Functional Analysis and Operator Theory

Valencia, September 18-23, 2017
Universitat Politècnica de València

http://wcaot2017.blogs.upv.es/

Scientific and Organizing Committee: M. José Beltrán-Meneu, José Bonet, M. Carmen Gómez-Collado, Enrique Jordá, Nuria Ortigosa
Welcome

The aim of this workshop is twofold: Firstly, to exhibit recent developments about Functional Analysis and Operator Theory and state open problem in this framework and also, to create a friendly mathematical environment in which to foster collaborations between researchers from different groups and research networks, both Spanish and foreign. This meeting is organized in the frame of activities of the Project AICO/2016/054 of GVA and it is supported by it.

The first meeting of this series was celebrated in Valencia in October 2016 and this one will take place in September 2017, from 18 to 23. The lectures will be given in lecture room of School of Architecture (ETSAV) of the Universitat Politecnica de Valncia.

This publication contains the abstracts of the conferences held at this workshop.

We welcome you to the city of Valencia, to our University, and to this meeting and we hope you will enjoy the city and the mathematical activities.


Organizing Committee
# Index

## Schedule

<table>
<thead>
<tr>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

## ABSTRACTS

<table>
<thead>
<tr>
<th>O. Blasco</th>
<th>Lipschitz-type conditions on homogeneous Banach spaces of analytic functions</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. Boggiatto</td>
<td>Time-frequency representations of signals, linear operators and uncertainty principles</td>
<td>2</td>
</tr>
<tr>
<td>C. Boiti</td>
<td>Semilinear $p$-evolution equations in Sobolev spaces</td>
<td>3</td>
</tr>
<tr>
<td>T. Clas</td>
<td>On Fréchet algebras admitting a dominating Hilbert algebra norm</td>
<td>4</td>
</tr>
<tr>
<td>J.A. Conejero</td>
<td>Lineability within probability theory settings</td>
<td>5</td>
</tr>
<tr>
<td>A. Debruyne</td>
<td>Solution to the first Cousin problem for vector-valued quasianalytic functions</td>
<td>6</td>
</tr>
<tr>
<td>A. Galbis</td>
<td>Composition operators on the Schwartz space</td>
<td>7</td>
</tr>
<tr>
<td>J. Galindo</td>
<td>The Fourier algebra and the center of its bidual</td>
<td>8</td>
</tr>
<tr>
<td>P. Galindo</td>
<td>Symmetric analytic functions on Banach spaces</td>
<td>9</td>
</tr>
<tr>
<td>A. Goncharov</td>
<td>On geometric characterizations of the extension property</td>
<td>10</td>
</tr>
<tr>
<td>A.J. Guirao</td>
<td>F-flatness and Bishop–Phelps–Bollobás type theorems for operators</td>
<td>11</td>
</tr>
<tr>
<td>J. Jiménez-Garrido</td>
<td>Growth indices for weight sequences and weight functions</td>
<td>12</td>
</tr>
<tr>
<td>J. Kakol</td>
<td>Separable quotient problem for spaces $C_p(K)$ over compact (Efimov) spaces $K$</td>
<td>13</td>
</tr>
<tr>
<td>T. Kalmes</td>
<td>Dynamics of weighted composition operators on function spaces defined by local properties</td>
<td>14</td>
</tr>
<tr>
<td>M. López-Pellícer</td>
<td>On properties $G$, $N$ and $wN$ in Boolean rings</td>
<td>15</td>
</tr>
<tr>
<td>E. Mangino</td>
<td>Composition operators between Fock spaces</td>
<td>17</td>
</tr>
<tr>
<td>P. Martínez-Jiménez</td>
<td>The shadowing property for linear operators</td>
<td>18</td>
</tr>
<tr>
<td>Author</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>V. Montesinos</td>
<td>Differentiability and structure in Banach spaces</td>
<td>19</td>
</tr>
<tr>
<td>A. Oliaro</td>
<td>The global Gabor wave front set in ultradifferentiable spaces</td>
<td>20</td>
</tr>
<tr>
<td>A. Osançliol</td>
<td>Weighted Orlicz algebras on locally compact groups</td>
<td>21</td>
</tr>
<tr>
<td>A.M. Peralta</td>
<td>New progress on Tingley’s problem for C*-algebras</td>
<td>22</td>
</tr>
<tr>
<td>A. Peris</td>
<td>Mean Li-Yorke chaotic operators</td>
<td>23</td>
</tr>
<tr>
<td>K. Piczczek</td>
<td>Amenable and Contractible Köthe Co-echelon Algebras</td>
<td>24</td>
</tr>
<tr>
<td>A. Przestacki</td>
<td>Dynamical properties of weighted composition operators</td>
<td>25</td>
</tr>
<tr>
<td>A. Rodríguez-Arenas</td>
<td>Ergodic properties of the multiplication operator</td>
<td>26</td>
</tr>
<tr>
<td>M. Sanchis</td>
<td>Completeness, metrizability and compactness in spaces of fuzzy-number-valued functions</td>
<td>27</td>
</tr>
<tr>
<td>J. Sanz</td>
<td>Surjectivity of the Borel map in Roumieu ultraholomorphic classes in sectors</td>
<td>28</td>
</tr>
<tr>
<td>P. Sevilla-Peris</td>
<td>Hardy spaces and holomorphic functions in infinitely many variables</td>
<td>29</td>
</tr>
<tr>
<td>M. Trybula</td>
<td>Hadamard multipliers on spaces of holomorphic functions</td>
<td>30</td>
</tr>
<tr>
<td>J. Wengenroth</td>
<td>Smooth functions on compact sets</td>
<td>31</td>
</tr>
<tr>
<td>E. Wolf</td>
<td>Composition operators between weighted Bergman spaces and weighted Banach spaces of holomorphic functions</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>List of participants</td>
<td>33</td>
</tr>
</tbody>
</table>
WORKSHOP ON FUNCTIONAL ANALYSIS AND OPERATOR THEORY
Valencia, September 18 - 23, 2017

SCHEDULE

Monday, September, 18

14:45–15:15  Registration
14:15–15:30  Welcome
15:30–16:10  J. Wengenroth: Smooth functions on compact sets
16:15–16:55  A. Goncharov: On geometric characterizations of the extension property
17:00–17:30  Coffee break
17:30–18:10  A. Galbis: Composition operators on the Schwartz space
18:15–18:55  A. Przystacki: Dynamical properties of weighted composition operators

Tuesday, September, 19

09:30–10:10  M. López Pellicer: On properties G, N and N in Boolean rings
10:15–10:55  T. Kalmes: Dynamics of weighted composition operators on function spaces defined by local properties
11:00–11:30  Coffee break
11:30–12:10  K. Piszczek: Amenable and Contractible Kthe Co-echelon Algebras
13:00–15:30  Lunch
15:30–16:10  A. Debrowere: Solution to the first Cousin problem for vector-valued quasianalytic functions
17:00–17:30  Coffee break
17:30–18:10  A. Peralta: New progress on Tingleys problem for C*-algebras
21:30  Social dinner

Wednesday, September, 20

09:30–10:10  M. Sanchs: Completeness, metrizability and compactness in spaces of fuzzy-number-valued functions
10:15–10:55  J. Galindo: The Fourier algebra and the center of its bidual
11:00–11:30  Coffee break
11:30–12:10  P. Galindo: Symmetric analytic functions on Banach spaces
12:15–12:55  E. Wolf: Composition operators between weighted Bergman spaces and weighted Banach spaces of holomorphic functions
13:00–15:30  Lunch
15:30–16:10  P. Boggiatto: Time-frequency representations of signals, linear operators and uncertainty principles
16:15–16:55  A. Oliaro: The global Gabor wave front set in ultradifferentiable spaces
17:00–17:30  Coffee break
17:30–18:10  J.A. Conejero: Lineability within probability theory settings
18:15–18:55  P. Sevilla-Peris: Hardy spaces and holomorphic functions in infinitely many variables
Thursday, September, 21

09:30–10:10  O. Blasco: Lipschitz-type conditions on homogeneous Banach spaces of analytic functions
10:15–10:55  A. Osangliol: Weighted Orlicz algebras on locally compact groups
11:00–11:30  Coffee break
11:30–12:10  A. Rodríguez-Arenas: Ergodic properties of the multiplication operator
12:15–12:55  T. Ciaś: On Frchet algebras admitting a dominating Hilbert algebra norm
13:00–15:30  Lunch
15:30–16:10  A. Peris: Mean Li-Yorke chaotic operators
16:15–16:55  F. Martínez-Jiménez: The shadowing property for linear operators
17:00–17:30  Coffee break
17:30–18:10  E. Mangino: Composition operators between Fock spaces
18:15–18:55  J. Kakol: Separable quotient problem for spaces $C_p(K)$ over compact (Efimov) spaces $K$

Friday, September, 22

09:30–10:10  J. Sanz: Surjectivity of the Borel map in Roumieu ultraholomorphic classes in sectors
10:15–10:55  A. J. Guirao: -flatness and BishopPhelpsBollobbs type theorems for operators
11:00–11:30  Coffee break
11:30–12:10  J. Jiménez-Garrido: Growth indices for weight sequences and weight functions
12:15–12:55  V. Montesinos: Differentiability and structure in Banach spaces
13:00–15:30  Lunch

Saturday, September, 23

09:30– Working Session
Abstracts
Lipschitz-type conditions on homogeneous Banach spaces of analytic functions

Oscar Blasco

Universidad de Valencia, Spain

Joint work with Georgios Stylogiannis, University of Thessaloniki

In this paper we deal with Banach spaces of analytic functions $X$ defined on the unit disc satisfying that $R_t f \in X$ for any $t > 0$ and $f \in X$, where $R_t f(z) = f(e^{it}z)$ and continuous and non-decreasing weights $\omega : [0, \pi] \rightarrow \mathbb{R}^+$ with $\omega(0) = 0$. Under some assumptions on the space $X$ and on the weight $\omega$ it is shown that the behaviour $\|P_r(Df)\|_X = O(\frac{\omega(1-r)}{1-r})$, $r \rightarrow 1$ on the derivative $Df(z) = \sum_{n=0}^{\infty} (n+1)a_n z^n$ is equivalent to any of the following statements:

(a) $\|R_t f - f\|_X = O(\omega(t))$, $t \rightarrow 0^+$, (b) $\|P_r f - f\|_X = O(\omega(1-r))$, $r \rightarrow 1^-$, (c) $\|\Delta_n f\|_X = O(\omega(2^{-n})), n \rightarrow \infty$ or (d) $\|f - s_n f\|_X = O(\omega(n^{-1})), n \rightarrow \infty$, where $P_r f(z) = f(rz)$, $s_n f(z) = \sum_{k=0}^{n} a_k z^k$ and $\Delta_n f = s_2^n f - s_2^{n-1} f$.

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Time-frequency representations of signals, linear operators and uncertainty principles

Paolo Boggiatto
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Whereas a function and its Fourier transform are the classical tools for representing a signal with respect to time and frequency separately, there exists a vast literature dealing with representations defined on the time-frequency plane, yielding therefore information simultaneously with respect to both variables.

The Cohen class of signal representations consists of quadratic forms obtained by filtering the classical Wigner transform by a convolution with a fixed kernel. Remarkably, by suitable choices of the kernel, practically all significant quadratic time-frequency representations can be obtained.

Various types of uncertainty principle can be formulated in this context according to the type of properties and representations which are involved. To this regards we present some results about uncertainty principles which deal with properties of supports, and local versions of uncertainty.

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Semilinear $p$-evolution equations in Sobolev spaces

Chiara Boiti
University of Ferrara, Italy

The talk is based on a joint work with Alessia Ascanelli

Let $p \geq 2$ and consider the semilinear $p$-evolution operator

$$P_u(D)u := D_t u + a_p(t)D^p_x u + \sum_{j=0}^{p-1} a_j(t, x, u)D^j_x u,$$  \hspace{1cm} (1)

where $D = \frac{1}{i} \partial$, $a_p \in C([0, T]; \mathbb{R})$, and $a_j \in C([0, T]; C^\infty(\mathbb{R} \times \mathbb{C}))$ with $x \mapsto a_j(t, x, w) \in B^\infty(\mathbb{R})$, for $0 \leq j \leq p - 1$ ($B^\infty(\mathbb{R})$ is the space of complex valued functions which are bounded on $\mathbb{R}$ together with all their derivatives).

As an example, the Korteweg-de Vries equation is of the form (1) for $p = 3$.

We look for sufficient conditions for $H^\infty$ local in time well-posedness of the Cauchy problem

$$(CP) \begin{cases}
P_u(D)u(t, x) = f(t, x), & (t, x) \in [0, T] \times \mathbb{R} \\
u(0, x) = u_0(x), & x \in \mathbb{R}.
\end{cases}$$

The assumption $a_p(t) \in \mathbb{R}$ is necessary by the Lax-Mizohata theorem. The hypothesis $a_j(t, x, w) \in \mathbb{C}$ implies some decay conditions on the coefficients as $|x| \to +\infty$ (see [I], [ABZ]).

We give in [AB] decay conditions on the coefficients for local in time well-posedness of the semilinear Cauchy problem (CP).

The most powerful instruments for the proof are the sharp-Gårding theorem, the Fefferman-Phong inequality and the Nash-Moser theorem.

References


On Fréchet algebras admitting a dominating Hilbert algebra norm

Tomasz Ciaś

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A Fréchet space \( E \) with a fundamental sequence \((\| \cdot \|_n)_{n \in \mathbb{N}}\) of seminorms has the property (DN) if there is a continuous norm \( \| \cdot \| \) on \( E \) such that for all \( k \in \mathbb{N} \) there is \( n \in \mathbb{N} \) and a constant \( C > 0 \) such that
\[
|\| x \|_k^2 \leq C \| x \| \| x \|_n
\]
for all \( x \in E \); each such norm \( \| \cdot \| \) is called a dominating norm on \( E \). The property (DN) plays a key role in the structure theory of nuclear Fréchet spaces – in 1977 Dietmar Vogt proved that a nuclear Fréchet space is isomorphic to a closed subspace of the space \( s \) of rapidly decreasing sequences if and only if it admits a dominating norm.

In the talk we consider (mostly commutative) Fréchet \( \ast \)-algebras \( E \) with unit – called DN-algebras – admitting a dominating Hilbert algebra norm, i.e., a dominating Hilbert norm \( \| \cdot \| = \sqrt{\langle \cdot, \cdot \rangle} \) such that
\[
\begin{align*}
(i) & \quad (xy, z) = (y, x^*z) \text{ for all } x, y, z \in E; \\
(ii) & \quad (y^*, x^*) = (x, y) \text{ for all } x, y \in E; \\
(iii) & \quad \text{for all } x \in E \text{ there is } C > 0 \text{ such that } \|xy\| \leq C\|y\| \text{ for all } y \in E.
\end{align*}
\]

Many commutative Fréchet \( \ast \)-algebras are DN-algebras, e.g., the algebras \( C^\infty(M) \) of smooth functions on smooth compact manifolds \( M \) and the algebras \( \mathcal{E}(K) \) of Whitney jets on compact sets \( K \subset \mathbb{R}^n \) with the extension property. If we, moreover, assume that a DN-algebra is isomorphic as a Fréchet space to a nuclear power series space \( \Lambda_\infty(\alpha) \) of infinite type, then it is isomorphic to a complemented \( \ast \)-subalgebra of the noncommutative topological \( \ast \)-algebra \( \mathcal{L}(s) \cap \mathcal{L}(s') \). This result may be seen as a step towards an analogue – in the context of algebras of smooth functions – of the celebrated Gelfand-Naimark theorem describing commutative \( C^\ast \)-algebras.

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Lineability within probability theory settings

J. Alberto Conejero

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The search of lineability consists on finding large vector spaces of mathematical objects with special properties. Such examples have arisen in the last years in a wide range of settings such as in real and complex analysis, sequence spaces, linear dynamics, norm-attaining functionals, zeros of polynomials in Banach spaces, Dirichlet series, and non-convergent Fourier series, among others.

In this talk we present the novelty of linking this notion of lineability to the area of Probability Theory by providing positive (and negative) results within the framework of martingales, random variables, and certain stochastic processes.

Some future research lines and open questions are commented.

This is part of a joint work with M. Fenoy, M. Murillo-Arcila, and J.B. Seoane-Sepúlveda. This work is partially supported by projects MTM2013-47093-P and MTM2016-75963-P.

References


Solution to the first Cousin problem for vector-valued quasianalytic functions

Andreas Debrouwere
Ghent University, Belgium

The aim of this talk is to present the solution to the first Cousin problem for vector-valued quasianalytic functions. We first study the locally convex structure of spaces of quasianalytic functions. By using results about the vanishing of the derived projective limit functor for (PLS)-spaces, we show how this topological information leads to the solution of the Cousin problem. As an application, we indicate how this result can be used to construct Colombeau-type differential algebras in which spaces of (infra)hyperfunctions are embedded.

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Composition operators on the Schwartz space

Antonio Galbis
Universidad de Valencia, Spain

We consider composition operators on the Schwartz space of rapidly decreasing functions and we study some of their properties with emphasis in the following aspects: necessary or sufficient conditions for the range of the composition operator to be closed and dynamical behavior and spectra.

The talk is based on the following two papers

C. Fernández, A. Galbis, E. Jordá; *Dynamics and spectra of composition operators on the Schwartz space*, arXiv:1707.03627 [math.FA]


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The Fourier algebra and the center of its bidual
Jorge Galindo
Universidad Jaume I, Spain

The Fourier algebra $A(G)$ of a locally compact Abelian group $G$ is the algebra of functions on $G$ whose Fourier transforms are integrable on the dual group $\hat{G}$. When $G$ is not commutative, the definition of $A(G)$ is much more sophisticated and produces an intriguing object that has interest from the perspectives of Harmonic Analysis, Operator Theory and Banach Algebras.

In this talk, I will provide an introduction to the Fourier algebra and review the impact of the group structure on the properties of Arens products.

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Symmetric analytic functions on Banach spaces

Pablo Galindo
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We consider analytic functions on complex Banach spaces $X$ that are invariant under the action of a certain set of operators in $\mathcal{L}(X)$. Such invariant functions have been vaguely called "symmetric" in the mathematical literature.

When dealing with sequence Banach spaces, the most common notion of symmetry is invariance under permutation of the variables. When turning to function spaces like $L_p([0,1])$, $p \geq 1$, a different notion of symmetry has been used: Invariance under bijections of $[0,1]$ that preserve the Lebesgue measure. For spaces of continuous functions on compact spaces $C(K)$, the "symmetry" we consider is invariance under homeomorphisms of $K$.

Along the talk a variety of cases of spaces "symmetric" analytic functions on the most usual Banach spaces will be presented.

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On geometric characterizations of the extension property

Alexandre Goncharov

Bilkent University, Turkey

Given compact set $K \subset \mathbb{R}^d$, let $\mathcal{E}(K)$ denote the space of Whitney jets on $K$ with its natural quotient topology. The compact set $K$ is said to have the extension property if there exists a linear continuous extension operator $L : \mathcal{E}(K) \rightarrow C^\infty(\mathbb{R}^d)$. We review the main methods to construct such an operator and show that there is no complete characterization of the extension property of sets in terms of densities of Hausdorff contents or related characteristics. Also the extension property cannot be characterized in terms of growth of Markov’s factors of sets.

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Γ-flatness and Bishop–Phelps–Bollobás type theorems for operators

Antonio José Guirao
Universitat Politècnica de València, Spain

This is a joint work with B. Cascales, V. Kadets & M. Soloviova.

The Bishop–Phelps–Bollobás property deals with simultaneous approximation of an operator $T$ and a vector $x$ at which $T$ nearly attains its norm by an operator $T_0$ and a vector $x_0$, respectively, such that $T_0$ attains its norm at $x_0$. In this note we extend the already known results about the Bishop–Phelps–Bollobás property for Asplund operators to a wider class of Banach spaces and to a wider class of operators. Instead of proving a BPB-type theorem for each space separately we isolate two main notions: Γ-flat operators and Banach spaces with ACK$\rho$ structure. In particular, we prove a general BPB-type theorem for Γ-flat operators acting to a space with ACK$\rho$ structure and show that uniform algebras and spaces with the property $\beta$ have ACK$\rho$ structure. We also study the stability of the ACK$\rho$ structure under some natural Banach space theory operations. As a consequence, we discover many new examples of spaces $Y$ such that the Bishop–Phelps–Bollobás property for Asplund operators is valid for all pairs of the form $(X,Y)$.

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Growth indices for weight sequences and weight functions

Javier Jiménez-Garrido
Universidad de Valladolid, Spain

When defining ultradifferentiable (or ultraholomorphic) classes of functions by means of weight sequences or functions, it is standard to impose some conditions on the weights in order to guarantee stability (product, derivation and composition closedness) and quasianaliticity properties. It turns out that many of them are related to, or can be expressed in terms of, the indices of O-Regular Variation studied by several authors (S. Aljancić, D. Arandelović, N.H. Bingham W. Matuszewska, E. Seneta). In this talk, we will present this connection and we will also show the link between the indices for a weight sequence and the ones for its associated weight function. Finally, classical and new theorems regarding the injectivity and surjectivity of the asymptotic Borel map will be stated in a simple way using these indices.

Joint work with Javier Sanz (Universidad de Valladolid, Spain) and Gerhard Schindl (University of Vienna, Austria).

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Separable quotient problem for spaces $C_p(K)$ over compact (Efimov) spaces $K$

Jerzy Kakol

Adam Mickiewicz University, Poland

The classic Rosenthal-Lacey theorem asserts that the Banach space $C(K)$ of continuous real-valued maps on an infinite compact space $K$ has a quotient isomorphic to $c$ or $l_2$. In [?] it is proved that the space $C_p(K)$ endowed with the pointwise topology has an infinite-dimensional separable quotient algebra iff $K$ has an infinite countable closed subset. Hence $C_p(\beta\mathbb{N})$ lacks infinite-dimensional separable quotient algebras. This motivates the following question: (*) Does $C_p(K)$ admit an infinite-dimensional separable quotient (shortly SQ) for any infinite compact space $K$? Particularly, does $C_p(\beta\mathbb{N})$ admit SQ? Our main theorem implies that $C_p(K)$ has SQ for any compact space $K$ containing a copy of $\beta\mathbb{N}$. Consequently, this result reduces problem (*) to the case when $K$ is an Efimov space (i.e. $K$ is an infinite compact space that contains neither a non-trivial convergent sequence nor a copy of $\beta\mathbb{N}$). Although, it is unknown if Efimov spaces exist in ZFC, we show, making use of some result of R. de la Vega (2008) (under ♦), that for some Efimov space $K$ the space $C_p(K)$ has SQ. Some applications of the main result are provided.

References:


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Dynamics of weighted composition operators on function spaces defined by local properties

Thomas Kalmes
Technische Universität Chemnitz, Germany

We give a framework for weighted composition operators on locally convex spaces of functions defined by local properties (like, for example, being continuous, smooth, holomorphic, or harmonic) in which it is possible to characterize dynamical properties like transitivity, mixing, or being power bounded by properties of the weight and the symbol of the composition operator. Depending on the linear topological structure of the underlying function space these results thus yield characterizations of hypercyclicity and mean ergodicity, respectively.

Apart from recovering well-known as well as recent results about the dynamics of weighted composition operators on spaces of holomorphic or smooth functions (see e.g. [1], [2], [3], [4], [5], we concentrate on weighted composition operators defined on kernels of certain constant coefficient partial differential operators including elliptic and non-degenerate parabolic operators.

References


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On properties $G$, $N$ and $wN$ in Boolean rings

Manuel López-Pellicer
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Joint work with J.C. Ferrando$^{(2)}$ and S. López-Alfonso$^{(3)}$

Let $\mathcal{R}$ be a ring of subsets of $\Omega$, $\ell_\infty(\mathcal{R})$ the complex Banach space of all bounded $\mathcal{R}$-measurable functions with the supremum-norm and let $\ell_\infty^0(\mathcal{R})$ be the linear hull of the characteristic functions $\chi_A, A \in \mathcal{R}$. For a $\sigma$-algebra $\Sigma$ of subsets of set $\Omega$, for the ring $\mathcal{Z}$ of subsets of density zero of $\mathbb{N}$ as well as for the algebra $\mathcal{J}(K)$ of Jordan measurable subsets of a compact interval $K$ of $\mathbb{R}^k$, we have that $\ell_\infty^0(\Sigma)$, $\ell_\infty^0(\mathcal{Z})$ and $\ell_\infty^0(\mathcal{J}(K))$ are baireled spaces ([5, Theorem 2.7], [1, theorem 2.5] and [3, Theorem 1]LA).

If $\mathcal{R}$ is a Boolean ring, the barrelledness of $\ell_\infty^0(\mathcal{R})$ is equivalent to the fact that $\mathcal{R}$ verifies the Nikodým-Grothendieck theorem. Since Schachermayer’s [7, 2.4 Definition (see also [2] and [8])]Sc such rings are called Boolean rings with property (N) and a subset $\Delta$ of $\mathcal{R}$ is a Nikodým set if pointwise boundedness on $\Delta$ implies norm-boundedness in the Banach space $\text{ba}(\mathcal{R})$ of bounded finitely additive measures on $\mathcal{R}$ with supremum-norm. If $\ell_\infty^0(\mathcal{R})$ is baireled then each increasing web $\{\mathcal{R}_{n_1,n_2,\ldots,n_p} : p, n_1, n_2, \ldots, n_p \in \mathbb{N}\}$ on $\mathcal{R}$ contains a strand $\{\mathcal{R}_{m_1,m_2,\ldots,m_i} : i \in \mathbb{N}\}$ consisting of Nikodým sets; then it is said that $\mathcal{R}$ has property ($wN$) ([5, Theorem 3.5]).

Concerning the open question of characterize those Boolean rings $\mathcal{R}$ for which $(N) \Longleftrightarrow (wN)$ we get the two following partial approaches:

- If a $\sigma$-algebra $\Sigma$ of subsets of a set $\Omega$ contains a $\Sigma$-hereditary ring $\mathcal{R}$ with a countably generated subring $\mathcal{M}$ such that if $\{A_n : n \in \mathbb{N}\} \subseteq \mathcal{R}$ there exists $\{M_n : n \in \mathbb{N}\} \subseteq \mathcal{M}$ verifying that $\bigcup_{n=1}^\infty (A_n \setminus M_n) \in \mathcal{R}$, then the properties $(N)$ and $(wN)$ are equivalents in $\mathcal{R}$. This contains [1], [3] and [5], and imply that if $\{\mu_n : n \in \mathbb{N}\}$ is a sequence of atomless probability measures on $\Sigma$ and $\{E_n : n \in \mathbb{N}\}$ a pairwise disjoint sequence in $\mathcal{R}$ such that $\mu_n(E_m) = \delta_{n,m}$ for $n, m \in \mathbb{N}$, then the ring $\mathcal{R} = \{A \in \Sigma : \mu_n(A) \to 0\}$ has property $(wN)$ but not property $(G)$. Let us recall that a Boolean ring $\mathcal{R}$ has property ($G$) if each uniformly bounded and pointwise convergent sequence $\{\mu_n\}_{n=1}^\infty$ in $\text{ba}(\mathcal{R})$ is uniformly exhaustive.

- A Boolean ring $\mathcal{R}$ has property $(G)$ if and only if $\mathcal{R}$ is a Rainwater set (cf. [6]) for $\text{ba}(\mathcal{R})$.

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Composition operators between Fock spaces

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The talk will provide a survey about composition operators between generalized Fock spaces, focusing on various open problems

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The shadowing property for linear operators

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Anosov and Bowen introduced the so called shadowing property for a dynamical system $(X,f)$, where $(X,d)$ is a metric space. Given $\delta > 0$, a (finite or infinite) sequence $\{x_n\}_{n=0}^{N}$ is a $\delta$-pseudo orbit if
\[ d(f(x_{n-1}),x_n) < \delta, \quad n = 1,\ldots,N. \]

Given $\varepsilon > 0$, we say that a true orbit $\{y_n\}_{n=0}^{N}$ (i.e., $f(y_{n-1}) = y_n$, $n = 1,\ldots,N$) $\varepsilon$-shadows $\{x_n\}_{n=0}^{N}$ if
\[ d(x_n,y_n) < \varepsilon, \quad n = 0,\ldots,N. \]

The dynamical system $(X,f)$ has the (finite) shadowing property if, for $N < \infty$ $N = \infty$, and for each $\varepsilon > 0$, there exists $\delta > 0$ such that every $\delta$-pseudo orbit $\{x_n\}_{n=0}^{N}$ is $\varepsilon$-shadowed by a true orbit $\{y_n\}_{n=0}^{N}$. We will study the shadowing property, and related notions, for the dynamics of linear operators. Some connections with other known properties in linear dynamics will be established. This is part of joint work with S. Bartoll, P. Oprocha and A. Peris.

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Differentiability and structure in Banach spaces

Vicente Montesinos

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We review some topics in differentiability and structure of Banach spaces, mentioning contributions of M. Fabian, A. J. Guirao, P. Hájek, V. Zizler and the author among others. In particular, we shall focus on weakly compactly generated Banach spaces and their relatives (subspaces of them, spaces weakly countably determined and weakly Lindelöf determined, Hilbert generated and superreflexive Banach spaces). The tools are projectional resolutions of the identity and the more recent projectional skeletons (we shall provide new characterizations of classes of spaces in this language), Markushevich bases and renormings. We shall mention, too, connections with differentiability of the norm, several classes of compacta and weak compactness. Some open problems shall be also presented.

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The global Gabor wave front set in ultradifferentiable spaces

Alessandro Oliaro
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The talk is based on collaborations with Chiara Boiti (Univ. Ferrara) and David Jornet (Univ. Politénica Valencia)

We consider, for a non-quasianalytic subadditive weight function \( \omega \), the space \( S_\omega \) of weighted Schwartz functions

\[
S_\omega(\mathbb{R}^d) = \{ u \in S(\mathbb{R}^d) : \sup_{\mathbb{R}^d} e^{\lambda \omega(x)} |D^\alpha u(x)| < +\infty, \\
\sup_{\mathbb{R}^d} e^{\lambda \omega(\xi)} |D^\alpha \hat{u}(\xi)| < +\infty, \quad \forall \lambda > 0, \, \alpha \in \mathbb{N}_0^d \}.
\]

This is a Fréchet space with several equivalent systems of seminorms (cf. [1], [2]), such as

\[
p_\lambda(u) = \sup_{z \in \mathbb{R}^{2d}} |V_\varphi u(z)| e^{\lambda \omega(z)},
\]

for \( \lambda > 0 \), where \( V_\varphi u \) is the short-time Fourier transform of \( u \) for a window function \( \varphi \in S_\omega(\mathbb{R}^d) \).

The system \( p_\lambda(u) \), together with Paley-Wiener type theorems in \( S_\omega \) and \( S'_\omega \), suggest the use of the short-time Fourier transform to check the regularity of an element in the ultradistribution space \( S'_\omega \); a corresponding global wave front set can then be defined. We refer to Rodino and Wahlberg [4], who study these kind of things in the Schwartz space \( S' \); they introduce a global wave front set in terms of the short-time Fourier transform and in terms of Gabor frames, and show that they are the same and coincide with the global wave front set defined by Hörmander [3].

Following ideas of [4], we consider in [2] the \( \omega \)-wave front set \( WF'_\omega(u) \) of a \( \omega \)-tempered distribution \( u \in S'_\omega(\mathbb{R}^d) \) and then we consider the Gabor \( \omega \)-wave front set \( WF^G_\omega(u) \). We prove that the two wave front sets are equal, and we give applications to partial differential and pseudodifferential operators.


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Weighted Orlicz algebras on locally compact groups

Allen Osançliol
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Let $G$ be a locally compact group with left Haar measure and let $\omega$ be a weight on $G$. The weighted Orlicz space determined by a Young function $\Phi$, denoted by $L_\omega^\Phi(G)$, is a natural generalization of the weighted Lebesgue space $L_p^\omega(G)$, $1 \leq p \leq \infty$.

In this talk, we study on the weighted Orlicz algebra $L_\omega^\Phi(G)$ with respect to convolution. We show that, for non-discrete group $G$, $L_\omega^\Phi(G)$ admits no bounded left approximate identity under some conditions. Further, we characterize the all closed left ideals of the weighted Orlicz algebra $L_\omega^\Phi(G)$ similar to $L_\omega^1(G)$. Moreover, we describe the spectrum (the maximal ideal space) of the weighted Orlicz algebra $L_\omega^\Phi(G)$ for abelian group $G$ and show that these algebras are semi-simple. Also, we obtain the known results as a special cases.

This is a joint work with Prof. Serap ztop (Istanbul University)
New progress on Tingley’s problem for C*-algebras

Antonio M. Peralta
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In the previous Workshop on Complex Analysis and Operator Theory, held in Valencia in October 2016, I delivered a talk based on the first studies on the so-called Tingley’s problem for compact operators and C*-algebras. This problem can be simply stated in the following terms: Let $X$ and $Y$ be normed spaces, whose unit spheres are denoted by $S(X)$ and $S(Y)$, respectively. Suppose $f : S(X) \to S(Y)$ is a surjective isometry.

Almost a year ago, we revisited the main results on classical Banach spaces, commutative and finite dimensional C*-algebras. In this occasion, the talk will be devoted to present new positive answer to Tingley’s problem in the case of $B(H)$ and in the case of the space of trace class operators.

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Mean Li-Yorke chaotic operators

Alfred Peris

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An operator $T$ on a Banach space $X$ is mean Li-Yorke chaotic if there is an uncountable subset $S$ of $X$ such that every pair $(x, y)$ of distinct points in $S$ satisfies

$$\liminf_{N \to \infty} \frac{1}{N} \sum_{j=1}^{N} \|T^j x - T^j y\| = 0 \text{ and } \limsup_{N \to \infty} \frac{1}{N} \sum_{j=1}^{N} \|T^j x - T^j y\| > 0.$$

If $S$ can be chosen to be dense (resp. residual) in $X$, then we say that $T$ is densely (resp. generically) mean Li-Yorke chaotic. We show that mean Li-Yorke chaos differs from the notion of distributional chaos of type 2, contrary to what happens in the context of topological dynamics on compact metric spaces. Every mean Li-Yorke chaotic operator is shown to be densely mean Li-Yorke chaotic on some infinite-dimensional closed invariant subspace. A (Dense) Mean Li-Yorke Chaos Criterion and a sufficient condition for the existence of a dense absolutely mean irregular manifold are also obtained. This is a joint work with N. Bernardes and A. Bonilla.

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Amenable and Contractible Köthe Co-echelon Algebras

Krzysztof Picszczek
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Recall that a Köthe co-echelon space $k_p(V)$ is an inductive limit of weighted $\ell_p$-spaces defined by a decreasing sequence of weights $v_n: \mathbb{N} \to (0, \infty)$, $n \in \mathbb{N}$. These spaces become algebras for point-wise multiplication if and only if for every $n \in \mathbb{N}$ there is $k \in \mathbb{N}$ such that $v_k/v_n^2 \in \ell_\infty$. We will characterize amenable and contractible Köthe co-echelon algebras. It will be preceded by the investigation of these two notions in the category of DF-algebras. We will also show the background of these theories arising in the category of Banach algebras.

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Dynamical properties of weighted composition operators

Adam Przestacki
Adam Mickiewicz University, Poland

In the first part of the talk I will discuss the dynamical properties weighted composition operators acting on the space $C^\infty(\Omega, \mathbb{K})$ of $\mathbb{K}$ valued smooth functions on $\Omega$, i.e., operators of the form

$$C_{w,\psi} : C^\infty(\Omega, \mathbb{K}) \to C^\infty(\Omega, \mathbb{K}), \ F \mapsto w \cdot (F \circ \psi),$$

where $w : \Omega \to \mathbb{K}$ and $\psi : \Omega \to \Omega$ are smooth.

In the second part of the talk I will focus on the dynamical properties of weighted shifts acting on the Schwartz space $S(\mathbb{R})$ of rapidly decreasing functions, i.e., operators of the form

$$B_w : S(\mathbb{R}) \to S(\mathbb{R}), \ B_w(F)(x) = w(x) \cdot F(x + 1)$$

where $w : \Omega \to \mathbb{K}$ is smooth.

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Ergodic properties of the multiplication operator

Alberto Rodríguez-Arenas
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We present some results regarding the convergence of the Csaro means (and other ergodic properties) of the multiplication operator defined on Banach spaces of weighted continuous functions on general topological spaces and on inductive limits of those Banach spaces. We report joint work with J. Bonet and E. Jordá

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Completeness, metrizability and compactness in spaces of fuzzy-number-valued functions

Manuel Sanchís
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Fuzzy Analysis is based on the notion of fuzzy number in the same way as Classical Analysis is based on the concept of real number. From 1986, the so-called representation theorem of fuzzy numbers eased considerably the development of the theory concerning fuzzy-number-valued functions, that is, functions defined on a topological space taking values in the space of fuzzy numbers. Such functions, as real-valued functions do in the classical setting, play a central role in Fuzzy Analysis. Namely, fuzzy-number-valued functions have become the main tool in several fuzzy contexts, such as fuzzy differential equations, fuzzy integrals, fixed point theory or fuzzy optimization.

In this talk we address three topological aspects of the spaces of fuzzy-number-valued functions when endowed with the most usual topology. Namely we will study completeness, metrizability and compactness in this context. Only the latter one, which is clearly related to Ascoli theorem, seems to have received certain attention in fuzzy literature. The prototype of such result in Classical Analysis was proved by Ascoli in 1883 and, independently, by Arzelà, who acknowledged Ascoli’s priority in 1895. Nowadays, Arzelà-Ascoli type theorems encompass the study of the (relative) compacity of a family of functions endowed with several topologies and their literature is extense. The applications of these results are numerous in different settings; namely, in the context of differential equations, in finding extremal curves, in most criteria for the consistency of systems involving inequalities, etc.

Joint paper with J.J. Font and D. Sanchís

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Surjectivity of the Borel map in Roumieu ultraholomorphic classes in sectors

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We consider Roumieu ultraholomorphic classes in sectors defined by weight sequences, weight functions or weight matrices under some standard assumptions. Our aim is to discuss the surjectivity of, or the existence of extension operators for, the Borel map at the vertex of the sector. We will extend some results of J. Schmets and M. Valdivia and of V. Thilliez for classes defined by weight sequences, and we will obtain extension operators for classes defined by weight functions or matrices by means of the construction of optimal at functions and truncated integral transforms, following the idea of B. Malgrange for the Gevrey case. The opening of the sector plays a crucial role, and it turns out to be limited above by a growth index associated with the weight sequence or function defining the class.

Joint work with Javier Jimenez-Garrido (Universidad de Valladolid, Spain) and Gerhard Schindl (University of Vienna, Austria).

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Hardy spaces and holomorphic functions in infinitely many variables

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It is a well known fact that for functions in one complex variable, the Hardy spaces $H_p(\mathbb{T})$ and $H_p(\mathbb{D})$ are isometrically isomorphic. This creates a sort bridge between integrable functions on the torus and holomorphic functions on the whole disc. When we consider functions in infinitely many variables, on the side of the integrable functions we naturally have the Hardy space $H_p(\mathbb{T}^\infty)$, but it is not so clear what do we have to consider on the holomorphic side. The aim of this talk is to show that this space is isometrically isomorphic to $H_p(\ell_2 \cap B_{ca})$, a Banach space of holomorphic functions.

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Hadamard multipliers on spaces of holomorphic functions

Maria Trybula
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Several representations theorems of Hadamard multipliers on spaces of holomorphic functions will be presented.

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There are essentially two ways to define smooth functions on compact subsets $K \subseteq \mathbb{R}^d$ (which may be too small to determine enough directional derivatives): Either one considers the space of restrictions

$$C^\infty(K) = \{ f|_K : f \in C^\infty(\mathbb{R}^d) \}$$

or the space of Whithney jets

$$\mathcal{E}(K) = \{ (\partial^\alpha f)_{\alpha \in \mathbb{N}^d_0} : f \in C^\infty(\mathbb{R}^d) \}.$$  

A celebrated theorem of Whitney characterizes when a family $(f^{(\alpha)})_{\alpha \in \mathbb{N}^d_0}$ of continuous functions on $K$ belongs to $\mathcal{E}(K)$ by approximation properties of the formal Taylor polynomials. The restriction spaces $C^n(K)$ have been characterized by Fefferman but since, in general, $C^\infty(K) \neq \bigcap_n C^n(K)$ a characterization for $C^\infty(K)$ is still not known.

In this talk we compare both spaces and discuss the problem whether there exist continuous linear extension operators $\mathcal{E}(K) \to C^\infty(\mathbb{R}^d)$ and/or $C^\infty(K) \to C^\infty(\mathbb{R}^d)$ (where $\mathcal{E}(K)$ and $C^\infty(K)$ are endowed with their natural Fréchet space topologies).

If the restriction space does not coincide with $\mathcal{E}(K)$ the question for $C^\infty(K)$ is wide open. We discuss some sufficient conditions as well as necessary ones which, for one-dimensional sets, allow to improve relatively recent results of Fefferman and Ricci as well as Vogt.

The talk is based on joint work with Enrique Jordá (Alcoy) and Leonhard Frerick (Trier).
Composition operators between weighted Bergman spaces and weighted Banach spaces of holomorphic functions

Elke Wolf
Universität Paderborn, Germany

An analytic self-map $\phi$ of the open unit disk $\mathbb{D}$ in the complex plane induces the so-called composition operator

$$C_\phi : H(\mathbb{D}) \to H(\mathbb{D}), \quad f \mapsto f \circ \phi,$$

where $H(\mathbb{D})$ denotes the set of all analytic functions on $\mathbb{D}$. Now, let $v : \mathbb{D} \to (0, \infty)$ be a weight, $A_v^2$ the weighted Bergman space generated by $v$ and $H_v^\infty$ the weighted Banach space of holomorphic functions endowed with the weighted sup-norm. In this talk we consider operators $C_\phi : A_v^2 \to H_v^\infty$. We start with giving a characterization of the boundedness of the operator $C_\phi$ in terms of the weight $v$ and the symbol $\phi$. The work of Bonet, Domański, Lindström and Taskinen led us to analyze under which condition on the weight $v$ the operator $C_\phi$ is bounded for every $\phi$. Finally, motivated by results of Bourdon, we show when $C_\phi$ is a bellwether of boundedness, i.e. when for each typical weight $v$ the boundedness of $C_\phi : A_v^2 \to H_v^\infty$ ensures the boundedness of all composition operators acting between $A_v^2$ and $H_v^\infty$.

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