(1+t)^{n-2\lfloor n/2\rfloor}, t^{\lfloor n/2\rfloor+1}, \ldots, t^n\Big\}.$$

In particular, if f is palindromic (symmetric), its γ-numbers may be positive, negative, or zero (some of these numbers are necessarily zero). The γ-numbers are especially interesting when they are positive integers, since they can be associated to the counting of various combinatorial objects. The standard Eulerian and Narayana polynomials are two well-known examples of palindromic polynomials whose γ-numbers are positive integers.

The purpose of this talk is to present a general formula to compute the γ-numbers of any polynomial. We will pay special attention to the γ-numbers of a class of polynomials that contains the Eulerian and the Narayana polynomials, and discuss some of their combinatorial and geometrical interpretations.

Semi-Fredholmness of weighted singular integral operators with shifts and slowly oscillating data

Alexei Karlovich, Universidade Nova de Lisboa, FCT, Portugal

Let α, β be orientation-preserving diffeomorphisms (shifts) of $\mathbb{R}_+ = (0, \infty)$ onto itself, which have only two fixed points $0, \infty$ and let $U_\alpha f = (\alpha')^{1/p} f \circ \alpha$, $U_\beta f = (\beta')^{1/p} f \circ \beta$ be the corresponding isometric shift operators on $L^p(\mathbb{R}_+)$. We prove sufficient conditions for the right and left Fredholmness on $L^p(\mathbb{R}_+)$ of singular integral operators of the form $A_+ P_\gamma^+ + A_- P_\gamma^-$, where $P_\gamma^\pm = (I \pm S_\gamma)/2$, S_γ is a weighted Cauchy singular integral operator, $A_+ = aI - bU_\alpha$, $A_- = cI - dU_\beta$ are binomial functional operators with shifts. We assume that the coefficients a, b, c, d and the derivatives of the shifts α', β' are bounded continuous functions on $\mathbb{R}_+$, which may have slowly oscillating discontinuities at 0 and ∞. This is a joint work with Yuri Karlovich and Amarino Lebre.