Organization committee
Marcel de Jeu (Leiden, chair)
Ben de Pagter (Delft)
Miek Messerschmidt (Leiden)
Jan Rozendaal (Delft)
Onno van Gaans (Leiden)
Mark Veraar (Delft)

Adriaan Cornelis Zaanen (1913-2003)
PROGRAM
### MONDAY 22 JULY

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<tr>
<td>09:45–10:00</td>
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<td></td>
<td>Room C1</td>
<td><strong>Plenary lectures</strong>&lt;br&gt;Chair: Hernandez</td>
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<tr>
<td>10:00–10:45</td>
<td></td>
<td>Wolfgang Arendt: <em>Positive solutions of evolution equations governed by forms</em></td>
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<tr>
<td>10:50–11:35</td>
<td></td>
<td>Qingying Bu: <em>Multilinear operators and homogeneous polynomials on Banach lattices</em></td>
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<td></td>
<td><strong>Break</strong></td>
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<tr>
<td>12:05–12:50</td>
<td></td>
<td>Evgeny Semenov: <em>Banach limits</em></td>
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<td><strong>Lunch</strong></td>
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<td>Room C1</td>
<td><strong>Contributed lectures</strong>&lt;br&gt;<em>Chair: Sukochev</em></td>
</tr>
<tr>
<td>14:00–14:30</td>
<td>Sakhnovich</td>
<td>Watson</td>
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<td>14:40–15:10</td>
<td>Alekhno</td>
<td>Grobler</td>
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<tr>
<td>15:20–15:50</td>
<td>Osaka</td>
<td>Vardy</td>
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<td></td>
<td><strong>Break</strong></td>
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<tr>
<td>16:10–16:40</td>
<td>Tradacete</td>
<td>Kawabe</td>
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<tr>
<td>16:50–17:20</td>
<td>Dirksen</td>
<td>Xanthos</td>
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<tr>
<td>17:30–18:00</td>
<td>Oikhberg</td>
<td>Gao</td>
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<tr>
<td></td>
<td></td>
<td><strong>Wine and Cheese party</strong></td>
</tr>
</tbody>
</table>
Monday 22 July: Lectures

Plenary lectures Chair: Hernandez
10:00–10:45 Wolfgang Arendt
(University of Ulm, Ulm, Germany)
Positive solutions of evolution equations governed by forms.
10:50–11:35 Qingying Bu
(University of Mississippi, Oxford, USA)
Multilinear operators and homogeneous polynomials on Banach lattices.
12:05–12:50 Evgeny Semenov
(University of Voronezh, Voronezh, Russia)
Banach limits.

Contributed lectures: Room C1 Chair: Sukochev
14:00–14:30 Alexander Sakhnovich
(University of Vienna, Vienna, Austria)
Canonical systems and spectral densities.
14:40–15:10 Egor Alekhno
(Belorussian State University, Minsk, Belarus)
Some properties of Banach-Mazur limits.
15:20–15:50 Hiroyuki Osaka
(Ritsumeikan University, Kusatsu, Japan)
Matrix monotone functions and a generalized Powers-Størmer inequality.
16:10–16:40 Pedro Tradacete
(Universidad Carlos III de Madrid, Leganes, Spain)
Random unconditionally convergent bases in Banach spaces.
16:50–17:20 Sjoerd Dirksen
(Universität Bonn, Bonn, Germany)
Noncommutative Boyd interpolation theorems.
17:30–18:00 Timur Oikhberg
(University of Illinois, Urbana, USA)
Operators on ordered spaces belonging to certain ideals.

Contributed lectures: Room C2 Chair: Polyrakis
14:00–14:30 Bruce Watson
(University of the Witwatersrand, Johannesburg, South Africa)
Mixingales on Riesz spaces.
14:40–15:10 Jacobus Grobler
(North-West University, Potchefstroom, South Africa)
Inequalities for stochastic processes in Riesz spaces.
15:20–15:50 Jessica Vardy
(University of the Witwatersrand, Johannesburg, South Africa)
Quasi-martingales in Riesz spaces.
16:10–16:40 Jun Kawabe
(Shinshu University, Nagano, Japan)
Metrizing the Lévy topology on nonadditive measures by explicit metrics.
16:50–17:20 Foivos Xanthos
(University of Alberta, Edmonton, Canada)
Unbounded order convergence in Banach lattices.
17:30–18:00 Niushan Gao
(University of Alberta, Edmonton, Canada)
Martingales without probability.
Contributed lectures: Room C3 Chair: Conradie

14:00–14:30 Ryszard Pluciennik  
(Poznań University of Technology, Poznań, Poland)  
\( \lambda \)-points in Orlicz spaces.

14:40–15:10 Karol Leśnik  
(Poznań University of Technology, Poznań, Poland)  
Factorization of some Banach function spaces.

15:20–15:50 Paweł Kolwicz  
(Poznań University of Technology, Poznań, Poland)  
Pointwise products of some Banach function spaces.

16:10–16:40 Santiago Boza  
(Polytechnical University of Catalonia, Barcelona, Spain)  
Isometries on \( L^2(X) \) and monotone functions.

16:50–17:20 Agata Panfil  
(Adam Mickiewicz University, Poznań, Poland)  
Non-square Lorentz spaces \( \Gamma_{p,\omega} \).

17:30–18:00 Maciej Ciesielski  
(Poznań University of Technology, Poznań, Poland)  
Monotonicity structure of symmetric spaces with applications.

Contributed lectures: Room C6 Chair: Fourie

14:00–14:30 Björn de Rijk  
(Leiden University, Leiden, The Netherlands)  
The order bicommutant: a study of analogues of the von Neumann Bicommutant Theorem, reflexivity results and Schur’s Lemma for operator algebras on Dedekind complete Riesz spaces.

14:40–15:10 Gerard Buskes  
(University of Mississippi, Oxford, USA)  
Band decompositions of bi-disjointness preserving maps.

15:20–15:50 Jan Rozendaal  
(Delft University of Technology, Delft, The Netherlands)  
Decomposing positive representations on \( L^p \)-spaces for locally compact Polish transformation groups.

16:10–16:40 Marko Kandić  
(University of Ljubljana, Ljubljana, Slovenia)  
On diagonals of commutators of positive compact operators and ideal-triangularizability.

16:50–17:20 Roman Drnovšek  
(University of Ljubljana, Ljubljana, Slovenia)  
On semigroups of nonnegative functions and positive operators.

17:30–18:00 Witold Wnuk  
(Adam Mickiewicz University, Poznań, Poland)  
On order properties of Riesz subspaces which are not preserved by closedness.
# TUESDAY 23 JULY

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<th>Plenary lectures Chair: Buskes</th>
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<tbody>
<tr>
<td>08:45–09:30</td>
<td>Karim Boulabiar: <em>Algebraic order bounded disjointness preserving operators</em></td>
<td></td>
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<tr>
<td>09:35–10:20</td>
<td>Julio Flores: <em>Disjointly homogeneous spaces: some bits and pieces</em></td>
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<tr>
<td>10:50–11:35</td>
<td>Abdelaziz Rhandi: <em>A weighted Hardy inequality and nonexistence of positive solutions to some nonlinear problems</em></td>
<td></td>
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<tr>
<td>11:40–12:25</td>
<td>Ioannis Polyrakis: <em>Some topics on the theory of cones</em></td>
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<td>Break</td>
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<tr>
<th>Time</th>
<th>Room C1</th>
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<th>Room C3</th>
<th>Room C6</th>
<th>Room C7</th>
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<tbody>
<tr>
<td>13:45–14:15</td>
<td>Ganiev</td>
<td>Mekler</td>
<td>Kalauch</td>
<td>Aksoy</td>
<td>Shahidi</td>
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<tr>
<td>14:25–14:55</td>
<td>Muzundu</td>
<td>Hudzik</td>
<td>Schep</td>
<td>Pedersen</td>
<td>Lajara</td>
</tr>
<tr>
<td>15:05–15:35</td>
<td>Kunze</td>
<td>van der Walt</td>
<td>Conradie</td>
<td>Galé</td>
<td>Wisła</td>
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<tr>
<td></td>
<td>Break</td>
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</tr>
<tr>
<td>16:00–16:30</td>
<td>Gerlach</td>
<td>Foralewski</td>
<td>Roelands</td>
<td>Barret</td>
<td>del Campo</td>
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<tr>
<td>16:40–17:10</td>
<td>Erkursun</td>
<td>Astashkin</td>
<td>Wortel</td>
<td>Ostaszewska</td>
<td>Naranjo</td>
</tr>
<tr>
<td>17:20–17:50</td>
<td>Mouton</td>
<td>Raynaud</td>
<td>Messerschmidt</td>
<td>Reynov</td>
<td>Fourie</td>
</tr>
<tr>
<td>18:00–18:30</td>
<td>Leonessa</td>
<td>Hu</td>
<td>van Gaans</td>
<td>Corduneanu</td>
<td>Troitsky</td>
</tr>
</tbody>
</table>
Tuesday 23 July: Lectures

Plenary lectures Chair: Baskes

08:45–09:30 Karim Boulabiar
(University of Tunis, Tunis, Tunisia)
Algebraic order bounded bisjointness preserving operators.

09:35–10:20 Julio Flores
(Rey Juan Carlos University, Madrid, Spain)
Disjointly homogeneous spaces: some bits and pieces.

10:50–11:35 Abdelaziz Rhandi
(University of Salerno, Salerno, Italy)
A weighted Hardy inequality and nonexistence of positive solutions to some nonlinear problems.

11:40–12:25 Ioannis Polyrakis
(National Technical University of Athens, Athens, Greece)
Some topics on the theory of cones.

Contributed lectures: Room C1 Chair: Arendt

13:45–14:15 Inomjon Ganiev
(International Islamic University Malaysia, Kuala Lumpur, Malaysia)
Ergodic theorem for $L_1 - L_\infty$ contractions in Banach-Kantorovich $L_p$ lattices.

14:25–14:55 Kelvin Muzundu
(University of Zambia, Lusaka, Zambia)
Commutatively ordered Banach algebras.

15:05–15:35 Markus Kunze
(University of Ulm, Ulm, Germany)
Mean ergodic theorems on norming dual pairs.

16:00–16:30 Moritz Gerlach
(University of Ulm, Ulm, Germany)
Asymptotic behavior of semigroups of kernel operators.

16:40–17:10 Nazife Erkursun
(University of Tübingen, Tübingen, Germany, and Selcuk University, Konya, Turkey)
On quasi-compactness and uniform convergence.

17:20–17:50 Sonja Mouton
(Stellenbosch University, Stellenbosch, South Africa)
Domination by ergodic elements in ordered Banach algebras.

18:00–18:30 Vita Leonessa
(University of Basilicata, Potenza, Italy)
Approximation of solutions to some abstract Cauchy problems by means of Szász-Mirakjan-Kantorovich operators.

Contributed lectures: Room C2 Chair: Semenov

13:45–14:15 Alexander Mekler
(University of Bremen, Dresden, Germany)
Unique approach to topological invariants of Marcinkiewicz-Lorentz-Orlicz spaces.

14:25–14:55 Henryk Hudzik
(Adam Mickiewicz University, Poznań, Poland)
On the moduli and characteristic of monotonicity in Orlicz-Lorentz function spaces.

15:05–15:35 Jan Harm van der Walt
(University of Pretoria, Pretoria, South Africa)
Riesz spaces of minimal upper semi-continuous compact valued maps.

16:00–16:30 Paweł Foralewski
(Adam Mickiewicz University, Poznań, Poland)
Generalized and classical Orlicz-Lorentz spaces.

16:40–17:10 Sergey Astashkin
(Samara State University, Samara, Russia)
$\Lambda(p)$-spaces and disjointly strictly singular inclusions of rearrangement invariant spaces.
17:20–17:50  **Yves Raynaud**  
(University Pierre et Marie Curie & CNRS, Paris, France)  
*Generalized Lorentz spaces and Kőthe duality.*

18:00–18:30  **Huiying Hu**  
(Shanghai Normal University, Shanghai, P.R. China)  
*A general system of generalized nonlinear mixed composite-type equilibria in Hilbert spaces.*

**Contributed lectures: Room C3 Chair: Gordon**

13:45–14:15  **Anke Kalauch**  
(TU Dresden, Dresden, Germany)  
*Directed ideals in partially ordered vector spaces.*

14:25–14:55  **Anton Schep**  
(University of South Carolina, Columbia, USA)  
*Cone isomorphism and almost-surjective operators.*

15:05–15:35  **Jurie Conradie**  
(University of Cape Town, Cape Town, South Africa)  
*Asymmetric norms and cones.*

16:00–16:30  **Mark Roelands**  
(University of Kent, Canterbury, United Kingdom)  
*Unique geodesics and embeddings of cones.*

16:40–17:10  **Marten Wortel**  
(University of Kent, Canterbury, United Kingdom)  
*Dynamics of self-maps on cones.*

17:20–17:50  **Miek Messerschmidt**  
(Leiden University, Leiden, The Netherlands)  
*A stronger Open Mapping Theorem with applications in ordered Banach spaces.*

18:00–18:30  **Onno van Gaans**  
(Leiden University, Leiden, The Netherlands)  
*On the number of bands in finite dimensional partially ordered vector spaces.*

**Contributed lectures: Room C6 Chair: Tradacete**

13:45–14:15  **Asuman Aksoy**  
(Claremont McKenna College, Claremont CA, USA)  
*Minimal projections with respect to various norms.*

14:25–14:55  **Henrik Laurberg Pedersen**  
(University of Copenhagen, Copenhagen, Denmark)  
*Positivity and remainders in expansions of Gamma functions.*

15:05–15:35  **José Galé**  
(Universidad de Zaragoza, Zaragoza, Spain)  
*Differential geometry for reproducing kernels.*

16:00–16:30  **Martine Barret**  
(University of La Réunion, Saint Denis, France)  
*Pure states and the Axiom of Choice.*

16:40–17:10  **Urszula Ostaszewska**  
(University of Białystok, Białystok, Poland)  
*On the Cramér transform and the t-entropy.*

17:20–17:50  **Oleg Reynov**  
(Saint Petersburg State University, Saint Petersburg, Russia)  
*Eigenvalues of \((r,p)\)-nuclear operators and approximation properties of order \((r,p)\).*

18:00–18:30  **Silvia-Otilia Corduneanu**  
(Gh. Asachi Technical University, Iaşi, Romania)  
*Convolution equations involving almost periodic measures with positive solutions.*

**Contributed lectures: Room C7 Chair: Curbera**

13:45–14:15  **Farruh Shahidi**  
(International Islamic University Malaysia, Kuala Lumpur, Malaysia)  
*On martingale-ergodic theorems for positively dominated operators on the space of Bochner integrable functions.*
14:25–14:55 **Sebastian Lajara**
(Universidad de Castilla-La Mancha, Albacete, Spain)
*Rotund renormings of spaces of Bochner integrable functions.*

15:05–15:35 **Marek Wisła**
(Adam Mickiewicz University, Poznań, Poland)
*Closedness of the set of extreme points of the unit ball in Orlicz and Calderon-Lozanovskii spaces.*

16:00–16:30 **Ricardo del Campo**
(University of Sevilla, Sevilla, Spain)
*Complex interpolation of Orlicz spaces with respect to a vector measure.*

16:40–17:10 **Francisco Naranjo**
(Universidad de Sevilla, Sevilla, Spain)
*Complex interpolation of $L^p$-spaces of vector measures on $\delta$-rings.*

17:20–17:50 **Jan Fourie**
(North-West University, Potchefstroom, South Africa)
*On $p$-convergent operators on Banach lattices.*

18:00–18:30 **Vladimir Troitsky**
(University of Alberta, Edmonton, Canada)
*Representing multinormed spaces as subspaces or quotients of Banach lattices.*
# WEDNESDAY 24 JULY

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<td>08:45–09:30</td>
<td>Room C1</td>
<td>Yehoram Gordon: <em>Applications of the Gaussian Min-Max Theorem</em></td>
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<tr>
<td>09:35–10:20</td>
<td>Room C1</td>
<td>Jun Tomiyama: <em>Piling structure of families of matrix monotone functions and of matrix convex functions</em></td>
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<tr>
<td>10:50–11:20</td>
<td>Room C1</td>
<td>Leping Sun</td>
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<tr>
<td>11:30–12:00</td>
<td>Room C1</td>
<td>Alpay</td>
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<tr>
<td>12:10–12:40</td>
<td>Room C1</td>
<td>Yan Sun</td>
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<td>14:00–14:30</td>
<td>Room C1</td>
<td>Luca-Tudorache</td>
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<td>14:40–15:10</td>
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<td>Stovall</td>
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<tr>
<td>15:20–16:05</td>
<td>Room C1</td>
<td>Fedor Sukochev: <em>Advances in modern noncommutative analysis</em></td>
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<td>16:30</td>
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<td>Excursion</td>
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**Room C1**

**Plenary lectures Chair: Schep**

- Yehoram Gordon: *Applications of the Gaussian Min-Max Theorem*
- Jun Tomiyama: *Piling structure of families of matrix monotone functions and of matrix convex functions*
- Leping Sun
- Alpay
- Yan Sun
- Luca-Tudorache
- Stovall  
- Fedor Sukochev: *Advances in modern noncommutative analysis*
Wednesday 24 July: Lectures

**Plenary lectures** *Chair: Schep*

08:45–09:30 **Yehoram Gordon**  
(Technion-Israel Institute of Technology, Haifa, Israel)  
*Applications of the Gaussian min-max theorem.*

09:35–10:20 **Jun Tomiyama**  
(Tokyo Metropolitan University, Tokyo, Japan)  
*Piling structure of families of matrix monotone functions and of matrix convex functions.*

**Contributed lectures: Room C1** *Chair: Boulabiar*

10:50–11:20 **Denny Leung**  
(National University of Singapore, Singapore)  
*Nonlinear order isomorphisms in sequence spaces.*

11:30–12:00 **Horst Thieme**  
(Arizona State University, Tempe, USA)  
*Eigenvectors of homogeneous order-preserving maps.*

12:10–12:40 **Moshe Goldberg**  
(Technion-Israel Institute of Technology, Haifa, Israel)  
*Submultiplicativity and stability of sup norms on homotonic algebras.*

14:00–14:30 **Roger Nussbaum**  
(Rutgers University, New Brunswick, USA)  
*Positive operators and Hausdorff dimension of invariant sets.*

**Contributed lectures: Room C2** *Chair: Wnuk*

10:50–11:20 **Leping Sun**  
(Shanghai Normal University, Shanghai, P.R. China)  
*Asymptotic stability for the system of neutral delay differential equations.*

11:30–12:00 **Liuchuan Zeng**  
(Shanghai Normal University, Shanghai, P.R. China)  
*Hybrid viscosity methods for finding common solutions of general systems of variational inequalities and fixed point problems.*

12:10–12:40 **Yan Sun**  
(Shanghai Normal University, Shanghai, P.R. China)  
*Existence of positive solutions for a nonlinear singular coupled elastic beam system.*

14:00–14:30 **Rodica Luca-Tudorache**  
(Gheorghe Asachi Technical University, Iaşi, Romania)  
*Positive solutions for a system of higher-order multi-point boundary value problems.*

14:40–15:10 **Jessica Stovall**  
(University of North Alabama, Florence, USA)  
*An associated linear operator for a given nonlinear operator.*

**Contributed lectures: Room C3** *Chair: Bu*

10:50–11:20 **Arkady Kitover**  
(Rider University, Lawrenceville, USA)  
*Essential spectra of disjointness preserving operators.*

11:30–12:00 **Safak Alpay**  
(Middle East Technical University, Ankara, Turkey)  
*On M- and L-weakly compact operators.*

12:10–12:40 **Zalina Kusraeva**  
(South Mathematical Institute of the Russian Academy of Sciences, Vladikavkaz, Russia)  
*Algebraic band preserving operators.*

14:00–14:30 **Zafer Ercan**  
(Abant Izzet Baysal University, Bolu, Turkey)  
*Simple proof of two theorems on the Riesz homomorphisms.*
14:40–15:10  **Włodzimierz Fechner**  
(University of Silesia, Katowice, Poland)  
*Factorization theorems of Arendt type for additive monotone mappings.*

**Contributed lectures: Room C6 Chair: Grobler**

10:50–11:20  **Han Ju Lee**  
(Dongguk University, Seoul, South Korea)  
*The Bishop-Phelps theorem and recent developments.*

11:30–12:00  **Krzysztof Zajkowski**  
(University of Białystok, Białystok, Poland)  
*On the correlation matrix of patterns and some questions deal with their occurrence in a random text.*

12:10–12:40  **Paul Ressel**  
(Katholische Universität Eichstätt-Ingolstadt, Eichstätt, Germany)  
*Higher order monotonic functions of several variables.*

14:00–14:30  **Radosław Szwedek**  
(Adam Mickiewicz University, Poznań, Poland)  
*Entropy numbers and eigenvalues of operators acting on interpolation spaces.*

14:40–15:10  **Richard Becker**  
(Université Paris VI, Paris, France)  
*About comonotonicity and the Choquet integral.*

**Plenary lecture Chair: Schep**

15:20–16:05  **Fedor Sukochev**  
(University of New South Wales, Sydney, Australia)  
*Advances in modern noncommutative analysis.*
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<tr>
<td>08:45</td>
<td>Chair: Troitsky</td>
<td>Chair: Troitsky</td>
<td>Chair: Wickstead</td>
<td>Chair: Flores</td>
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<tr>
<td>09:15</td>
<td>Jan van Neerven: $\gamma$-Radonifying operators</td>
<td>Guillermo Curbera: The Cesaro operator acting on $c_0$, and consequences for Hardy spaces on the disc</td>
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<tr>
<td>10:50</td>
<td>Chil</td>
<td>Papachristodoulou</td>
<td>Atkins</td>
<td>Skvorsov</td>
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<tr>
<td>11:20</td>
<td>Chil</td>
<td>Papachristodoulou</td>
<td>Atkins</td>
<td>Skvorsov</td>
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<tr>
<td>12:10</td>
<td>Orhon</td>
<td>Avgurines</td>
<td>Plev</td>
<td>Soli</td>
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<tr>
<td>14:00</td>
<td>Ben Amor</td>
<td>Papathanasiou</td>
<td>Rihetanous</td>
<td>Klinker</td>
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<tr>
<td>14:30</td>
<td>Lennuns</td>
<td>Cavaliere</td>
<td>Ercot</td>
<td>Sucha</td>
</tr>
<tr>
<td>15:30</td>
<td>Rien Kaashoek: State space formulas for rational contractive solutions to a matrix-valued Leech problem</td>
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</table>

**Lunch**

16:00

**Plenary lectures Chair: Troitsky**

16:20

**Zaanen celebration**

17:20
Thursday 25 July: Lectures

Plenary lectures Chair: Troitsky
08:45–09:30 Jan van Neerven
(Delft University of Technology, Delft, The Netherlands)
\(\gamma\)-Radonifying operators

09:35–10:20 Guillermo Curbera
(University of Sevilla, Sevilla, Spain)
The Cesàro operator acting on \(\ell^p\), and consequences for Hardy spaces on the disc.

Contributed lectures: Room C1 Chair: Rhandi
10:50–11:20 Elmiloud Chil
(Tunis, Monflery, Tunisia)
On weak orthomorphisms.

11:30–12:00 Marek Wójtowicz
(Universytet Kazimierza Wielkiego, Bydgoszcz, Poland)
Testing systems and orthomorphisms.

12:10–12:40 Mehmet Orhon
(University of New Hampshire, Durham, USA)
Reflexivity of Banach \(C(K)\)-modules via the reflexivity of Banach lattices.

14:00–14:30 Mohammed Amine Ben Amor
(Research Laboratory of Algebra, Topology, Arithmetic, and Order, Department of Mathematics, Faculty of Mathematical, Physical and Natural Sciences of Tunis, Tunis, Tunisia)
A geometric characterization of algebra homomorphisms on \(f\)-algebras.

14:40–15:10 Bas Lemmens
(University of Kent, Canterbury, United Kingdom)
Continuity of the cone spectral radius.

Contributed lectures: Room C2 Chair: Labuschagne
10:50–11:20 Christos Papachristodoulos
(University of Athens, Athens, Greece)
Arzela type convergence for partial functions.

11:30–12:00 Evaggelia Athanassiadou
(University of Athens, Athens, Greece)
Hyper convergence in function spaces.

12:10–12:40 Evgenios Averinos
(University of the Aegean, Rhodes, Greece)
On the topological properties of the solution set of integrodifferential inclusions.

14:00–14:30 Nikolaos Papanastassiou
(University of Athens, Athens, Greece)
\(l_p\)-convergence in measure for sequence of measurable functions.

14:40–15:10 Paola Cavaliere
(University of Salerno, Fisciano (Salerno), Italy)
On the Lebesgue decomposition for non-additive functions.

Contributed lectures: Room C3 Chair: Wickstead
11:30–12:00 Guiling Chen
(Leiden University, Leiden, The Netherlands)
Stability of delay differential equations by using an integral inequality.

12:10–12:40 Marat Pliev
(South Mathematical Institute of the Russian Academy of Science, Vladikavkaz, Russia)
Some problems concerning orthogonally additive operators in vector lattices.

14:00–14:30 Juhani Riihentaus
(University of Oulu, Oulu, Finland)
Domination conditions for families of quasi-nearly subharmonic functions and some related problems.
14:40–15:10  **Paul Poncet**  
(École Polytechnique, Palaiseau, France)  
*Krein–Milman's and Choquet’s theorems in the max-plus world.*

**Contributed lectures: Room C6 Chair: Flores**

10:50–11:20  **Antonio Fernández**  
(Universidad de Sevilla, Sevilla, Spain)  
*Different integrals in the same formula.*

11:30–12:00  **Valentin Skvortsov**  
(Casimir The Great University, Bydgoszcz, Poland, and Moscow State University, Russia)  
*Integration in complex Riesz space setting and some application in harmonic analysis.*

12:10–12:40  **Mohd Amin Sofi**  
(Kashmir University, Srinagar, India)  
*Weaker forms of continuity and vector-valued Riemann integration.*

14:00–14:30  **Eder Kikianty**  
(University of the Witwatersrand, Johannesburg, South Africa)  
*Semi-inner products and angles in normed spaces.*

14:40–15:10  **Krzysztof Smela**  
(Technical University of Rzeszów, Rzeszów, Poland)  
*On Banach spaces $X$ whose bidual $X^{**}$ is complemented in a Banach lattice.*

**Plenary lecture Chair: Troitsky**

15:30–16:15  **Rien Kaashoek**  
(VU Amsterdam, Amsterdam, The Netherlands)  
*State space formulas for rational contractive solutions to a matrix-valued Leech problem.*

16:20–17:20 Zaanen Celebration
### FRIDAY 26 JULY

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<td>16:10-16:55</td>
<td>Francesco Altomare: <em>On positive linear operators preserving polynomials</em></td>
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Friday 26 July: Lectures

Plenary lectures Chair: Dodds

08:45–09:30 Boris Mordukhovich
(Wayne State University, Detroit, USA)
*Positivity in variational analysis and optimization.*

09:35–10:20 Coenraad Labuschagne
(University of Johannesburg, Johannesburg, South Africa)
*An order-theoretic approach to stochastic processes.*

Contributed lectures: Room C1 Chair: Orhon

10:50–11:20 Andrew Pinchuk
(Rhodes University, Grahamstown, South Africa)
*A vector lattice version of Rådström’s embedding theorem.*

11:30–12:00 Bram Westerbaan
(Radboud University, Nijmegen, The Netherlands)
*Lattice valuations, A generalisation of measure and integral.*

14:00–14:30 Mert Çağlar
(İstanbul Kültür University, Istanbul, Turkey)
*Order-unit-metric spaces.*

14:40–15:10 Neşet Özkan Tan
(TU Delft, Delft, The Netherlands)
*Riesz space valued integral.*

15:20–15:50 Willem van Zuijlen
(Leiden University, Leiden, The Netherlands)
*Integration for functions with values in a partially ordered vector space.*

Contributed lectures: Room C2 Chair: Alpay

10:50–11:20 Bikram Banerjee
(Ranaghat College, Kolkata, India)
*On existence of a minimum valuation prime ideal in C[0, 1].*

11:30–12:00 Asghar Ranjbari
(University of Tabriz, Tabriz, Iran)
*Barreledness and lower semi-continuous seminorms in locally convex cones.*

12:10–12:40 Maciej Sablik
(Silesian University, Katowice, Poland)
*Additivity of insurance premium.*

14:00–14:30 Eduardo Brandani da Silva
(Maringa State University, Maringa, Brazil)
*Bilinear regular operators on quasi-Banach lattices and compactness*

14:40–15:10 Jin Xi Chen
(Southwest Jiaotong University, Chengdu, P.R. China)
*Super-additive and super-multiplicative maps on functions spaces.*

15:20–15:50 Martin Väth
(The Free University of Berlin, Berlin, Germany)
*The Turing instability for a reaction-diffusion system with unilateral obstacles.*

Contributed lectures: Room C3 Chair: Raynaud

10:50–11:20 Nicolae Dăneț
(Technical University of Civil Engineering, Bucarest, Romania)
*The Dedekind completion of C(X).*

11:30–12:00 Retha Heymann
(Universität Tübingen, Tübingen, Germany)
*Eigenvalues of multiplication operators on vector-valued function spaces.*

12:10–12:40 Rodica-Mihaela Dăneț
(Technical University of Civil Engineering, Bucarest, Romania)
*Extension theorems in interval analysis.*
14:00–14:30  **Roman Ger**  
(Silesian University, Katowice, Poland)  
*Convexity, orthogonality and interactions of difference operators.*

14:40–15:10  **Tunç Misirlioğlu**  
(İstanbul Kültür University, Istanbul, Turkey)  
*Modulus of non-semicompact convexity.*

15:20–15:50  **Stuart McKenzie**  
(Queens University Belfast, Belfast, Northern Ireland)  
*The Riesz decomposition property for differential functions taking values in an atomic Banach lattice.*

**Contributed lectures: Room C6 Chair: Zi Li Chen**

10:50–11:20  **Mieczysław Mastyło**  
(Adam Mickiewicz University, Poznań, Poland)  
*Domination and factorizations theorems for multilinear operators.*

11:30–12:00  **Mirella Cappelletti Montano**  
(Università degli Studi di Bari “A. Moro”, Bari, Italy)  
*On some differential operators on hypercubes.*

12:10–12:40  **Mitsuru Uchiyama**  
(Shimane University, Matsue, Japan)  
*The principal inverse of the gamma function.*

14:00–14:30  **Yun Sung Choi**  
(Postech, Pohang, South Korea)  
*Some geometrical properties of certain classes of uniform algebras.*

14:40–15:10  **Jan van Waaij**  
(Leiden University, Leiden, The Netherlands)  
*The Riesz completion of tensor product of integrally closed directed partially ordered vector spaces is the Archimedean Riesz tensor product of its Riesz completions.*

**Plenary lecture Chair: Dodds**

16:10–16:55  **Francesco Altomare**  
(University of Bari, Bari, Italy)  
*On positive linear operators preserving polynomials.*
ABSTRACTS
1. Minimal projections with respect to various norms

Aksoy, Asuman (aaksoy@cmc.edu)
Claremont McKenna College, Claremont, USA

A theorem of Rudin permits us to determine minimal projections not only with respect to the operator norm but with respect to various norms on operator ideals and with respect to numerical radius. We prove a general result about N-minimal projections where N is a convex and lower semicontinuous function and give specific examples of cases of norms or seminorms of p-summing, p-integral and p-nuclear operator ideals.

2. Some properties of Banach-Mazur limits

Alekhno, Egor (Alekhno@bsu.by)
Belarussian State University, Minsk, Belaus

A positive functional \( x^* \) on the space \( \ell_\infty \) of all bounded sequences is called a Banach-Mazur limit if \( ||x^*|| = 1 \) and \( x^*x = x^*Tx \) for all \( x = (x_1, x_2, \ldots) \in \ell_\infty \), where \( T \) is the forward shift operator on \( \ell_\infty \), i.e., \( Tx = (0, x_1, x_2, \ldots) \). The set of all Banach-Mazur limits is denoted by BM and ext BM is a collection of extreme points of BM. Let

\[
ac_0 = \{ x \in \ell_\infty : x^*x = 0 \text{ for all } x^* \in BM \}.
\]

The following sequence spaces are studied:

\[
D(ac_0) = \{ x \in \ell_\infty : x \cdot ac_0 \subseteq ac_0 \} \quad \text{and} \quad I(ac_0) = ac_0^+ - ac_0^{-}.\]

E.g., if \( z \in \ell_\infty \) then \( z \in D(ac_0) \) iff \( z - Tz \in I(ac_0) \); moreover, \( z \in D(ac_0) \) iff \( x^* \{ n : |z_n - x^*z| \geq \epsilon \} = 0 \) for all \( \epsilon > 0 \) and \( x^* \in \text{ext BM} \). Order properties of Banach-Mazur limits are considered; e.g., it is shown that the non-atomic band of the AL-space \( N(I - T^*) \) does not have a weak order unit. Some properties of ext BM are derived; e.g., estimates of the cardinality of ext BM are given. We used the representation of functionals \( x^* \in BM \) as Borel measures on \( \beta N \setminus N \). We also consider some questions of the probability theory for finite-additive measures; e.g., for every \( x^* \in BM \) there exists an element \( x \in \ell_\infty \) such that the distribution function \( F_x(t) = x^* \{ n : x_n \leq t \} \) is continuous on \( \mathbb{R} \). Applications to the study of the superposition operator \( f_x = (f(1, x_1), f(2, x_2), \ldots) \) on \( ac_0 \), where a function \( f : N \times \mathbb{R} \to \mathbb{R} \), will be discussed.

3. On M-and L-weakly compact operators

Alpay, Safak (safak@metu.edu.tr)
Middle East Technical University, Ankara, Turkey

An operator \( T : E \to X \) between a Banach lattice \( E \) and a Banach space \( X \) is called M-weakly compact if \( \lim_n ||T(x_n)|| = 0 \) for each disjoint sequence \( (x_n) \) in \( E \). Duals of M-weakly compact operators are called L-weakly compact. We give a characterization of M-weakly compact operators and discuss properties of M and L-weakly compact operators. We study the relation between M and L-weakly compact operators with other classes of operators.

4. On positive linear operators preserving polynomials

Altomare, Francesco (altomare@dm.uniba.it)
Universita’ degli Studi di Bari, Bari, Italia

The talk will be centered about a special class of positive linear operators acting on the space \( C(K) \) of all continuous functions defined on a convex compact subset \( K \) of \( \mathbb{R}^d \), \( d \geq 1 \), having nonempty interior. Actually, this class consists of all positive linear operators \( T \) on \( C(K) \) which preserve polynomials on \( K \) and which, in addition, leave invariant the continuous affine functions on \( K \).

The interest for such operators comes from the study of the differential operator \( W_T \) naturally associated with \( T \) which is defined as
\[ W_T(u) := \sum_{i,j=1}^{d} \alpha_{ij} \frac{\partial^2 u}{\partial x_i \partial x_j} \] 

\((u \in C^2(K))\), where \(\alpha_{ij}(x) := T(pr_i pr_j)(x) - (pr_i pr_j)(x)\) (\(i, j = 1, \ldots, d\) and \(x = (x_i)_{1 \leq i \leq d} \in K\)).

The differential operator \(W_T\) is elliptic and it degenerates on the set of the extreme points \(\partial K\) of \(K\). Because of the special assumptions on \(T\), it turns out that \((W_T, C^2(K))\) is closable in \(C(K)\) and its closure generates a Markov semigroups on \(C(K)\) which can be represented as a limit of suitable iterates of Bernstein-Schnabl operators associated with \(T\).

The main aim of the talk is to discuss the existence of such operators in the special case when \(K\) is strictly convex, i.e., \(\partial K = \partial K\). In this same setting we also give a complete characterization of positive projections on \(C(K)\) which preserve polynomials.

For more details and for several other aspects related to this theory the reader is referred to the forthcoming monograph [1].


5. Positive solutions of evolution equations governed by forms

Arendt, Wolfgang (wolfgang.arendt@uni-ulm.de)
Universität Ulm, Ulm, Germany

Form methods play an important role to solve evolution equations. We will give an introduction starting by the generation theorem based on the Lax-Milgram lemma. In applications the underlying Hilbert space is an \(L^2\) space and we may ask when solutions with positive initial value remain positive for all time. In the case of symmetric forms the famous Beurling-Deny criterion gives a characterization.

In this talk we will show how positivity of the solutions of evolution equations governed by (not necessarily symmetric) non-autonomous forms can be characterized. These recent results obtained in collaboration with D. Dier and E.M. Ouhabaz generalize the classical Beurling-Deny criterion to situations which are most common in applications. More generally we will characterize when arbitrary closed convex sets are invariant. A particular case is the submarkovian property. Even in the finite-dimensional case new interesting results for ode can be deduced from our criterion.

Finally we will discuss local forms and semigroups of local operators. Here a beautiful result of Professor Zaanan will play an important role.


6. \(\Lambda(p)\)-spaces and disjointly strictly singular inclusions of rearrangement invariant spaces

Astashkin, Sergey (astash@samsu.ru)
Samara State University, Samara, Russia

A closed subspace \(H\) of \(L_p = L_p[0,1], 0 < p < \infty\), is a \(\Lambda(p)\)-space if \(L_p\)-convergence in \(H\) is equivalent to convergence in measure. If \(X\) is an r.i. space such that \(X \subset L_p\), the inclusion operator \(I : X \to L_p\) is disjointly strictly singular (DSS) and the norms of \(L_p\) and \(X\) are equivalent on a closed subspace \(H\) of \(X\), then \(H\) is a \(\Lambda(p)\)-space.

**Theorem.** Let \(1 < p \leq 2\), and let an r.i. space \(X \subset L_p\). If the operator \(I : X \to L_p\) is DSS, \(H\) is a closed subspace of \(X\) such that the norms of \(L_p\) and \(X\) are equivalent on \(H\), then the set \(K_H := \{f \in H : \|f\|_p \leq 1\}\) has equi-absolutely continuous norms in \(L_p\).

At the same time, for arbitrary \(p \geq 2\) there exists an Orlicz space \(L_F \subset L_p\) with the properties: the inclusion operator \(I : L_F \to L_p\) is DSS and the norms of \(L_p\) and \(L_F\) are equivalent on some closed subspace \(H\) such that the set \(K_H := \{f \in H : \|f\|_p \leq 1\}\) does not have equi-absolutely continuous norms in \(L_p\).
7. Hyper convergence in function spaces
Athanassiadou, Evaggelia (eathan@math.uoa.gr)
University of Athens, Athens, Greece

An important concept in Harmonic Analysis and Complex Function Theory is the uniform convergence or continuous convergence or \(\alpha\)-convergence at a point \(x_0\). In this talk we obtain new results regarding this convergence and the corresponding convergence in hyperspaces.

8. On the topological properties of the solution set of integrodifferential inclusions
Avgerinos, Evgenios (eavger@aegean.gr)
University of the Aegean, Rhodes, Greece

We examine non-linear integrodifferential inclusions in IRN. For the non convex problem, we show that the solution set is a retract of the Sobolev space \(W^{1,1}(T,\mathbb{R}^n)\) and the retraction can be chosen to depend continuously on a parameter \(\lambda\). Using that result we show that the solution multifunction admits a continuous selector. For the convex problem we show that the solution set is a retract of \(C(T,\mathbb{R}^n)\).

9. On existence of a minimal valuation prime ideal in \(C([0,1])\)
Banerjee, Bikram (pbikraman@rediffmail.com)
Ranaghat College, Kolkata, India

Assuming \(\beta\mathbb{N}\setminus\mathbb{N}\) contains a P-point (\(\mathbb{N}\) denotes a countable discrete space and \(\beta\mathbb{N}\) is the Stone-Čech compactification) we investigate whether a maximal ideal \(M\) of \(C([0,1])\) contains a minimal prime ideal \(Q\) such that the residue class ring of \(C([0,1])\) modulo \(Q\) is a valuation domain.

10. Pure states and the Axiom of Choice
Barret, Martine (barretmartine@hotmail.fr)
University of La Réunion, Saint Denis, France

Given a real ordered vector space \(E\), a positive element \(e\) of \(E\) is said to be a unit order if \(\forall x \in E, \exists t \in \mathbb{R}^+, -te \leq x \leq te\). The semi-norm \(||.||_e : E \to \mathbb{R}_+\) associated to the unit order \(e\) is defined by: \(||x||_e := \inf\{t \in \mathbb{R}^+, -te \leq x \leq te\}\). A state on an ordered vector space \(E\) endowed with a unit order \(e\) is a positive linear functional \(f : E \to \mathbb{R}\) such that \(f(e) = 1\) (thus \(f\) is continuous and \(||f||_e = 1\)). The state \(f\) is a pure state if for every positive linear functional \(g : E \to \mathbb{R}\), \((g \leq f \Rightarrow \exists t \in \mathbb{R}^+ g = tf)\).

We work in set theory without the axiom of choice \(ZF\). Consider the following Tychonov axiom, a weak form of the Axiom of Choice: “The product of a family of compact Hausdorff spaces is compact”. We prove that the Tychonov axiom is equivalent to the following statement: “For every ordered vector space \(E\) with a unit order \(e\), and every \(a \in E^+\), there exists a pure state \(f\) on \(E\) such that \(f(a) = ||a||_e\)”.

It follows that the Tychonov axiom implies the existence of pure states on every unital \(C^*\)-algebra. This result slightly extends a result by Buskes and van Rooij ([1]) who used the ultrafilter theorem and the countable Axiom of Choice.


11. About comonotonicity and the Choquet integral
Becker, Richard (beckermath@yahoo.fr)
Université Paris VI, Paris, France

Within several frameworks (for example decision theory) it is not sufficient to consider linear functionals. We have to deal with more general functionals, namely with functionals that are additive on comonotonic pairs \(f, g\). \((f, g)\) are real valued and satisfy \((f(x) - f(y))(g(x) - g(y)) \geq 0\).
for all $x, y$.

An example of such a functional is the Choquet integral.

We shall recall some results and paradoxes of decision theory: decision under risk (Theorem of Von Neumann-Morgenstern and the Allais paradox), and decision under uncertainty (Theorem of Savage and the Ellsberg paradox).

These results make use of linear functionals.

We shall describe some axiomatics avoiding these 2 paradoxes, involving comonotonicity, due to A. Chateaubuneuf (decision under risk) and D. Schmeidler (decision under uncertainty).

Their results make use of the Choquet integral.

We describe some recent results concerning the representation of comonotonic functionals in terms of the Choquet integral, due to S. Cerreira-Vioglio, F. Machheroni, M. Marinacci, and L. Montrucchio, that encompass various former results.

Finally, we give an abstract Alexandroff Theorem for a Riesz vector space of bounded functions containing 1.

12. A geometric characterization of algebra homomorphisms on $f$-algebras

**Ben Amor, Mohamed Amine** (Mohamedamine.Benamor@ipest.rnu.tn)
Research Laboratory of Algebra, Topology, Arithmetic, and Order, Department of Mathematics, Faculty of Mathematical, Physical and Natural Sciences of Tunis, Tunis, Tunisia

An Archimedean semiprime $f$-algebra $A$ for which

$$I_A \wedge f \in A \text{ for all } f \in A$$

is called a Stone $f$-algebra, where $I_A$ is the identity operator on $A$. Moreover, an operator $T$ between two Stone $f$-algebras $A$ and $B$ is said to be contractive if

$$f \in A \text{ and } 0 \leq f \leq I_A \text{ imply } 0 \leq Tf \leq I_B.$$ 

The set $K(A, B)$ of all positive contractive operators from $A$ into $B$ is a convex set. This paper characterizes extreme points in $K(A, B)$. In this regard, we prove that $T \in K(A, B)$ is extreme if and only if $T$ is an algebra homomorphism. Furthermore, we show that $T \in K(A, B)$ is extreme if and only if $T$ is a Stone operator, meaning that,

$$T(I_A \wedge f) = I_B \wedge Tf \text{ for all } f \in A.$$ 

These extend previous results by Huijsmans and de Pagter whom studied the unital case.

13. Algebraic order bounded disjointness preserving operators

**Boulabiar, Karim** (karim.boulabiar@ipest.rnu.tn)
Tunis-El Manar University, Tunis, Tunisia

A (linear) operator $T$ on a real vector space is said to be algebraic if $\Pi(T) = 0$ for some non-zero real polynomial $\Pi$. This talk discusses algebraic order bounded disjointness preserving operators on an Archimedean Riesz space $E$. One of the major results asserts that, if $T$ is an order bounded disjointness preserving operator on $E$ such that $T(E)$ is Riesz subspace of $E$, then $T$ is algebraic if and only if there exist integers $0 \leq m \leq n$ such that $T^m$ is an $I$-step function on $T^m(E)$. The talk ends up with a few open problems. This research is based upon a joint work with Gerard Buskes and Gleb Sirotkin.

14. Isometries on $L^2(X)$ and monotone functions

**Boza, Santiago** (boza@ma4.upc.edu)
Polytechnical University of Catalonia, Barcelona, Spain

Necessary and sufficient conditions on a bounded operator $T$ defined on the Hilbert space $L^2(X)$ to be an isometry are studied. It is shown that, under suitable hypothesis, it suffices to restrict $T$ to a smaller class of functions (e.g., if $X = \mathbb{R}^+$, to the cone of positive and decreasing functions).

We also consider the problem of characterizing the sets $Y \subset X$ for which the orthogonal projection
of the operator $T$ on $L^2(Y)$ is also an isometry. We illustrate our results with several examples involving classical operators on different settings.

15. Bilinear regular operators on quasi-Banach lattices and compactness

Brandani da Silva, Eduardo (ebsilva@vnet.com.br)
Maringa State University, Maringa, Brazil

Positive and regular bilinear operators on quasi-normed functional spaces are introduced and theorems characterizing compactness of these operators are proved. Relations between positive and bilinear operators and their adjoint in normed functional spaces are also proved.

16. Multilinear operators and homogeneous polynomials on Banach lattices

Bu, Qingying (qbu@olemiss.edu)
University of Mississippi, Oxford, USA

In this talk, we will discuss multilinear operators and homogeneous polynomials on Banach lattices by employing Fremlin positive projective tensor product of Banach lattices, and will study them by using the operator norm, the regular norm, and the norm of bounded variation of multilinear operators and homogeneous polynomials on Banach lattices. As a result, we will obtain when all continuous multilinear operators and homogeneous polynomials on Banach lattices are regular. We will also provide new AM-spaces and AL-spaces of multilinear operators and homogeneous polynomials.

17. Band decompositions of bi-disjointness preserving maps

Buskes, Gerard (mmbuskes@olemiss.edu)
University of Mississippi, University, USA

We give band decompositions of bijective bi-disjointness preserving maps on vector lattices under a mild condition on the vector lattices but without additional assumptions, like order boundedness, on the maps. This is joint work with Robert Redfield of Hamilton College (NY).

18. Order-unit-metric spaces

Çağlar, Mert (m.caglar@iku.edu.tr)
İstanbul Kültür University, İstanbul, Turkey

We will study the concept of cone metric space in the context of ordered vector spaces by introducing the concept of order-unit-metric space as a natural adjustment for it. Making use of the machinery originating from the works of F.F. Bonsall [1] and R. Kadison [2], we will show that all fundamental results pertaining the former can be obtained via the latter.

This is joint work with Z. Ercan (İzett Baysal University, Bolu, Turkey).


19. On some differential operators on hypercubes

Cappelletti Montano, Mirella (mirella.cappellettimontano@uniba.it)
Università degli Sudi di Bari "A. Moro", Bari, Italy

Joint work with F. Altomare and V. Leonessa

We denote by $[0, 1]^N$ the $N$-dimensional hypercube in $\mathbb{R}^N$, $N \geq 1$. We shall focus our attention on the elliptic-second order differential operator

$$V_i(u)(x) := \frac{1}{2} \sum_{i=1}^{N} x_i(1-x_i) \frac{\partial^2 u}{\partial x_i^2}(x) + \sum_{i=1}^{N} \left( \frac{1}{2} - x_i \right) \frac{\partial u}{\partial x_i}(x)$$
(u ∈ C²([0,1]^N), x = (x_i)_{1≤i≤N} ∈ [0,1]^N), where t ∈ [0,2] is a suitable constant.

We shall prove that (V_l,C²([0,1]^N)) is closable and its closure (A_l,D(A_l)) is the generator of a
Markov semigroup \( (T_l(t))_{t≥0} \) on \( C([0,1]^N) \).

Our approach is based on Approximation Theory; in fact, in order to prove our generation result, we
introduce a suitable sequence \( (C_n)_{n≥1} \) of positive linear operators on \( L^1([0,1]^N) \), that generalize
the Kantorovich operators on \( [0,1]^N \). Such operators seem to have an interest on their own, since
they allow to reconstruct an integrable function throughout its mean value on a finite numbers of
sub-cells of \( [0,1]^N \) which do not need to be a subdivision of \( [0,1] \).

Moreover, they are of concern in proving, not only our generation result on the operator \( (V_l,C²([0,1]^N)) \),
but also an approximation formula for the semigroup itself, namely
\[
T_l(t)(f) = \lim_{n→∞} C_n^{int}(f) \quad \text{in } C([0,1]^N)
\]
for every \( f ∈ C([0,1]^N) \) and \( t ≥ 0 \).

Finally, under suitable assumptions, the semigroup \( (T_l(t))_{t≥0} \) extends to a \( C_0 \)-semigroup \( (\tilde{T}_l(t))_{t≥0} \)
on \( L^p([0,1]^N) \) (\( 1 ≤ p < +∞ \)), for which the approximation formula (1) still holds true, with respect
to the \( L^p \)-norm.

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20. On the Lebesgue decomposition for non-additive functions

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A Lebesgue decomposition theorem for non-additive functions, acting on a σ-complete orthomod-
ular lattice and taking values in Hausdorff uniform spaces, is established. No algebraic structure
is required on target spaces. The Boolean case is also investigated.
This is joint work with Anna De Simone, Paolo de Lucia e Flavia Ventriglia(University "Federico
II" of Naples)

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21. Stability of delay differential equations by using an integral inequality

Chen, Guiling (guiling@math.leidenuniv.nl)
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Exponential stability of a class of neutral stochastic differential equations with variable delays,
impulses and jumps will be investigated by means of an impulsive-integral inequality. An exponen-
tial estimate for a function satisfying an implicit integral inequality will be presented. It will be
explained how it can be used to establish stability of certain types of delay differential equations.
The results will be compared with the stability results derived by a fixed point method.
This is joint work with Onno van Gaans and Sjoerd Verduyn Lunel.

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22. Super-additive and super-multiplicative maps on functions spaces

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Let \( X, Y \) be nonempty sets, and let \( A(X) ⊆ \mathbb{R}^X \) and \( A(Y) ⊆ \mathbb{R}^Y \) be subalgebras of \( \mathbb{R}^X \)
and \( \mathbb{R}^Y \), respectively. When \( A(X) \) is positively generated, we show that every super-additive and
super-multiplicative positive map \( T : A(X) → A(Y) \) is linear and multiplicative, that is, \( T \) is a
homomorphism of algebras. In particular, if \( A(X) \) is positively generated and square-root closed,
then every super-additive and super-multiplicative map \( T : A(X) → A(Y) \) is linear and multiplica-
tive. Our results generalize some known results on super-additive and super-multiplicative maps
between spaces of real functions, and deal with some cases when the function spaces in question
do not contain constant functions.

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23. On weak orthomorphisms

Chil, Elmiloud (Elmiloud.chil@ipeit.rnu.tn)
Monfleury, Tunis, Tunisia
In this talk we study some important structural properties of weak orthomorphisms. Some new results of such operators will be presented.

24. Some geometrical properties of certain classes of uniform algebras
Choi, Yun Sung (mathchoi@postech.ac.kr)
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We show some geometrical properties of certain classes of uniform algebras, in particular the disk algebras $A_n(B_X)$ of all uniformly continuous functions on the closed unit ball and holomorphic on the open unit ball of a complex Banach space $X$. We prove that $A_n(B_X)$ has $k$-numerical index 1 for every $k$, has the lush property and has the AHSP property. Also that the algebra of the disk $A(D)$, and more in general any uniform algebra such that its Choquet boundary has no isolated points, has the polynomial Daugavet property. Most of that properties are extended to the vector valued version $A^K$ of a uniform algebra $A$.

This is joint work with D. Garcia (University of Valencia), S.K. Kim (KIAS) and M. Maestre (University of Valencia)

25. Monotonicity structure of symmetric spaces with applications.
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Poznań University of Technology, Poznań, Poland

Let $L^p(I)$ be a set of all (equivalence classes of) extended real valued $m$-measurable functions on $I$ where $I = [0, 1]$ or $I = [0, \infty)$. For $f \in L^p(I)$ we denote $f^*(t) = \inf \{\lambda > 0 : m(|f| > \lambda) \leq t\}$, $f^{**}(t) = \frac{1}{t} \int_0^t f^*(s)ds$ for $t > 0$. Given $1 \leq p < \infty$ and a weight $w \geq 0$, the Lorentz space $\Lambda_{p,w}(I)$ and $\Gamma_{p,w}(I)$ are subspaces of all measurable functions $L^p(I)$ such that $\|f\|_{\Lambda_{p,w}} := \left(\int_0^\infty f^*(t)w(t)dt\right)^{1/p} < \infty$ and $\|f\|_{\Gamma_{p,w}} := \|f^{**}\|_{\Lambda_{p,w}} < \infty$, respectively. For more details about the properties of $\Gamma_{p,w}$ and $\Lambda_{p,w}$ we refer to [2, 3, 4, 5].

We show some applications of the notion of $UM$-point and $LM$-point to local best dominated approximation problems in Banach ideal spaces $E$. Concerning local geometric structure in symmetric Banach function spaces $E$ we give the answer for the natural question whether a point $x \in E$ has local property if and only if $x^*$ has the analogous property. Finally, we characterize the full criteria for local monotonicity structure in Lorentz spaces. Presented results come from the joint paper [3].

References


26. Asymmetric norms and cones
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An asymmetric norm $p$ on a real vector space $X$ is a sub-additive, positively homogeneous function $p : x \to [0, \infty)$ such that $p(x) = p(-x) = 0$ if and only if $x = 0$. Associated with $p$ is a norm $p^*$
on $X$ defined by $p^*(x) = \max\{p(x), p(-x)\}$ and the proper cone $C_p = \{x \in X : p(-x) = 0\}$. This cone induces a partial order on $X$ compatible with the linear structure which could, but need not be, a lattice order. On the other hand, if $X$ is a real normed space and $C$ a closed proper cone in $X$, it is possible to define an asymmetric norm $p_C$ on $X$ such that $C = \{x \in X : p_C(-x) = 0\}$. This suggests questions like the following: If $p$ is an asymmetric norm on $X$, then $p^*$ is a norm on $X$ and $C_p$ is a $p^*$-closed cone in $X$. What is the relationship between $p$ and $p_C$? What can be said in the case where $C_p$ induces a lattice order on $X$? We explore questions like these and find that even in finite-dimensional spaces the situation is far from simple.

As a second example of the complications that can arise in the asymmetric situation we derive an analogue of the Heine-Borel theorem for asymmetrically normed finite-dimensional spaces.

27. Convolution equations involving almost periodic measures with positive solutions

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Denote by $AP(G)$ (respectively $ap(G)$) the space of almost periodic functions (respectively almost periodic measures) defined on a Hausdorff locally compact abelian group $G$. We consider the space $AP_1(G)$ of those almost periodic functions, which are representable as the sums of their Fourier series, in the context where these series are absolutely convergent. We also consider the space $ap_1(G)$ of those measures $\mu \in ap(G)$ having the property that $f * \mu \in AP_1(G)$ for every continuous complex-valued function $f$ with compact support. We are looking for positive almost periodic measures $\mu$ belonging to the space $ap_1(G)$ which satisfy the equation:

$$\mu = g\lambda + \nu * \mu.$$  

In this context $g$ belongs to the space $AP_1(G)$, $\lambda$ is the Haar measure and $\nu$ is a bounded measure. Using the property that two almost periodic measures coincide if they have the same Fourier-Bohr coefficients we prove the following result:

Theorem. If $|\nu|(G) < 1$ then the above equation has a unique solution $\mu \in ap_1(G)$. In addition, if $g$ is a positive function and $\nu$ is a positive measure, then the solution $\mu$ is positive.


28. The Cesàro operator acting on $\ell^p$, and consequences for Hardy spaces on the disc

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The Cesàro operator on sequences, given by

$$a = (a_n)_{n=0}^\infty \in C: C(a) = \left(\frac{1}{n+1} \sum_{k=0}^{n} a_k\right)_{n=0}^\infty \in C,$$

is bounded on $\ell^p$, for $1 < p < \infty$. From this starting point several sequence spaces arise; namely:

$$[C, \ell^p] := \left\{a = (a_n)_{n=0}^\infty \in C : C(a) = \left(\frac{1}{n+1} \sum_{k=0}^{n} a_k\right)_{n=0}^\infty \in \ell^p\right\},$$

and

$$ces_p := \left\{a = (a_n)_{n=0}^\infty \in C : C(|a|) = \left(\frac{1}{n+1} \sum_{k=0}^{n} |a_k|\right)_{n=0}^\infty \in \ell^p\right\}.$$  

The discussion of the action of the Cesàro operator on these spaces allows to deduce consequences for the Cesàro operator

$$f(z) = \sum_{n=0}^{\infty} a_k z^n \mapsto C(f)(z) := \sum_{n=0}^{\infty} \left(\frac{1}{n+1} \sum_{k=0}^{n} a_k\right) z^n.$$
when acting on the Hardy spaces on the disc, $H^p(\mathbb{D})$, for $1 \leq p < \infty$. In this way, it arises the Banach space of analytic functions $[C, H^p]$ consisting of all analytic functions that $C$ maps into $H^p(D)$. It is noteworthy that its elements are characterized (for $1 < p < \infty$) by a growth condition:

$$f \in [C, H^p] \iff \int_0^{2\pi} \left( \int_0^1 \frac{|f(re^{i\theta})|^2}{|1-re^{i\theta}|^2} (1-r)^{p/2} \, dr \right)^{1/p} \, d\theta < \infty.$$ 

Of particular interest is the subspace $H(\text{ces}_2)$ of $[C, H^2]$ consisting on those functions which are the unconditional sum of their Taylor series. For this space $H(\text{ces}_2)$ we discuss the multipliers and the spectrum of the Cesàro operator.

The work presented is a collaboration with Werner J. Ricker, from the Katholische Universität Eichstät-Ingolstadt (Germany).

29. The Dedekind completion of $C(X)$

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The Riesz space $C(X)$ of all real-valued continuous functions on a topological space $X$ is not Dedekind complete. In this talk I present different methods to construct the Dedekind completion of $C(X)$, for $X$ a compact space.

One method, which uses Hausdorff continuous interval-valued functions (in the sense of B. Sendov [5]), was developed by R. Anguelov [1] (see also [2]). These functions are nothing else than Dedekind cuts in $C(X)$ [3].

The other methods use equivalence classes of real-valued semicontinuous functions. For this aim I apply to the real-valued functions the ideas of S. Kaplan [4], which he used in the study of the bidual of $C(X)$.

All functions used in these constructions are defined on the space $X$.


30. Extension theorems in interval analysis

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Classical extension theorems for linear functionals or, more generally, for linear operators, in the vector spaces setting are well-known. For example, Hahn-Banach theorem and Mazur-Orlicz theorem extend linear functionals (operators) dominated in some sense by sublinear functionals (operators) [1]. It is also known that these theorems have many applications.

To have more applications we propose to give some versions of these extension theorems in interval analysis. In the literature of this domain, intervals are viewed as extension of any value they contain, things being motivated by the fact that in many practical situations some values are known with interval uncertainty.

We will work in the ordered vector spaces setting. It is known that the set of all closed intervals in such spaces is not a vector space [2]. Indeed, for example, there is no additive inverse element for each closed interval. Therefore in the proofs of the extension results appear some difficulties.


31. The order bicommutant: a study of analogues of the von Neumann Bicommutant Theorem, reflexivity results and Schur’s Lemma for operator algebras on Dedekind complete Riesz spaces

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We are interested in an analogue of the von Neumann Bicommutant Theorem and related results in the context of Riesz spaces. Let $\mathcal{H}$ be a Hilbert space and $\mathcal{D} \subset \mathcal{L}_0(\mathcal{H})$ a subset invariant under taking the adjoint. The bicommutant $\mathcal{D}'$ equals $\mathcal{P}(\mathcal{D}')'$, where $\mathcal{P}(\mathcal{D}')$ denotes the set of projections in $\mathcal{D}'$. Since the sets $\mathcal{D}'$ and $\mathcal{P}(\mathcal{D}')'$ agree, there are multiple possibilities to define an analogue of bicommutant for Riesz spaces. Let $\mathcal{E}$ be a Dedekind complete Riesz space and $\mathcal{A} \subset \mathcal{L}_n(\mathcal{E})$ a subset. Since the band generated by the projections in $\mathcal{L}_n(\mathcal{E})$ is given by the orthomorphisms $\text{Orth}(\mathcal{E})$ and order projections in the commutant correspond bijectively to reducing bands, our approach is to define the bicommutant of $\mathcal{A}$ on $\mathcal{E}$ by $\mathcal{U} := (\mathcal{A}' \cap \text{Orth}(\mathcal{E}))'$.

Our first result is that the bicommutant $\mathcal{U}$ equals $\{T \in \mathcal{L}_n(\mathcal{E}) : T$ is reduced by every $\mathcal{A}$-reducing band$\}$. Hence $\mathcal{U}$ is fully characterized by its reducing bands. Note that this is similar to the classical reflexivity result known for Hilbert spaces with “closed invariant subspaces” replaced by “reducing bands”. Similarly, we obtain Schur’s Lemma with “invariant subspaces” replaced by “reducing bands”. This is a consequence of the fact that there is no natural counterpart of the adjoint for Riesz spaces. However, we may define $\mathcal{A} \subset \mathcal{L}_n(\mathcal{E})$ to have the $*$-property, if every $\mathcal{A}$-invariant band is reducing. If $\mathcal{A}$ has the $*$-property, we obtain the classical results known for Hilbert spaces. An instance in which $\mathcal{A}$ has the $*$-property is a subgroup $\mathcal{A}$ of the Riesz automorphisms on $\mathcal{E}$.

Secondly we obtain that the commutant $\mathcal{A}'$ in $\mathcal{L}_n(\mathcal{E})$ is a unital band algebra and that the commutant $\mathcal{A}' \cap \text{Orth}(\mathcal{E})$ is an order closed full Riesz subalgebra of $\mathcal{L}_n(\mathcal{E})$. Using these results we retrieve an analogue of the von Neumann Bicommutant Theorem for atomic Riesz spaces and also an approximation result for general Dedekind complete Riesz spaces. For more information, see [1].

This is joint work with Marcel de Jeu (Leiden University).


32. Complex interpolation of Orlicz spaces with respect to a vector measure

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Let $X$ be a complex Banach space, $\Sigma$ a $\sigma$-algebra of subsets of some nonempty set $\Omega$ and $m : \Sigma \to X$ a countably additive vector measure. Associated to $m$, there are the Banach function spaces $L^p(m)$ and $L^p_w(m)$, with $1 \leq p < \infty$, of (equivalence classes of) scalar $p$-integrable and weakly $p$-integrable functions with respect to $m$. The Calderón interpolation spaces $[L^p(m), L^p_w(m)]_\theta$ and $[L^p(m), L^p_w(m)]_\theta^0$ (see [1] and [4]) of the couples $(X_0, X_1)$ where $X_0$ and $X_1$ are spaces $L^p(m)$ or $L^p_w(m)$ were obtained in [3]. In such a case, the first method always gives another $L^p(m)$-space and the second one yields an $L^p_w(m)$-space. More precisely, given $1 \leq p_0 \neq p_1 \leq \infty$, $0 < \theta < 1$ and $\frac{1}{p} = \frac{1-\theta}{p_0} + \frac{\theta}{p_1}$, we have

$$[L^p_w(m), L^p(m)]_\theta = [L^p_w(m), L^p(m)]_\theta^0 = L^p(m),$$

$$[L^p(m), L^p_w(m)]_\theta = [L^p(m), L^p_w(m)]_\theta^0 = L^p_w(m).$$

The Orlicz space $L^\phi(m)$ and the weak Orlicz space $L^\phi_w(m)$, associated to an N-function $\phi$ and to $m$, were introduced in [2] and they generalize the Banach function spaces $L^p(m)$ and $L^p_w(m)$, respectively (for convenient choosing of $\phi$). Therefore, it is a natural question to wonder if these interpolation equalities can be extended to this setting of Orlicz spaces. To be specific, given two N-functions $\phi_0, \phi_1$ related by certain partial ordering ($\phi_1 \prec \phi_0$), $0 < \theta < 1$ and $\phi$ such that
the aim of this talk is to establish the following equalities:

\[ [L^{\phi_0}(m), L^{\phi_1}(m)]_0 = [L^{\phi_0}(m), L^{\phi_1}(m)]_0 = L^\phi(m), \]
\[ [L^{\phi_0}(m), L^{\phi_1}(m)]_0 = [L^{\phi_0}(m), L^{\phi_1}(m)]_0 = L^\phi(m), \]
\[ [L^{\phi_0}(m), L^{\phi_1}(m)]_0 = [L^{\phi_0}(m), L^{\phi_1}(m)]_0 = L^\phi(m), \]
\[ [L^{\phi_0}(m), L^{\phi_1}(m)]_0 = [L^{\phi_0}(m), L^{\phi_1}(m)]_0 = L^\phi(m). \]

This is joint work with A. Fernández, F. Mayoral, F. Naranjo (University of Sevilla) and A. Manzano (University of Burgos).


33. Noncommutative Boyd interpolation theorems

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In 1969, D.W. Boyd introduced two indices $p_E$ and $q_E$, nowadays called Boyd’s indices, for a rearrangement invariant Banach function space $E$ on $\mathbb{R}_+$. Based on earlier work by Calderón, Boyd showed that every (sub)linear map of weak types $(p,p)$ and $(q,q)$ is bounded on $E$ if and only if $p < p_E \leq q_E < q$. The ‘if’ part is Boyd’s interpolation theorem.

In my talk I will present a new approach to this theorem, which leads to Boyd-type interpolation results for certain operators in noncommutative vector-valued Banach function spaces. In particular one can interpolate several noncommutative probabilistic inequalities, such as the dual Doob inequality and the ‘upper’ Khintchine inequalities. As a consequence, one finds an exact characterization of the noncommutative Banach function spaces in which the upper Khintchine inequalities hold. If time permits, I will discuss some further applications in noncommutative martingale theory.

Part of the talk is based on joint work with Ben de Pagter, Denis Potapov and Fedor Sukochev.

34. On semigroups of nonnegative functions and positive operators

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We give extensions of results on nonnegative matrix semigroups which deduce finiteness or boundedness of such semigroups from the corresponding local properties, e.g., from finiteness or boundedness of values of certain linear functionals applied to them. We also consider more general semigroups of nonnegative functions.

This is joint work with Heydar Radjavi (University of Waterloo, Canada).

35. Simple proofs of two theorems on the Riesz homomorphisms

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Simple proofs of the main results of the papers "Laterally closed lattice homomorphisms" and "Homomorphisms with respect to a function" are given.

35
36. On quasi-compactness and uniform convergence

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Great interest in the ergodic theory of operators and one-parameter operator semigroups is the asymptotic behavior of iterates. Limits of positive operators acting on Banach lattices have attracted special attention. The interesting properties and regular asymptotic behavior of iterates hold also for quasi-compact Markov operators and operator semigroups. Kryloff and Bogoliouboff introduced this important class of operators for which the uniform mean ergodic theorem can be obtained. For a single Markov operator, it is uniformly mean ergodic to a finite dimensional Markovian projection if and only if it is quasi-compact. On the other hand uniform ergodicity with finite dimensional fixed points space does not imply quasi-compactness in the case of continuous-time Markov semigroups.

In this talk we express some characterization of quasi-compactness to operator nets on Banach lattices and special spaces, some of them are based on [7†]. Moreover we examine the condition of operator semigroups which the convergence of it is equivalent to quasi-compactness on Banach lattices.


37. Factorization theorems of Arendt type for additive monotone mappings

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Abstract versions of the Radon-Nikodym theorem were obtained firstly by Dorothy Maharam [3, 4]. She dealt with function-valued measures and abstract integrals. Her results were generalized in the framework of Riesz spaces by Wilhelmus A. J. Luxemburg and Anton R. Schep [2†]. Theorems 3.1, 3.4 and 4.2. Wolfgang Arendt [1] proved factorization theorems for positive operators which generalize the Luxemburg-Schep theorem.

Our purpose is to provide analogues of results of Arendt. We present four factorization theorems for additive monotone mappings defined on a lattice-ordered Abelian group and having values in a Dedekind complete Riesz space.

References


38. Different integrals in the same formula

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We study some relationships between the Bartle–Dunford–Schwartz integral of a scalar valued function $f$, with respect to a vector measure $m$, and the Dunford, Pettis or Bochner integrals of its (vector valued) distribution function $m_f$. The Dunford (or Pettis) integrability of $m_f$ is strongly related to the weak integrability (or the integrability) of $f$ in the sense of Bartle–Dunford–Schwartz.
In the case of the Bochner integrability of $m_f$, a new function space appears. It is defined through the Choquet integrability of $f$ with respect to the semivariation $\|m\|$ of the measure $m$. We also study this space and present its main properties.

This is joint work with Fernando Mayoral (Universidad de Sevilla) and Francisco Naranjo (Universidad de Sevilla)

39. Disjointly homogeneous spaces: some bits and pieces
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Rey Juan Carlos University, Madrid, Spain

A Banach lattice $E$ is said to be disjointly homogeneous if every pair of normalized disjoint sequences in $E$ have equivalent subsequences. In this talk we consider some aspects around this notion; in particular we are interested in deciding whether being disjointly homogeneous is a selfdual property.

Joint work with F.L Hernández, E. Spinu, P. Tradacete and V. Troitsky

40. Generalized and classical Orlicz-Lorentz spaces
Foralewski, Paweł (katon@amu.edu.pl)
Adam Mickiewicz University in Poznań, Poznań, Poland

In this lecture some new results concerning generalized and classical Orlicz–Lorentz spaces will be presented. Recall that the construction of generalized Orlicz–Lorentz spaces $\Lambda_\varphi$ is based on the idea of taking a Musielak–Orlicz function $\varphi$ satisfying appropriate conditions instead of the couple $(\psi,\omega)$ (where $\psi$ is an Orlicz function and $\omega$ is a weight function) which is used in the construction of classical Orlicz–Lorentz spaces $\Lambda_{\psi,\omega}$. It is worth noticing that the class of $\Lambda_\varphi$ spaces is much wider than the class of $\Lambda_{\psi,\omega}$ spaces.

41. On $p$-convergent operators on Banach lattices
Fourie, Jan (jan.fourie@nwu.ac.za)
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The concept “$p$-convergent operator” on Banach spaces (for $1 \leq p < \infty$) was introduced by J. Castillo and F. Sánchez in a paper “Dunford-Pettis-like Properties of Continuous Vector Function Spaces” in Revista Matemática de la Universidad Complutense de Madrid 6(1) (1993). In recent joint work with Elroy Zeekoei, we observed that each bounded linear operator from a Banach space $X$ to the space $c_0$ is $p$-convergent if and only if the scalar sequence $(x^*_n(x_n))_n$ converges to 0 for all weak* null sequences $(x^*_n)_n$ in $X^*$ and all weakly-$p$-summable sequences $(x_n)_n$ in $X$ and equivalently, that this the case when every symmetric bilinear separately compact map $X \times X \to c_0$ is $p$-convergent. Banach spaces for which this is true, are said to have the $\ast$-Dunford Pettis property of order $p$ (or briefly, they have the $DP^*_p$). We introduce weak $p$-convergent operators on Banach spaces and almost $p$-convergent operators on Banach lattices and discuss the relationship between them. Characterizations of Banach spaces for which weakly $p$-summable sequences are norm null sequences are well known in the literature. We characterize the Banach lattices for which all positive disjoint weakly $p$-summable sequences are norm null sequences. Some applications to polynomials and holomorphic functions on Banach spaces will be considered.

42. Differential geometry for reproducing kernels
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In this talk it will be shown how to construct a canonical (functorial) correspondence between reproducing kernels and linear connections on infinite-dimensional Hermitian vector bundles. This construction relies on pull-back operations involving the tautological universal bundle and the classifying morphisms of the kernels. Covariant derivatives arising from the linear connections will be computed in terms of the input reproducing kernels, and examples will be given which include kernels associated with homogeneous vector bundles and completely positive mappings.

This talk is based on a joint work with D. Beltita.
43. Ergodic theorem for $L_1-L_{\infty}$ contractions in Banach -Kantorovich $L_p$-lattices

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It is proved a version of individual ergodic theorem for $L_1-L_{\infty}$ contractions in Banach -Kantorovich $L_p$-lattices associated with the Maharam measure taking values in the algebra of measurable functions.

44. Martingales without probability

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University of Alberta, Edmonton, Canada

We use the concept of uo-Cauchy sequences to extend Doob’s classical (sub-)martingale convergence theorems to vector lattices and Banach lattices. This talk is based on joint work with F. Xanthos.

45. Convexity, orthogonality and iterations of difference operators

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We shall present selected results on higher order delta convexity (among others of Nemyckii and Hammerstein operators) as well as on higher order polynomial operators controlled by their scalar counterparts. Abstract orthogonality, supporting polynomial functionals and stability aspects of delta-convexity along with delta-exponential mappings in Banach algebras will also be considered.

Iterations of the classical difference operators are the leitmotiv of the material discussed and reported on.

46. Asymptotic behavior of semigroups of kernel operators

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A positive operator $T$ on a Banach lattice $E$ is called a kernel operator if $T$ belongs to the band generated by the finite rank operators or equivalently – in the case where $E = L^p(\Omega,\mu)$ – if

$$Tf = \int_\Omega k(\cdot,y)f(y)d\mu(y)$$

almost everywhere for a measurable function $k$.

Greiner proved in [3] that a positive, bounded and irreducible $C_0$-semigroup $(T(t))_{t\geq0}$ on $L^p(\Omega,\mu)$ with a nonzero fixed space converges strongly to its ergodic projection if $T(t_0)$ is a kernel operator for some $t_0 > 0$.

In this talk we see some generalizations of Greiner’s theorem to strongly continuous or discrete semigroups of Harris operators [1].

As an application we give a new proof of Doob’s theorem on the convergence of Markovian strong Feller transition semigroups [2] and we compare the different notions of kernel operators in this context.

References


47. Submultiplicativity and stability of sup norms on homotonic algebras

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An algebra \( A \) of real or complex valued functions defined on a set \( S \) shall be called \textit{homotonic} if \( A \) is closed under forming of absolute values, and if for all \( f \) and \( g \) in \( A \), the product \( f \times g \) satisfies \(|f \times g| \leq |f| \times |g|\). In this talk we offer several examples of homotonic algebras and provide a simple inequality which characterizes submultiplicativity and strong stability for weighted sup norms on such algebras.

48. Applications of the Gaussian min-max theorem

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We show how to apply the \textit{Gaussian min-max theorem} to provide simple full proofs of several famous results in asymptotic geometric analysis, such as, the Dvoretzky theorem, the Johnson-Lindenstrauss Lemma, Gluskin’s theorem on embedding in \( \ell^p \), the Milman-Schechtman theorem on isomorphic embedding, the restricted isometry property (RIP) for sparse vectors, and more.

49. Inequalities for stochastic processes in Riesz spaces

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We present some martingale and general inequalities for stochastic processes in Riesz spaces. The Kolmogorov-Čentsov inequality, in particular, gives a condition for a stochastic process to be continuous; this leads us to a general definition of Brownian motion for continuous time stochastic processes in Riesz spaces, generalising the definition of Labuschagne and Watson given in the discrete case.

50. Eigenvalues of multiplication operators on vector-valued function spaces

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Multiplication operators on \( L^p \)-spaces of Banach space-valued functions are considered and stability properties with respect to different topologies are investigated. Spectral theory and especially properties of the eigenvalues of operators are important in this setting. A characterization of the eigenvalues of a multiplication operator which has been obtained for this purpose is discussed.

51. A general system of generalized nonlinear mixed composite-type equilibria in Hilbert spaces

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Very recently, Ceng and Yao [L.C.Ceng, J.C.Yao, A relaxed extragradient-like method for a generalized mixed equilibrium problem, a general system of generalized equilibria and a fixed point problem, Nonlinear Anal.,72(2009),1922-1937], suggested and analyzed a relaxed extragradient-like method for finding a common solution of a generalized mixed equilibrium problem, a general system of generalized equilibria and a fixed point problem of a strict pseudocontractive mapping in a Hilbert space. In this paper, based on the authors’ iterative method, we introduce a modification of the relaxed extragradient-like method, we introduce a modification of the relaxed extragradient-like method for finding a common solution of a generalized mixed equilibrium problem with perturbed mapping, a general system of generalized nonlinear mixed composite-type equilibria and a fixed point problem of a strict pseudocontractive mapping in a Hilbert space, and then obtain a strong
convergence theorem. Utilizing this theorem, we establish some new strong convergence results in fixed point problems, variational inequalities, mixed equilibrium problems and systems of generalized nonlinear mixed composite-type equilibria in Hilbert spaces.

52. On the moduli and characteristic of monotonicity in Orlicz–Lorentz function spaces

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First we will present the result that for Köthe spaces the classical characteristic of monotonicity is the same as the characteristic of monotonicity corresponding to another modulus of monotonicity in the definition of which smaller nonnegative elements are restrictions of the bigger elements to measurable sets. Using this result the characteristic of monotonicity of Orlicz–Lorentz function spaces \( \Lambda_{\varphi,\omega} \) is calculated. Since degenerate Orlicz functions \( \varphi \) and degenerate weight functions \( \omega \) are also admitted the investigations concern the most possible wide class of Orlicz–Lorentz function spaces. The results concern both cases - an infinite as well as a finite non-atomic measure spaces, although in case of the finite measure the results are much more interesting. The motivation of these investigations comes from the fixed point theory for Banach lattices.

53. State space formulas for rational contractive solutions to a matrix-valued Leech problem

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Let \( G \) and \( K \) be matrix-valued \( H^\infty \) functions of sizes \( m \times p \) and \( m \times q \), respectively. By definition a contractive solution to the Leech problem generated by \( G \) and \( K \) is a \( p \times q \) matrix-valued \( H^\infty \) function \( X \) satisfying the equation \( G(z)X(z) = K(z) (|z| < 1) \) and the norm constraint \( \sup_{|z| < 1} \|X(z)\| \leq 1 \). A famous result of R.B. Leech tells us that such a contractive solution exists if and only if \( T_GT_G^* - T_KT_K^* \) is positive, where \( T_G \) and \( T_K \) are the (block) Toeplitz operators defined by \( G \) and \( K \), respectively. In this talk we assume additionally that \( G \) and \( K \) are rational functions. In that case it is known from mathematical system and control theory that \( G \) and \( K \) admit state space representations of the form:

\[
G(z) = D_1 + zC(I_n - zA)^{-1}B_1, \quad K(z) = D_2 + zC(I_n - zA)^{-1}B_2.
\]

Here \( I_n \) is the \( n \times n \) identity matrix, \( A \) is a square matrix of order \( n \) which has all its eigenvalues in the open unit disc, and \( B_1, B_2, C, D_1 \) and \( D_2 \) are matrices of appropriate sizes. Inspired by recent work of T. Trent and S. ter Horst, we shall present a finite dimensional state space procedure to obtain rational contractive solutions to our Leech problem assuming that \( G \) and \( K \) are given by the above state space representations and the necessary positivity condition is satisfied. Relations with the classical corona problem will be discussed too. The talk is based on joint work with A.E. Frazho and S. ter Horst.

54. Directed ideals in partially ordered vector spaces

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For a linear subspace \( I \) of a Riesz space there are various well-known properties that are equivalent to \( I \) being an ideal, such as \( I \) is a full Riesz subspace, \( I \) is a solid subspace, \( I \) is a Riesz subspace and the kernel of a positive linear map, \( I \) is the kernel of a Riesz homomorphism. Generalizations of these properties to partially ordered vector spaces are considered and their relations are investigated. It is shown that for directed subspaces all these generalizations are equivalent, just as in the case of Riesz spaces.
55. On diagonals of commutators of positive compact operators and ideal-triangularizability

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Let \( E \) be a Banach lattice with order continuous norm, and let \( S \) be a multiplicative semigroup of ideal-triangularizable positive compact operators on \( E \). In general, the semigroup \( S \) is not simultaneously ideal-triangularizable. It turns out that \( S \) is ideal-triangularizable if and only if the atomic diagonal of the commutator \( ST - TS \) is equal to zero for every pair \( \{S, T\} \subseteq S \).

This is joint work with R. Drnovšek (University of Ljubljana)

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56. Metrizing the Lévy topology on nonadditive measures by explicit metrics

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Weak convergence of measures on a topological space not only plays a very important role in probability theory and statistics, but is also interesting from a topological measure theoretic view, since it gives a convergence closely related to the topology of the space on which the measures are defined. Thus, it is possible to study weak convergence of measures on a topological space in association with some topological properties of the space, such as the metrizability, separability and compactness.

Nonadditive measures, which are set functions that are monotonic and vanish at the empty set, have been extensively studied; see Wang and Klir [3]. They are closely related to nonadditive probability theory and the theory of capacities and random capacities. Nonadditive measures have been used in expected utility theory, game theory, and some economic topics under Knightian uncertainty.

The notion of weak convergence of nonadditive measures was formulated by Girotto and Holzer in a fairly abstract setting [1]. Some of their fundamental results for weak convergence, such as the portmanteau theorem and the direct and converse Prokhorov theorems, have been extended to the nonadditive case. In particular, the portmanteau theorem allows us to show that the weak topology, which is the topology generated by weak convergence, coincides with the Lévy topology, which is the topology generated by convergence of measures on a special class of sets.

In this talk, we will present successful nonadditive analogs of the theory of weak convergence of measures with a particular focus on metrizability and we will also supply weak convergence methods to related fields; see the author’s recent paper [2].


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57. Semi-inner products and angles in normed spaces

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The semi-inner products are generalisations of inner products in normed spaces; and they play an important role to describe the geometry of normed spaces. Using the semi-inner products, the theories that hold in inner product spaces can be carried to the settings of normed spaces. These theories include the notion of angle, orthogonality, Riesz representation theorem, Gram-Schmidt projection, parallelogram equality, etc.

In this talk, I will give a brief overview of semi-inner products, and will focus on the notion of angles. In particular, I will discuss the existence of Wielandt inequality. In its original setting, the Wielandt inequality relates the angle between a pair of (non-trivial) complex lines in the space \( \mathbb{C}^n \) and the angle between the transformed pair of these complex lines (under a linear transformation).
Sinnamon and Lin in 2011, generalised this problem by considering the corresponding relationship in a more abstract settings: vector spaces with two inner products. The resulted Wielandt inequality is stated for angle between pair of vectors instead of lines. Using semi-inner products, we define angles in normed spaces and, in a similar fashion, relate the angle between a pair of vectors in a vector space with two norms. Our result shows that the existence of Wielandt inequality has a close relationship with the shape of the unit spheres of these norms.

This is a joint work with Gord Sinnamon (University of Western Ontario).

58. Essential spectra of disjointness preserving operators

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Let $X$ be a Banach lattice and $U$ be a $d$-isomorphism of $X$ onto itself such that the spectrum of $U$ is a subset of the unit circle. Let $W$ be an element of the center of $X$. We describe various essential spectra (Fredholm, semi-Fredholm, et cetera) of the operator $WU$. In particular, it follows from our results that if the lattice $X$ has no atoms then the essential spectra of $WU$ coincide with its spectrum.

59. Pointwise products of some Banach function spaces

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Given two Banach ideal spaces (real or complex) $E$ and $F$ on a measure space $(\Omega, \Sigma, \mu)$ define the pointwise product space $E \odot F$ as

$$E \odot F = \{x \cdot y : x \in E \text{ and } y \in F\}.$$ 

with a functional $\| \cdot \|_{E \odot F}$ defined by the formula

$$\|z\|_{E \odot F} = \inf \{\|x\|_{E}\|y\|_{F} : z = xy, x \in E, y \in F\}.$$ (1)

We will discuss fundamental properties of the space $(E \odot F, \| \cdot \|_{E \odot F})$. The most important of them will follow from the identification of the space $E \odot F$ with the $1/2$-concavification of Calderón space $E^{1/2}F^{1/2}$. We present also the formula for the fundamental function of the product space, namely $f_{E \odot F}(t) = f_{E}(t)f_{F}(t)$ if $E$ and $F$ are symmetric Banach spaces on $I = (0, 1)$ or $I = (0, \infty)$. We will give also a description of the space $E \odot F$ for special classes of Banach function spaces. The product $E_{\varphi_{1}} \odot E_{\varphi_{2}}$ of Calderón-Lozanovskii $E_{\varphi}$-spaces will be described by relations between inverses to Young functions generated the spaces. Finally we present results on the product space $E \odot F$ for Lorentz spaces $\Lambda_{p}$ and Marcinkiewicz spaces $M_{\phi}$. Recall that the well-known factorization theorem of Lozanovskii can be written in the form $L^{1} \equiv E \odot E'$, where $E'$ is a Köthe dual of $E$. Then natural question arises: when is it possible to factorize $F$ through $E$, i.e., when

$$F \equiv E \odot M(E, F)?$$ (2)

where $M(E, F)$ denotes the space of multipliers. However, it seems to be also useful to have equality [2] with just equivalence of the norms, that is,

$$F = E \odot M(E, F).$$ (3)

This can be done by finding $M(E, F)$ and $E \odot M(E, F)$ separately. Thus the form of space $E \odot F$ for concrete class of Banach spaces may be applied at this point.

60. Mean ergodic theorems on norming dual pairs

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The classical mean ergodic theorem on Banach spaces gives several equivalent conditions for the norm-convergence of Cesàro means of a given operator/semigroup. However, it is not always reasonable to expect convergence of the means in the norm topology. For example, when working on the Banach space $M(E)$ of measures on the Borel $\sigma$-algebra of a Polish space $E$, convergence
in the total variation norm is too strong for many purposes, including the convergence of Cesàro means. It is more reasonable to expect \textit{weak} convergence of the means, i.e. convergence when tested against a bounded, continuous function on \( E \).

In the talk, I will discuss extensions of the mean ergodic theorem to norming dual pairs, in particular, the pair \((C_b(E), M(E))\). I will also present counterexamples which show that not all equivalences from the Banach space setting generalize. Finally, I will show that for Markovian semigroups on the pair \((C_b(E), M(E))\) which satisfy additional assumptions (such as the e-property) these problems disappear and the mean ergodic theorem generalizes completely to our situation.

This is joint work with Moritz Gerlach (University of Ulm), obtained in \cite{gerlach_kunze_2012}.

\begin{thebibliography}{9}
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61. Algebraic band preserving operators

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It is proved that for a universally complete vector lattice \( E \) the following are equivalent: (1) Every algebraic band preserving operator in \( E \) is strongly diagonal; (2) Every band preserving projector in \( E \) is a band projection; (3) The Boolean algebra \( \mathcal{B}(E) \) of components in \( E \) is \( \sigma \)-distributive.

62. An order-theoretic approach to stochastic processes

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It is possible to develop a theory of stochastic processes in Riesz space without using measure theory. In this approach, there is no underlying measure space; instead, the ordering on the Riesz space is used in the development.

Many of the notions and results in the classical setting of stochastic processes on probability spaces have been extended to the Riesz space setting for discrete time stochastic processes. Progress has also been made with this development in the case of continuous time stochastic processes in Riesz spaces.

These ideas are applicable, for example, in Banach spaces, Banach lattices, Bochner spaces and their extensions to the \( l \)-tensor product of a Banach lattice and a Banach space.

We will give a brief overview of the theory as developed thus far.

63. Rotund renormings of spaces of Bochner integrable functions

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We show that if \( \mu \) is a probability measure and \( X \) is a Banach space, then the space Lebesgue-Bochner space \( L^1(\mu, X) \) admits an equivalent norm which is rotund (uniformly rotund in every direction, locally uniformly rotund, or midpoint locally uniformly rotund) if \( X \) does. We also prove that if \( X \) admits a uniformly rotund norm, then the space \( L^1(\mu, X) \) has an equivalent norm whose restriction to every reflexive subspace is uniformly rotund. This is done via the Luxemburg norm associated to a suitable Orlicz function.

This is joint work with Marian Fabian (Institute of Mathematics, Academy of Sciences of the Czech Republic, Prague).

64. The Bishop-Phelps theorem and recent developments

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A bounded linear operator \( T \) from a Banach space \( X \) to a Banach space \( Y \) is said to be norm-attaining if there is an element \( x \) in the closed unit ball \( B_X \) of \( X \) such that \( ||T|| = ||Tx|| \). If \( Y \) is a scalar (real or complex) field, then such a \( T \) is called a norm-attaining functional. The celebrated Bishop-Phelps theorem says that norm-attaining functionals are dense in the dual space \( X^* \). This
Theorem has far-reaching applications. Bishop-Phelps asked in the same paper if the set of norm-attaining operators is dense in the space $L(X, Y)$ of bounded linear operators from $X$ to $Y$. Even though the answer is negative in general, there has been several attempts to find a proper solution to this question. In this talk, I briefly review various approach to find the proper solution of the Bishop-Phelps question and introduce new quantitative approach, so-called “Bishop-Phelps-Bollobas property”, which is a stronger property than the Bishop-Phelps property. In particular, the Bishop-Phelps-Bollobas theorem holds for $L(L_p, L_q)$ for $1 \leq p, q < \infty$.

65. Continuity of the cone spectral radius

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It is well known that a significant part of the spectral theory of positive linear operators on a cone $C$ can be extended to maps $f: C \to C$ that are order-preserving and homogeneous (of degree one). For such maps there exists the notion of the (Bonsall) cone spectral radius, $r_C(f)$, and under suitable compactness conditions on $f$ there exists a corresponding eigenvector in $C$.

In this talk I will discuss the problem whether the cone spectral radius of a continuous compact order-preserving homogeneous map on a closed cone $C$ in a Banach space $X$ depends continuously on the map. Using the fixed point index we show that if there exist $0 < a_1 < a_2 < a_3 < \cdots$ with $a_k \to r_C(f)$ and the $a_i$'s are not in the cone spectrum of $f$, then $f$ has a continuous cone spectral radius. For finite dimensional cones it is unknown if such a sequence of $a_i$'s always exists. I will also discuss some partial results concerning this problem.

This talk is based on joint work with Roger Nussbaum (Rutgers University, USA).

66. Approximation of solutions to some abstract Cauchy problems by means of Szász-Mirakjan-Kantorovich operators

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For a fixed $0 \leq l \leq 2$, let $V_l$ be the second-order differential operator defined by

$$V_l(u)(x) := xu''(x) + \frac{l}{2} u'(x) \quad (x > 0, u \in C^2([0, +\infty[)).$$

It is known that such an operator, defined on a suitable domain of continuous functions on $[0, +\infty[$, as well as on weighted continuous functions on $[0, +\infty[$, generates a strongly continuous semigroup. Further, on a suitable domain, it is also the generator of a Feller semigroup in $L^p([0, +\infty))$ $(1 < p < 2)$.

Then the abstract Cauchy problem

$$\frac{du}{dt}(t) = V_l(u(t)), \quad t > 0, \quad u(0) = u_0, \quad u_0 \in D(V_l)$$

associated with $(V_l, D(V_l))$ admits a unique solution given by

$$u(t) = T(t)(u_0) \quad (t \geq 0), \quad (1)$$

$(T(t))_{t \geq 0}$ being the semigroup generated by $(V_l, D(V_l))$.

The aim of this talk is to show a representation formula for the semigroup, and hence for the solution (1), by means of suitable iterates of the operators $C_n$, first introduced in [1], that generalize the classical Szász-Mirakjan-Kantorovich.

As we shall see, such a formula allows to study the qualitative properties of the solution (1) by means of similar ones held by the operators $C_n$.

The results which will be discussed during the talk are taken from [1] and [2].


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67. Factorization of some Banach function spaces
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Let \( X, Y \) be a couple of Banach ideal spaces over the same measure space \((\Omega, \Sigma, \mu)\). The space of pointwise multipliers \( M(X, Y) \) is defined as

\[
M(X, Y) = \{ x \in L^0(\Omega) : xy \in Y \text{ for all } y \in X \}
\]

with the usual operator norm

\[
\|y\|_{M(X, Y)} = \sup \{\|yx\|_Y : x \in X, \|x\|_X \leq 1\}.
\]

and the pointwise product of \( X \) and \( Y \) is just

\[
X \odot Y = \{ xy : x \in X, y \in Y \},
\]

with the quasi norm

\[
\|z\|_{X \odot Y} = \inf \{\|x\|_X \|y\|_Y : z = xy, x \in X, y \in Y \}.
\]

Using this notion, the factorization theorem of Lozanovskii may be written in the form

\[
X \odot M(X, L^1) \equiv L^1.
\]

The natural question arise, when the following generalization of the above holds true

\[
X \odot M(X, Y) \equiv Y?
\]

This is, when \( Y \) may be factorized through \( X \)? We will discuss some known theorems of such a type as well as present new results on factorization of concrete classes of Banach function spaces including Calderón - Lozanovskii, Orlicz, Lorentz and Marcinkiewicz spaces. Finally, some general relations between constructions \( M(X, Y) \) and \( X \odot Y \), as for instance cancellation law, will be discussed.


68. Nonlinear order isomorphisms in sequence spaces
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If \( E \) and \( F \) are partially ordered (real) vector spaces, an order isomorphism between \( E \) and \( F \) is a (not necessarily linear) bijection from \( E \) onto \( F \) that preserves order. We present several results concerning order isomorphisms, with particular attention to order isomorphisms between sequence spaces, i.e., subspaces of \( \ell^0 \) endowed with the natural order. For example, a structural result is the following:

**Theorem.** Let \( E \) and \( F \) be quasi-Banach lattices. If \( E \) contains a closed sublattice that is order isomorphic to \( c_0 \), and \( E \) and \( F \) are order isomorphic, then \( F \) contains a closed sublattice linearly order and topologically isomorphic to \( c_0 \).

We also give characterizations of when two Orlicz sequence spaces, respectively Lorentz sequence spaces, are order isomorphic.

69. Positive solutions for a system of higher-order multi-point boundary value problems
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Gheorghe Asachi Technical University, Iasi, Romania
This is a joint work with Prof. Johnny Henderson (Baylor University, Waco, Texas, USA). We consider the system of nonlinear higher-order ordinary differential equations

\[
\begin{align*}
\{ & u^{(n)}(t) + \lambda a(t)f(u(t),v(t)) = 0, \ t \in (0, T), \\
& v^{(m)}(t) + \mu b(t)g(u(t),v(t)) = 0, \ t \in (0, T), 
\end{align*}
\]

with the multi-point boundary conditions

\[
\begin{align*}
\{ & u(0) = p \sum_{i=1}^{r} a_i u(\xi_i), \ u'(0) = \cdots = u^{(n-2)}(0) = 0, \ u(T) = \sum_{i=1}^{p} b_i u(\eta_i), \\
& v(0) = r \sum_{i=1}^{l} c_i v(\zeta_i), \ v'(0) = \cdots = v^{(m-2)}(0) = 0, \ v(T) = \sum_{i=1}^{l} d_i v(\rho_i), 
\end{align*}
\]

where \( n, m \in \mathbb{N} \), \( n, m \geq 2 \), \( p, q, r, l \in \mathbb{N} \). By using the Guo-Krasnosel’skii fixed point theorem, we give sufficient conditions on \( \lambda, \mu, f \) and \( g \) such that positive solutions of \((S)-(BC) exist (see [1]). The nonexistence of positive solutions is also investigated.


70. Domination and factorization theorems for multilinear operators

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We will discuss some recent works with E. A. Sánchez Pérez concerning vector norm inequalities and their applications to factorization of multilinear operators.

71. Weighted Hardy inequalities and real interpolation of spaces associated to a vector measure

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We analyze the role of weighted Hardy inequalities and the classes \( B_q \), of Arinó-Muckenhoupt weights, in the characterization of the \( K \)-interpolation spaces, defined by a function parameter, for a pair \((X,L^\infty(m))\). Here \( L^\infty(m) \) is the space of essentially bounded scalar measurable functions with respect to a vector measure \( m \) and \( X \) is an intermediate quasi-Banach space between the space \( L^1(||m||) \), of scalar integrable functions with respect the semivariation \( ||m|| \) of \( m \), and the weak-\( L^1 \) space \( L^{1,\infty}(||m||) \) associated to \( ||m|| \).

This talk is based in a joint work with: Ricardo del Campo, Antonio Fernández, Antonio Manzano and Francisco Naranjo.

72. The Riesz decomposition property for differentiable functions taking values in an atomic Banach lattice

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In [1] it is shown that the space of differentiable functions from \( \mathbb{R}^n \) \((n \geq 1) \) into \( \mathbb{R} \) has the Riesz decompositions property. The proof of the result relies on constructing the solutions via a formula, we discuss the generalisation of this construction and prove the following theorem.

**Theorem.** Let \( X \) be an atomic Banach lattice, the space \( D^1(\mathbb{R},X) \) of differentiable functions from \( \mathbb{R} \) into \( X \) has the Riesz decomposition property.

73. Unique approach to topological invariants of Marcinkiewicz-Lorentz-Orlicz spaces

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It may be shown that for some triples of spaces in the title all their topological invariants may be considered in a parallel way. These invariants, which form some algebraical structures in a semigroup with respect to composition, may be represented as limit/extreme properties of the densities (in the natural series) of the suitable natural sequences.

74. A stronger Open Mapping Theorem with applications in ordered Banach spaces

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The usual Banach–Schauder Open Mapping Theorem can be formulated as follows:

**Theorem.** Let $X$ and $Y$ be Banach spaces and $T : Y \to X$ a bounded linear map. Then the following are equivalent:
1. $T$ is surjective;
2. $T$ is open;
3. There exist $K > 0$ and a map $\gamma : X \to Y$, such that $T \circ \gamma(x) = x$ and $\|\gamma(x)\| \leq K\|x\|$, for all $x \in X$.

We will indicate how this can be combined with Michael’s Selection Theorem to yield the following stronger and more general Open Mapping Theorem:

**Theorem.** Let $X$ and $Y$ be Banach spaces and let $C \subset Y$ be a closed (not necessarily proper) cone. Let $T : C \to X$ be a continuous additive positively homogeneous map. Then the following are equivalent:
1. $T$ is surjective;
2. $T$ is open;
3. There exist $K > 0$ and a continuous positively homogeneous map $\gamma : X \to C$, such that $T \circ \gamma(x) = x$ and $\|\gamma(x)\| \leq K\|x\|$, for all $x \in X$.

This readily implies the following:

**Theorem.** Let $X$ be a Banach space and $\{C_i\}_{i \in I}$ be an arbitrary collection of closed cones in $X$, such that every $x \in X$ can be written as an absolutely convergent series $x = \sum_{i \in I} c_i$, where $c_i \in I$, for all $i \in I$. Then there exist a constant $K > 0$ and continuous positively homogeneous maps $\gamma_i : X \to C_i (i \in I)$, such that:
1. $x = \sum_{i \in I} \gamma_i(x)$, for all $x \in X$;
2. $\sum_{i \in I} \|\gamma_i(x)\| \leq K\|x\|$, for all $x \in X$.

If $X$ is an ordered Banach space with a closed (not necessarily proper) generating cone $C$, then Andô’s Theorem [1, Lemma 1] asserts that there exists $K > 0$ with the property that, for all $x \in X$, there exist $x^+ \in C$ such that $x = x^+ - x^-$ and $\|x^\pm\| \leq K\|x\|$. As a consequence of the above result, there exists such a bounded decomposition that is, in addition, continuous and positively homogeneous.

This is joint work with Marcel de Jeu.


75. Modulus of non-semicompact convexity

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The talk will consist of two parts. In the first part, we develop the cornerstone theorem given in [2, Proposition 2.1], which states that for a Banach lattice $E$ with order continuous norm (OCN)
if $D$ is a PL-compact subset of $E$ then $\chi(D) = \rho(D)$, by showing that if $E$ has OCN, then $w(D) \leq \rho(D)$; on the other hand, if $E$ has the Schur property, then $\rho(D) \leq w(D)$ for any norm bounded subset $D$ of $E$. Here, $\chi$, $\rho$, and $w$ are Hausdorff measure of non-compactness, the measure of non-semicompactness introduced in [2], and the measure of weak non-compactness, respectively. Secondly, we introduce the notion of the modulus of non-semicompact convexity in Banach lattices defined with the help of the measure of non-semicompactness in Banach lattices. We extend the results obtained in [1] by showing that the modulus of non-semicompact convexity is continuous and has some extra properties in reflexive Banach lattices.


76. Positivity in variational analysis and optimization
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We discuss interrelationships between positivity ideas in analysis and novel developments in variational analysis and generalized differentiation of vector-valued and set-valued mappings with values in ordered spaces. Significant progress of these developments has been recently achieved in applications to multiobjective optimization and economic modeling, which will be presented in the talk.

77. Domination by ergodic elements in ordered Banach algebras
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The classical domination problem for positive operators on Banach lattices entails the determining of conditions under which a property of a positive operator $T$ will be inherited by a positive operator $S$ such that $S \leq T$. This problem has also been investigated in the more general context of ordered Banach algebras. In this talk we are specifically interested in the property of ergodicity, where a Banach algebra element $a$ is said to be ergodic if the sequence $\left(\sum_{k=0}^{n-1} a^k \right)$ converges. By generalising part of ([1], Theorem 3.16), we establish an ergodic theorem for Banach algebras, in which necessary and sufficient conditions are given for an element to be ergodic. This is then used to obtain answers to the problem of domination by ergodic elements. In particular, we show that if $0 \leq a \leq b$ in an ordered Banach algebra $A$ and $b$ is ergodic, then, under natural conditions, $a$ will be ergodic, provided that the spectral radius of $b$ is a Riesz point of the spectrum of $b$ relative to some inessential ideal of $A$. This result generalises an important special case of ([3], Theorem 4.5), where this problem has been studied in the operator-theoretic setting. This talk is based on joint work with Kelvin Muzundu (see [2]).

References

78. Commutatively ordered Banach algebras
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An ordered Banach algebra (OBA) is defined as a complex unital Banach algebra containing a subset $C$, called an algebra cone, such that $C$ contains the unit and is closed under addition,
positive scalar multiplication and multiplication. The elements of \( C \) are called \textit{positive}. Several aspects of spectral theory in OBAs have been studied. Although the results are applicable to many concrete situations, the definition above excludes the important case of a non-commutative \( C^* \)-algebra, since in a non-commutative \( C^* \)-algebra, the product of positive elements is positive only if the elements commute.

In this talk we will define a \textit{commutatively ordered Banach algebra} (COBA) as a complex unital Banach algebra containing a subset \( C \), called an algebra \( c \)-cone, such that \( C \) contains the unit and is closed under addition, positive scalar multiplication and multiplication by commuting elements. Every OBA is COBA. We will give examples and discuss the basic properties of COBAS, and then proceed to show how known results in OBAs can be generalized to the COBA setting. We will then discuss a problem about the peripheral spectrum of a positive element under perturbation by a positive Riesz element in a COBA. The results obtained, of course, hold true in an OBA. These results extend the theory of COBAs and OBAs.

The material covered in this talk forms part of the work done by the presenter for a PhD completed in the year 2012, under the supervision of Sonja Mouton.

79. Complex interpolation of \( L^p \)-spaces of vector measures on \( \delta \)-rings

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We apply the Calderón interpolation methods to Banach lattices of \( p \)-integrable and weakly \( p \)-integrable functions with respect to a Banach-space-value measure defined on a \( \delta \)-ring. In general, the results we obtain are quite different from those in the case of vector measures on \( \sigma \)-algebra. However, we find a wide class of vector measures on \( \delta \)-rings for which the results on \( \sigma \)-algebra hold true.

80. Positive operators and Hausdorff dimension of invariant sets

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This talk will describe an intimate connection between a class of positive linear operators and the Hausdorff dimension of invariant sets given by graph directed (possibly countably infinite) iterated function systems. See the recent paper “Positive operators and Hausdorff dimension of invariant sets,” by R.D. Nussbaum, A. Priyadarshi and S. Verduyn Lunel (Transactions of the AMS 364 (2012), pages 1029-1066). We shall also describe ongoing work with Professor Richard Falk in which these ideas are used to obtain sharp estimates of Hausdorff dimension for some nontrivial examples like the set of complex continued fractions studied by Mauldin and Urbanski.

81. Operators on ordered spaces belonging to certain ideals

\textbf{(joint work with E.Spinu)}

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Suppose \( X \) and \( Y \) are ordered spaces (for instance, \( C^* \)-algebras, or non-commutative function spaces), and \( \mathcal{I} \) is an operator ideal (for instance, the ideal of compact, weakly compact, or strictly singular operators). Under what conditions does \( T \in B(X,Y) \) belong to \( \mathcal{I} \)? We concentrate on two possible criteria:

1. Domination: suppose \( 0 \leq T \leq S \), and \( S \in \mathcal{I}(X,Y) \). Under suitable conditions, \( T \) belongs to \( \mathcal{I}(X,Y) \) as well. A sample result: suppose \( A \) and \( B \) are \( C^* \)-algebras, and \( 0 \leq T \leq S \). Then the compactness of \( S \) implies the compactness of \( T \) if and only if \( T \) is compact, or \( A \) is scattered.

2. Inclusion of ideals: \( \mathcal{J}(X,Y) \subset \mathcal{I}(X,Y) \), where \( \mathcal{J} \) is a different ideal. Among other things, we prove: suppose \( X \) is either the Schatten space \( C_p \) (\( 1 \leq p < \infty \)), or the space \( L_p(\tau) \) (\( 1 < p < \infty \), and \( \tau \) is a normal faithful finite trace on a hyperfinite von Neumann algebra. Then, for \( T \in B(X) \), the following are equivalent: (i) \( T \) is not strictly singular; (ii) \( T \) is not inessential; (iii) \( X \) contains a subspace \( E \), isomorphic to either \( \ell_2 \) or \( \ell_p \), so that \( T|_E \) is an isomorphism, and both \( E \) and \( T(E) \) are complemented in \( X \). For \( 1 < p < \infty \) these conditions are equivalent to \( T \) not being strictly cosingular.
82. Reflexivity of Banach $C(K)$-modules via the reflexivity of Banach lattices

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We extend the well known criteria of reflexivity of Banach lattices due to Lozanovsky and Lotz to the class of finitely generated Banach $C(K)$-modules. Namely we prove that a finitely generated Banach $C(K)$-module is reflexive if and only if it does not contain any subspace isomorphic to either $l^1$ or $c_0$.

(Joint work with Arkady Kitover)

83. Matrix monotone functions and a generalized Powers-Størmer inequality

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The Powers-Størmer inequality asserts that for $s \in [0, 1]$ the following inequality

$$2\text{Tr}(A^s B^{1-s}) \geq \text{Tr}(A + B - |A - B|)$$

holds for any pair of positive matrices $A, B$. This is a key inequality to prove the upper bound of Chernoff bound, in quantum hypothesis testing theory. This inequality was first proven by Audenaert et. al, using an integral representation of the function $t^s$. After that, N. Ozawa gave a much simpler proof for the same inequality, using fact that for $s \in [0, 1]$ function $f(t) = t^s$ ($t \in [0, +\infty)$) is an operator monotone. Recently, Y. Ogata extended this inequality to standard von Neumann algebras.

The following is a main result in our talk.

**Theorem.** Let $\text{Tr}$ be a canonical trace on $M_n$ and $f$ be a matrix monotone function of order $2n$ on $[0, \infty)$ such that $f((0, \infty)) \subset (0, \infty)$. Then for any pair of positive matrices $A, B \in M_n$,

$$\text{Tr}(A + B - |A - B|) \leq 2\text{Tr}(f(A)^{1/2} g(B) f(A)^{1/2}),$$

where $g(t) = \begin{cases} t^{1/2} & (t \in (0, \infty)) \\ 0 & (t = 0) \end{cases}$.

In particular, this inequality holds for an operator monotone function $f$.

This is a joint work with Dinh Trung Hoa and Ho Minh Toan.

84. On the Cramér transform and the $t$-entropy

**Ostaszewska, Urszula (uostasze@math.uwb.edu.pl)**
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$t$-entropy is the convex conjugate of the spectral exponent (the logarithm of the spectral radius) of a weighted composition operator (WCO). Let $X$ be a nonnegative random variable. We consider operators which are moment generating functions of WCO and then we investigate the Legendre-Fenchel transform of their spectral exponent. We show how it is expressed by the $t$-entropy and the Cramèr transform of the given random variable $X$.


85. Non-square Lorentz spaces $\Gamma_{p,\omega}$

**Panfil, Agata (agata.panfil@amu.edu.pl)**
Adam Mickiewicz University, Poznań, Poland

The Lorentz space $\Gamma_{p,\omega}$, for $0 < p < \infty$ and a measurable nonnegative weight function $\omega$, is a set of all Lebesgue measurable functions $f \in L^0$ such that $\int_0^\infty (f^*)^{p\omega} < \infty$, where $0 < \gamma \leq \infty$ and $f^*(t) = H^1 f^*(t) = \frac{1}{t} \int_0^t f^*$ is the Hardy operator. These spaces were introduced by Calderón, and are naturally related to classical Lorentz spaces $\Lambda_{p,\omega} = \{ f : \int_0^\infty (f^*)^{p\omega} < \infty \}$. 
We will characterize non-square Lorentz space $\Gamma_{p,\omega}$. We will also give a criterion of non-squareness for the subspace of order continuous elements $\left(\Gamma_{p,\omega}\right)_a$ in the case when $\left(\Gamma_{p,\omega}\right)_a \neq \Gamma_{p,\omega}$. Since we admit degenerated weight functions $\omega$, the results concern the most possible wide class of spaces $\Gamma_{p,\omega}$.

All results come from the joint paper with prof. Paweł Kolwicz, [4]. To read more about those spaces, we refer to [3], [1], [2].

References


86. Arzela type convergence for partial functions

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Since partial functions do not have a common domain the usual pointwise convergence cannot be defined. In this talk we introduced a new notion of convergence for sequences of partial functions and we obtain new results regarding this convergence.

87. $l_p$-convergence in measure for sequence of measurable functions

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Abstract: We introduce and study s-$l_p$-complete and cos-$\mu$ convergence and we obtain new results regarding statistical convergence of sequences of measurable functions.

88. Positivity and remainders in expansions of Gamma functions

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The remainders in asymptotic expansions of the logarithm of Euler’s gamma function can be studied through Binet’s formulas and this study has lead to the notion of complete monotonicity of positive order.

Monotonicity properties of remainders in asymptotic expansions of the logarithm of Barnes’ double and triple gamma function are investigated. The ideas behind these results can also be used in obtaining Turán type inequalities for the partial sums and remainders of the generating functions of the Bernoulli and Euler numbers.

The talk is based on joint work with Stamatis Koumandos from University of Cyprus. The research is supported by The Danish Council for Independent Research — Natural Sciences.

89. A vector lattice version of Rådström’s embedding theorem

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Rådström’s embedding theorem for ‘near vector spaces’, which are essentially vector spaces without additive inverses, is extended to vector lattices. Furthermore, if the ‘near vector spaces’ is endowed with a metric, we consider properties required for which the norm completion of the embedding space is one of the classical Banach spaces $C(\Omega)$ or $L^p(\mu)$ for $1 \leq p \leq \infty$. This order embedding procedure is examined and applied to the hyperspaces
90. A vector lattice version of Rådström’s embedding theorem

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We extend the notion of narrow operators to nonlinear maps on vector lattices. The main objects are orthogonally additive operators and, in particular, abstract Uryson operators. Most of the results extend known theorems obtained by O. Maslyuchenko, V. Mykhaylyuk and the second named author published in Positivity 13 (2009), pp. 459–495, for linear operators. For instance, we prove that every orthogonally additive laterally-to-norm continuous C-compact operator from an atomless Dedekind complete vector lattice to a Banach space is narrow. Another result asserts that the set $\mathcal{U}_{lc}^{cn}(E,F)$ of all order narrow laterally continuous abstract Uryson operators is a band in the vector lattice of all laterally continuous abstract Uryson operators from an atomless vector lattice $E$ with the principal projection property to a Dedekind complete vector lattice $F$. The band generated by the disjointness preserving laterally continuous abstract Uryson operators is the orthogonal complement to $\mathcal{U}_{lc}^{cn}(E,F)$.

91. $\lambda$-points in Orlicz spaces

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Let $(X, \|\cdot\|_X)$ be a real Banach space and $B(X)$ (ext $B(X)$) be the closed unit ball of $X$ (the set of all extreme points of $B(X)$), respectively. For any $x \in B(X)$ we define the number

$$\lambda(x) = \sup \{ \lambda \in [0,1] : x = \lambda e + (1-\lambda)y, \ e \in \text{ext}B(X), \ y \in B(X) \}.$$ 

If $\lambda(x) > 0$, then $x$ is called a $\lambda$-point of $B(X)$. If every point of $B(X)$ is a $\lambda$-point, then $X$ is said to have the $\lambda$-property. The $\lambda$-property was introduced by Aron and Lohman [1]. A criterion for $\lambda$-points of the unit ball in Orlicz spaces generated by arbitrary Orlicz functions (that is Orlicz functions which can vanish outside zero and which can attain infinite values to the right of some point $u > 0$ are not excluded) and equipped with the Orlicz norm is given. Moreover, Orlicz spaces with $\lambda$-property are characterized. In contrast to results in [2], Orlicz spaces considered by us need not have always the $\lambda$-property.

This is joint work with Adam Bohonos (West Pomeranian University of Technology)


92. Some topics on the theory of cones

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This is a general talk in which we present some results on the theory of cones and geometry of Banach spaces. A special emphasis will be taken to some known but not so familiar results and problems on the bases for cones, isomorphic cones and cone characterization of Banach space properties.
93. Krein–Milman’s and Choquet’s theorems in the max-plus world

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Idempotent analysis involves the study of infinite-dimensional linear spaces in which the usual addition is replaced by the supremum operation.

In this talk we shall present an idempotent version of the Choquet representation theorem. More precisely we shall show that, in a locally-convex topological \(\mathbb{R}_{\max}^+\)-module, where \(\mathbb{R}_{\max}^+\) is the idempotent semifield \((\mathbb{R}^+, \max, \times)\), every point of a compact convex subset \(K\) can be represented by a possibility measure supported by the extreme points of \(K\), meaning that every \(x \in K\) can be written as

\[ x = \sup_{y \in K} p(y) \cdot y, \]

where \(p\) is a possibility measure on \(K\) such that \(p(B) = 0\) for all Borel subsets \(B\) of \(K \setminus \text{ex}\(K\)), and \(\text{ex}\(K\)) denotes the set of extreme points of \(K\).

As a corollary we shall derive a Krein–Milman type theorem.

94. Barreledness and lower semicontinuous seminorms in locally convex cones

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The general theory of locally convex cones were developed in [K. Keimel and W. Roth, Ordered Cones and Approximation, Lecture Notes in Mathematics, Vol 1517, Springer-Verlag, Heidelberg-Berlin-New York, 1992]. A locally convex cone is a cone whose topology is defined by a preorder or a quasi-uniform structure. We verify some relations between lower semicontinuous seminorms and barreledness in locally convex cones. In particular, we show that if every lower semicontinuous seminorm on a locally convex cone \((P, V)\) is continuous, then \((P, V)\) is upper-barreled and so is barreled.

95. Generalized Lorentz spaces and Köthe duality

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Let \(w\) be a decreasing weight on a subinterval \(I = (0, a)\) of \((0, \infty)\). Consider the measure \(\nu = w \, dt\) and \(b = \nu(I)\). Let \(E\) be a strongly symmetric Banach function space over \(J = (0, b)\). Let \(E_w\) be the ideal in \(L_0(I)\) defined by

\[ f \in E_w \iff f_w^* \in E \]

where \(f_w^*\) is the decreasing rearrangement of \(f\) with respect to the measure \(\nu\). We define the Lorentz space \(\Lambda_{E,w}\) as the symmetrized space of \(E_w\), that is

\[ f \in \Lambda_{E,w} \iff f^* \in E_w \]

where \(f^*\) is now the ordinary decreasing rearrangement of \(f\) (with respect to the Lebesgue measure on \(I\)). If \(w\) is locally integrable at 0, that is

\[ W(t) = \int_0^t w(s) \, ds < \infty \]

for all \(t \in I\), then \(\Lambda_{E,w}\) is a strongly symmetric Banach function space on \(J\). When \(E\) is a \(L_p\) space, resp. an Orlicz space, then \(\Lambda_{E,w}\) is an ordinary Lorentz space, resp. an Orlicz-Lorentz space.

Similarly we define the class \(M_{E,w}\) by

\[ f \in M_{E,w} \iff f_w^* \in E_w \]

This class is not necessarily a Banach or quasi-Banach function space (it may even not be a linear space). The following results generalize facts which are known for Orlicz-Lorentz spaces.
Theorem. The Köthe dual of $M_{E,w}$ is $\Lambda_{E,w}$.

Theorem. If $w$ is regular, that is $W(t) \leq Ctw(t)$ for some finite constant $C$ then $M_{E,w}$ is normable.

Theorem. If $w$ is regular then the Köthe dual of $\Lambda_{E,w}$ is $M_{E,w}$.

A remarkable and useful fact in the theory of $M_{E,w}$ spaces is the following:

Proposition. If $f \in L_0$ and $f/w \in E_w$ then $f \in M_{E,w}$ and $\|f/w\|_{E_w} \leq \|f\|_{E_w}$.

96. Higher order monotonic functions of several variables

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Multivariate functions (defined on a product of intervals) with a specific degree of higher order monotonicity in each variable are introduced. When normalized, they turn out to form a Bauer simplex whose extreme points are precisely the tensor products of their univariate counterparts for which corresponding results go (partially) back to Schoenberg, Widder and Williamson.

97. Eigenvalues of $(r,p)$-nuclear operators and approximation properties of order $(r,p)$

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This is a common work with my PhD student Qaisar Latif. We introduce a new notion of the approximation property of order $(r,p)$, $AP_{r,p}$, and investigate the distribution of eigenvalues of $(r,p)$-nuclear operators, presenting a small part of Fredholm Theory for the corresponding ideal $N_{r,p}$.

We give different examples, showing that obtained eigenvalues results are sharp. For this, we use, in particular, examples of spaces without the properties $AP_{r,p}$.

As a by-product of our considerations, we obtain some examples of non $s$-nuclear operators ($0 < s < 1$) with $s$-nuclear adjoints, answering in negative a question of A. Hinrichs and A. Pietsch.

One of the main result:

Theorem. Let $X$ be a Banach space, let $r \in (0,1]$, $1 \leq p \leq 2$ and $1/s = 1 - 1/p + 1/2$. Then $X$ has the property $AP_{r,p}$, and for every $u \in X^* \otimes X$ (projective tensor product) of the form $u = \sum_{i=1}^{\infty} \lambda_i x_i^* \otimes y_i$ where $(\lambda_i) \in l_r$, $(x_i^*)$ is a bounded sequence in $X^*$ and $(y_i) \in l_p^w(X)$ (i.e., is weakly $p'$-summable), the sequence of all eigenvalues $(\mu_k(\tilde{u}))$ of the operator $\tilde{u}$ defined by $u$ is $s$-summable and $||\mu_k(\tilde{u})||_{l_s} \leq ||u||_{N_{r,p}(X,X)}$, where on the right is a natural quasi-norm in $N_{r,p}(X,X)$.

98. A weighted Hardy inequality and nonexistence of positive solutions to some nonlinear problems

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In this talk, we prove that the following weighted Hardy inequality

$$(\frac{|d-p|}{p})^{p} \int_{\Omega} \frac{|u|^p}{|x|^p} d\mu + \left(\frac{|d-p|}{p}\right)^{p-1} \text{sgn}(d-p) \int_{\Omega} \frac{|u|^p}{|x|^p} \frac{(x^tAx)^{p/2}}{|x|^p} dp$$

holds with optimal Hardy constant $\left(\frac{|d-p|}{p}\right)^{p}$ for all $u \in W_{p,0}^1(\Omega)$ if the dimension $d \geq 2$, $1 < p < d$, and for all $u \in W_{p,0}^1(\Omega \setminus \{0\})$ if $p > d \geq 1$. Here we assume that $\Omega$ is an open subset of $\mathbb{R}^d$ with $0 \in \Omega$, $A$ is a real $d \times d$-symmetric positive definite matrix, $c > 0$, and

$$d\mu := \rho(x) \, dx \quad \text{with density} \quad \rho(x) = c \cdot \exp(-\frac{1}{p}(x^tAx)^{p/2}), \quad x \in \Omega.$$

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Due to the optimality of the Hardy constant in (6), we can establish nonexistence (locally in time) of positive weak solutions of a $p$-Kolmogorov parabolic equation perturbed by a singular potential.

99. Translation invariant Banach function spaces and convolution operators

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Abstract: (joint work with Ben de Pagter)
Let $G$ be an infinite compact abelian group, equipped with normalized Haar measure. A Banach function space $E$ over $G$ is called translation invariant if, whenever a function $f$ belongs to $E$, then all translates of $f$ also belong to $E$ (and have the same norm). We will discuss various properties of such spaces $E$ and examine the class of all $E$-multiplier operators (i.e., those bounded linear operators on $E$ which commute with all translation operators on $E$).

100. Domination conditions for families of quasinearly subharmonic functions and some related problems

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Improving previous results of Sjöberg and Brelot, Domar gave 1957 a condition that ensures the existence of the largest subharmonic minorant of a given function. Later 1981 Rippon pointed out that a modification of Domar’s argument gives in fact a better result. Using our previous, rather general and flexible modification of Domar’s original argument, we have extended their results both to the subharmonic and quasinearly subharmonic settings. Now we give some further partial refinements.

In addition, and slightly related to the above topic, we also consider the following. It is a result of Wiegerinck that a separately subharmonic function need not be subharmonic. On the other hand, Lelong, Avanissian, Arsove, we, and Armitage and Gardiner have given certain sufficient conditions under which a separately subharmonic function is subharmonic. Now we consider briefly some of these sufficient conditions.

101. Unique geodesics and embeddings of cones

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Given a closed cone in a Banach space with non-empty interior, we consider Thompson’s metric on its interior, which is defined in terms of the partial ordering induced by the cone. We will show how Thompson’s metric is defined and classify its unique geodesics in certain cones. Moreover, this will allow us to characterize quasi-isometrical embeddings of these interiors with Thompson’s metric into finite dimensional normed spaces.

102. Decomposing positive representations on $L^p$-spaces for locally compact Polish transformation groups

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Let $G$ be a locally compact group acting on a space $X$ with a $G$-invariant measure $\mu$. Then $G$ acts in a unitary manner on $L^2(X,\mu)$, and it is well-established under which assumptions one can decompose the action of $G$ into irreducible representations. The case $L^p(X,\mu)$ for $p \neq 2$ is unknown. In this setting $G$ acts as a group of isometric lattice isomorphisms, and one can wonder whether this action can be decomposed into band-irreducible representations, i.e., a decomposition that respects the order structure.

For unitary representations on Hilbert spaces an essential ingredient for decomposition of representations is that of a direct integral. To replace this notion in the setting of Banach spaces we are lead to so-called Banach bundles. The space of $p$-integrable sections of such bundles can be viewed as a $p$-integral of Banach spaces.
Using such techniques we will show that, under appropriate assumptions on $X$ and $G$, the representation of $G$ on $L^p(X, \mu)$ can be decomposed into band-irreducible representations. This is joint work with Marcel de Jeu.

103. Additivity of insurance premium

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Let $u$ denote a utility function, $X$ be a random loss, $H(X)$ - a premium paid in case of loss, and, finally, let $w$ denote the initial wealth of insurer. Then the generalized zero utility principle under the rank-dependent utility model may be expressed as the following equation

$$u(w) = E_g(u(w + H(X) - X)),$$

where $g : [0, 1] \rightarrow [0, 1]$ is a so called probability distortion function, and $E_g$ denotes the Choquet integral. We ask for utility and probability distortion functions satisfying (1) if additionally the additivity of $H$ for independent risks is assumed.


104. Canonical systems and spectral densities

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General-type canonical system with Hamiltonian satisfying "positivity" condition is dealt with. Its spectral density is studied and asymptotics of fundamental solution, in terms of factorization of spectral density, is derived.

105. Cone isomorphism and almost-surjective operators

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Let $E$ be a Banach lattice and $F$ be a Banach space. A linear operator $T : E \rightarrow F$ is called a *cone isomorphism* if there exists constants $C_1$ and $C_2$ such that $C_1\|x\| \leq \|Tx\| \leq C_2\|x\|$ for all $0 \leq x \in E$. We introduce a new notion of almost-surjectivity which is dual to the notion of a cone isomorphism.

**Theorem.** Let $E$ be a Banach lattice, $F$ be a Banach space and $T : E \rightarrow F$ be a bounded linear operator. Then $T$ is a cone isomorphism if and only if $T^*$ is almost surjective.

A similar result is true for adjoints of almost-surjective operators. We discuss also positive cone isomorphism defined on $L^p$-spaces.

106. Banach limits

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A linear functional $B \in l_\infty^*$ is called a Banach limit if

1. $B \geq 0$, i. e. $Bx \geq 0$ for $x \geq 0$ and $B1 = 1$.
2. $B(Tx) = B(x)$ for all $x \in l_\infty$, where $T$ is a shift operator, i. e.

$$T(x_1, x_2, \ldots) = (x_2, x_3, \ldots).$$
The existence of Banach limits was proven by S. Banach in his book. It follows from the definition, that \( Bx = \lim_{n \to \infty} x_n \) for every convergent sequence \( x \in l_\infty \) and \( \|B\|_{l_*^\infty} = 1 \). Denote the set of all Banach limits by \( \mathcal{B} \). It is clear that \( \mathcal{B} \) is a closed convex subset of the unit sphere of the space \( l_*^\infty \). Hence, \( \|B_1 - B_2\| \leq 2 \) for every \( B_1, B_2 \in \mathcal{B} \).

The set \( A \subset l_\infty \) is called the set of uniqueness if the fact that two Banach limits \( B_1 \) and \( B_2 \) coincide on \( A \) implies that \( B_1 = B_2 \).

It was shown that under some restrictions on the operator \( H \), acting on \( l_\infty \), there exists such \( B \in \mathcal{B} \) that \( Bx = BHx \) for every \( x \in l_\infty \). We denote by \( \mathcal{B}(H) \) the set of all such Banach limits.

The sets of uniqueness, invariant Banach limits and extremal points of \( \mathcal{B} \) will be discussed in the talk.

Joint works with F. A. Sukochev and A. S. Usachev

107. On martingale-ergodic theorems for positively dominated operators on the space of Bochner integrable functions

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Unified ergodic and martingale convergence theorems were provided by A.G.Kachurovskii. In the talk we will give possible extensions of the result for positively dominated operators on the space of vector valued Bochner integrable functions. We prove martingale-ergodic and ergodic-martingale theorems for vector valued Bochner integrable functions under suitable assumptions. We obtain dominant and maximal inequalities. We also provide continuous time analogues of the theorems.

108. Integration in complex Riesz space setting and some application in harmonic analysis

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In [1] Walsh series with coefficients from a Riesz space were considered and the problem of recovering the coefficients of a convergent Walsh series from its sum, by generalized Fourier formulas, was solved by an appropriate Henstock-Kurzweil integral for Riesz-space-valued functions. Here we extend this result to the case of series with respect to characters of any zero-dimensional locally compact abelian group.

As characters are in general complex valued functions we have to consider complex Riesz spaces. To develop the theory of integration of functions with value in such spaces we need a suitable notion of the absolute value of elements of these spaces. This is guaranteed by considering complexification of a Riesz space which is assumed to be Archimedean and uniformly complete (see [2]).

Using the derivation basis on zero-dimensional locally compact abelian group (see [3]) we extend the Henstock-Kurzweil integration theory, with respect to this basis, to the case of functions with values in a complex Riesz space. The problem of recovering a primitive from its generalized derivative with respect to the basis is solved. Finally, we apply this result to the above mentioned problem of recovering coefficients of series with respect to characters, in a compact case, and to the one of obtaining an inversion formula for multiplicative integral transforms, in a locally compact case.

This is joint work with A. Boccuto (Università degli Studi di Perugia) and F. Tulone (Università degli Studi di Palermo)

109. On Banach spaces X whose bidual $X^{**}$ is complemented in a Banach lattice

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We shall consider characterisation of Banach spaces having local unconditional structure. Beginning with presentation of last century knowledge we list some open questions and recent developments.

110. Weaker forms of continuity and vector-valued Riemann integration

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It is well known that a continuous function $f$ on $[0, 1]$ and taking values in a Banach space is always Riemann integrable. However, the assertion is no longer true if the function $f$ is merely assumed to be weakly continuous. On the other hand, for functions taking values in a dual Banach space, it was shown by V. M. Kadets that for each infinite-dimensional Banach space $X$, there always exists an $X^*$-valued function on $[0, 1]$ which is weak*-continuous but not Riemann-integrable. We produce an alternative proof of this statement which follows as a special case of our main result which is following:

**Theorem:** For each weak*-continuous function from $[0, 1]$ into $X^*$- the (strong) dual of the Frechet space $X$-to be Riemann-integrable, it is both necessary and sufficient that $X$ be a Montel space.

111. An associated linear operator for a given nonlinear operator

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A Dedekind complete Banach lattice $E$ with a quasi-interior point $e$ is lattice isomorphic to a space of continuous, extended real-valued functions defined on a compact Hausdorff space $X$. Orthogonally additive, continuous, monotonic, and subhomogeneous nonlinear functionals on $E$ are analyzed in this talk. Though these maps are not linear, a complete measure on $X$ related to a nonlinear operator $T$ is constructed and thus an associated linear map $L$ is found.

112. Advances in modern noncommutative analysis

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Recent progress in noncommutative analysis has led to a resolution of three problems from the theory of spectral shift function (originated in 1940’s in the works related to solid state theory). We discuss the resolution of a M.G. Krein’s conjecture (1964), of a L.S. Koplienko’s conjecture (1984) and of a conjecture due to F. Gesztesy, A. Pushnitski and B. Simon (2008).

113. Asymptotic stability for the system of neutral delay differential equations

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This topic deals with the asymptotic stability of the system of neutral delay differential equations in an angle which has fewer reports. Stability regions are presented geometrically as well as two criteria which are obtained through the evaluation of a harmonic function on the boundary of a certain region. Numerical experiments on various circumstances are shown to locate the specific region which can make the system unstable so as to exclude it from the whole complex-plane.
114. Existence of positive solutions for a nonlinear singular coupled elastic beam system

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In this paper, the existence of positive solutions for a nonlinear singular coupled elastic beam system is investigated by constructing a special cone and applying fixed point theory. Finally, some discussions and examples are given to demonstrate the validity of the main results.

115. Entropy numbers and eigenvalues of operators acting on interpolation spaces

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In this talk, we will discuss some recent results concerning modern topics in the theory of operators on Banach spaces. We introduce and study entropy and spectral moduli of operators and show relationships between these moduli and eigenvalues of operators. In particular, some of the obtained formulas may be regarded as a generalization of the classical spectral radius formula. Combining our results with interpolation techniques yields an interpolation variant of the Carl-Triebel inequality. The talk is based on a joint work with M. Mastyło.

116. Riesz space valued integral

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In this study, an outer measure is generated from given a Riesz space valued measure with a fixed strictly positive functional taken from order continuous dual of same Riesz space. We obtained a type of convergence with this outer measure. We observed some elementary properties of this type convergence and outer measure. Also an integral definition with respect to mentioned strictly positive functional is given.

117. Eigenvectors of homogeneous order-preserving maps

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We consider homogeneous order-preserving continuous maps on the cone of an ordered normed vector space. It is shown that certain maps of that kind which are not necessarily compact themselves but have a compact power have a positive eigenvector that is associated with the cone spectral radius. Our results are illustrated in a mathematical model for spatially distributed two-sex populations.

118. Piling structure of families of matrix monotone functions and of matrix convex functions

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Let I be an interval on the real line and let f be a real continuous function on I. Write $M_n$ for the $n \times n$ matrix algebra. The function $f$ is then said to be $n$-monotone if $f(a) \leq f(b)$, for all selfadjoint $a \leq b \in M_n$ with both spectra contained in I. It is $n$-convex if $f(\lambda a + (1-\lambda) b) \leq \lambda f(a) + (1-\lambda) f(b)$, for all selfadjoint $a, b \in M_n$ with both spectra contained in I, and all $0 \leq \lambda \leq 1$.

The sequence $\{P_n(I)\}_{n=1}^{\infty}$ of sets of all $n$-monotone functions, and likewise the sequence $\{K_n(I)\}_{n=1}^{\infty}$ of sets of all $n$-convex functions, is decreasing with intersection $P_\infty(I)$, resp. $K_\infty(I)$. The functions belonging to these intersections are called operator monotone functions, resp. operator convex functions. One can think of all $P_n(I)$ as being “piled” on $P_\infty(I)$, and likewise for the convex case.

These notions were introduced and developed by K. Loewner and his two students O. Dobsch and
F. Kraus in 1934-1936. Since then the theory has developed, with a great variety of applications
to many fields of both pure and applied mathematics, and quite recently to quantum information
theory.

As to the structure of the piles, it has been suggested in the literature that the inclusion \( P_{n+1}(I) \subset P_n(I) \) must be proper, for all \( n \), and likewise for the convex case. Yet concrete examples of functions
in \( P_n \), but not in \( P_{n+1} \), are surprisingly lacking: even for \( n = 2 \) only one example was known (G. Sparr, 1980). In this lecture, based on joint work with F. Hansen and G. Ji, we will provide an
abundance of examples establishing the properness of all inclusions in the piling of the \( P_n(I) \) and the \( K_n(I) \).

119. A fixed point theorem for closed-graphed decomposable-valued correspondences
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We prove a fixed point theorem for closed-graphed, decomposable-valued correspondences whose
domain and range is a decomposable set of functions from an atomless measure space to a topo-
logical space. One consequence is an improvement of the fixed point theorem in Cellina, Colombo,
and Fonda (1986)

120. Random unconditionally convergent bases in Banach spaces
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A basis \((e_n)\) of a Banach space is called random unconditionally convergent (RUC) if there is a
constant \( K \geq 1 \) such that for any scalars \((a_n)\)

\[
\mathbb{E}\left( \left\| \sum_{n=1}^{m} \epsilon_n a_n e_n \right\| \right) \leq K \sum_{n=1}^{m} |a_n| e_n
\]

We will study the behavior of this kind of bases and the relation with unconditionality in Banach
spaces. Among other things, examples of RUC bases without unconditional subsequences will be
given.

121. Representing multinormed spaces as subspaces or quotients of Banach lattices
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Abstract: for \( 1 \leq p \leq \infty \), a \( p \)-multinormed space is a vector space \( E \) and a sequence of complete
norms \( \|\cdot\|_n \) on \( E^n \) such that \( \|A x\|_m \leq \|A\| \|x\|_n \) for every \( x \in E^n \) and \( A: \ell^m_p \to \ell^m_p \). Multinormed
spaces were introduced and studied by G.Dales and M.Polyakov. Multinormed spaces are related
to tensor norms on \( \ell^p \otimes E \), \( p \)-summing operators on \( E \), etc. We discuss a representation theorem
(essentially due to Pisier) that every \( \infty \)-multinormed space \( E \) can be represented as a subspace
of some Banach lattice \( X \) with \( \|x\|_n = \| \bigvee_{i=1}^{m} |x_i| \|_X \) for every \( x \in E^n \). We will also discuss a
dual version of this theorem that \( 1 \)-multinormed spaces can be represented as quotients of Banach
lattices. This is a joint work with G.Dales and N.J.Laustsen.

122. The principal inverse of the gamma function
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Let \( \Gamma(x) \) be the gamma function in the real axis and \( \alpha \) the maximal zero of \( \Gamma'(x) \). We call the
inverse function of \( \Gamma(x)|_{(0,\infty)} \) the principal inverse and denote it by \( \Gamma^{-1}(x) \). We show that \( \Gamma^{-1}(x) \)
has the holomorphic extension \( \Gamma^{-1}(z) \) to \( \mathbb{C} \setminus (-\infty, \Gamma(\alpha)] \), which maps the upper half plane into
itself, namely a Pick function or a Nevanlinna function, and that \( \Gamma(\Gamma^{-1}(z)) = z \) on \( \mathbb{C} \setminus (-\infty, \Gamma(\alpha)] \).
123. Riesz spaces of minimal upper semi-continuous compact valued maps

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University of Pretoria, Pretoria, South Africa

There is a natural and important connection between set valued analysis and Riesz spaces: For a completely regular topological space \( X \), the Dedekind completion of the Riesz space \( C(X) \) of continuous, real valued functions on \( X \) may be constructed as a subset of the set \( \mathcal{M}(X, \mathbb{R}) \) of minimal upper semi-continuous compact valued (MUSCO) maps. In particular, if \( X \) is a weak cb-space, then \( \mathcal{M}(X, \mathbb{R}) \) is the Dedekind completion of \( C(X) \), see [1,2,3]. The aim of this talk is to generalize these results in the following way. We consider the set \( \mathcal{M}(X, E) \), where \( E \) is a Banach lattice. We show that \( \mathcal{M}(X, E) \) is an Archimedean Riesz space containing \( C(X, E) \) as a Riesz subspace. Certain ideals of \( \mathcal{M}(X, E) \), defined through (order) boundedness conditions, are introduced and studied. An application to the construction of the Dedekind order completion of \( C(X, E) \) is made.


124. On the number of bands in finite dimensional partially ordered vector spaces

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By means of the notion of disjointness in partially ordered vector spaces, a band in a partially ordered vector space is defined to be a subspace that equals its double disjoint complement. We show that the number of bands in an \( n \)-dimensional partially ordered vector space with a closed generating cone is bounded by \( \frac{1}{2}2^n \) for \( n \geq 2 \). The bound is first shown for polyhedral cones with the aid of an order dense embedding into a higher dimensional vector lattice and by bounding the number of so-called bisaturated subsets. The general case then follows by an approximation argument.

This is joint work with Anke Kalauch (TU Dresden) and Bas Lemmens (University of Kent).

125. \( \gamma \)-Radonifying operators

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In recent years, \( \gamma \)-radonifying operators have become a mainstream tool in various branches of vector-valued Analysis. Roughly speaking, they give the correct generalisation to the Banach space valued context of the notion of a square integrable function and thus permit the extension to Banach spaces of various \( L^2 \)-isometries, such as the Fourier-Plancherel isometry and the Itô isometry. In this talk we aim to present a birds eye view of the theory of \( \gamma \)-radonifying operators and to point out some of its most salient applications.

126. The Riesz completion of tensor product of integrally closed directed partially ordered vector spaces is the Archimedean Riesz tensor product of its Riesz completions.

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Van Gaans and Kalauch (2010) give a construction for the tensor product of integrally closed directed partially ordered vector spaces \( E \) and \( F \); it is relatively uniformly closure \( K_I \) of the cone
$K_T$ in $E \otimes F$ generated by elements $x \otimes y, x \in E^+, y \in F^+$. To prove that $K_I$ is actually a cone, they embed $E \otimes F$ in the Archimedean Riesz tensor product $E^* \otimes F^*$, where $E^*$ and $F^*$ are the Riesz completions of $E$ and $F$ respectively. I will prove that the ordering on $(E \otimes F, K_I)$ coincide with the ordering induced by $E^* \otimes F^*$ and that $E^* \otimes F^*$ is the Riesz completion of $(E \otimes F, K_I)$.

127. Integration for functions with values in a partially ordered vector space
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A definition will be given of an integral for functions on a measure space that take values in a partially ordered vector space. For $\mathbb{R}$-valued functions, this integral is the same as the Lebesgue integral. An illustration will be given of an integrable function $\mathbb{R} \to \mathbb{C}$. This is joint work with Prof. Dr. A.C.M. van Rooij (Radboud University Nijmegen).

128. Quasi-martingales in Riesz spaces
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Quasi-martingales are a martingale generalisation and were first introduced by H. Rubin at an invited lecture in 1956. In this talk, we generalise quasi-martingales to the Riesz space setting. We show that quasi-martingales in a Riesz space can be decomposed into the sum of a martingale and a quasi-potential (a Riesz decomposition) and that a quasi-potential can be further decomposed as the difference of two supermartingales. We give an example of our results in the classical setting. Our proofs make heavy use of the ideas of Rao.

129. Turing instability for a reaction-diffusion system with unilateral obstacles
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Turing’s famous idea of morphogenesis by diffusion in connection with a stable equilibrium is sketched. Unfortunately, this idea requires an extreme asymmetry of diffusion speeds. It is discussed, why this idea works also without this requirement in the presence of a unilateral obstacle (e.g. a certain type of source for the inhibitor) which corresponds mathematically to a variational inequality: This can be explained in terms of bifurcation of stationary patterns or in the lack of stability of the equilibrium with diffusion. All related mathematical proofs are based on degree theory.

130. Mixingales on Riesz spaces
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Mixingales are stochastic processes which combine the concepts of martingales and mixing sequences. McLeish introduced the term mixingale at the 4th Conference of Stochastic Processes and Applications, at York University, Toronto in 1974. We generalize the concept of a mixingale to the measure-free Riesz space setting. This generalizes all of the $L^p, 1 \leq p \leq \infty$ variants. We also generalize the concept of uniform integrability to the Riesz space setting and prove that a weak law of large numbers holds for Riesz space mixingales.

131. Lattice valuations a generalisation of measure and integral
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The (Lebesgue) measure and integral are two closely related, but distinct objects of study. Nonethe-
less, they are both real-valued lattice valuations: order preserving real-valued functions $\varphi$ on a lattice $L$ which are modular, i.e.,

$$\varphi(x) + \varphi(y) = \varphi(x \land y) + \varphi(x \lor y) \quad (x, y \in L).$$

We unify measure and integral by developing a theory for lattice valuations. We allow these lattice valuations to take their values from the reals, or any suitable ordered Abelian group.

This is the subject of my Master’s thesis, see http://bram.westerbaan.name/master.pdf.

132. Closednes of the set of extreme points of the unit ball in Orlicz and Calderon-Lozanovskii spaces

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It is known (see [1]) that a compact linear operator from a Banach space $X$ into the space of continuous functions $C(Z, \mathbb{R})$ is extreme provided it is nice, i.e. $T^*(Z) \subset \text{Ext}B(X^*)$, where $Z$ is a compact Hausdorff space and $T^*: Z \to X^*$ is a continuous function defined by $T^*(z)(x) = T(x)(z)$. The nice operator condition can be weakened as long as the set of extreme points $\text{Ext}B(X^*)$ is closed, namely it suffices to assume that $T^*(Z_0) \subset \text{Ext}B(X^*)$ for some dense subset $Z_0 \subset Z$ in that case. The aim of the talk is to present some results on closedness of the set of extreme points of the unit ball in Orlicz and Calderon-Lozanovskii spaces.


133. On order properties of Riesz subspaces which are not preserved by closedness

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There are three types of Riesz spaces: discrete (represented by sequence spaces), continuous (containing spaces of measurable functions associated with atomless measures and continuous functions on compacts without isolated points) and heterogeneous (= neither discrete nor continuous). We will present old and new results related to the following question: when is the closure of a discrete (continuous) Riesz subspace discrete (continuous)? We will also discuss the problem concerning closedness of the algebraic sum of a closed ideal and a closed Riesz subspace. It is known that for every closed infinite dimensional and infinite codimensional ideal $I$ in a Banach lattice $E$ there exists a closed discrete separable $\sigma$-Dedekind complete Riesz subspace $F \subset E$ such that $I + F$ is not closed. We show several (not restrictive) conditions implying that for an ideal $I$ as above we can find a closed continuous (and also a closed heterogeneous) Riesz subspace $F$ with $I + F \neq I + F$.

134. Testing systems and orthomorphisms

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Let $E$ be a sublattice of an $f$-algebra $X$. A nonempty subset $T$ of $E$ is said to be testing w.r.t. $X$ if, for every $x \in X$, the inclusion $x \cdot T \subset E$ implies that $x \cdot E \subset E$.

I will show that such a system in $E$ allows us to describe easily the set $\text{Orth}(E)$. A few examples will be given.

135. Dynamics of self-maps on cones

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We consider dynamics of order-preserving and homogeneous maps $f: C^0 \to C^0$ defined on closed normal (not necessarily lattice) cones $C$ with non-empty interior in Banach spaces. We will show that under certain conditions the orbits of $f$ accumulate in a convex subset of $\partial C$. Moreover, given a strictly positive functional $q \in C^*$, we consider the rescaling of $f$ on the slice $\Sigma_q :=$
\{x \in C^\circ : q(x) = 1\}$, and under certain conditions the orbits of this rescaling will be shown to accumulate in a convex subset of $\delta \Sigma_q$, which is related to a recent conjecture of Karlsson and Nussbaum concerning dynamics of maps defined on convex subsets of $\mathbb{R}^n$.

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**136. Unbounded order convergence in Banach lattices**  
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University of Alberta, Edmonton, Canada

A sequence $(x_n)$ in a vector lattice $X$ is unbounded order convergent to $x$ if $|x_n - x| \wedge y \overset{w}{\to} 0$ for each $y \in X_+$. This type of convergence generalizes the almost everywhere convergence in $L_1(\mu)$-spaces. In this talk we will explore its main features and present characterizations of Banach lattices with the positive Schur property and KB-spaces in terms of unbounded order convergence.

This is joint work with Niushan Gao (University of Alberta)

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**137. On the correlation matrix of patterns and some questions deal with their occurrence in a random text**  
Zajkowski, Krzysztof (kryza@math.uwb.edu.pl)  
University of Bialystok, Bialystok, Poland

In my talk I show how probabilities for given patterns (words) to be first to appear in a sequence of i.i.d. random letters and the expected waiting time till one of them is observed can be expressed in terms of the correlation matrix of these patterns.


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**138. Hybrid viscosity methods for finding common solutions of general systems of variational inequalities and fixed point problems**  
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In this paper, let be a uniformly convex Banach space which either is uniformly smooth or has a weakly continuous duality map. Let be a nonempty closed convex subset of, be a sunny nonexpansive retraction from onto and be a contraction with contractive coefficient. Motivated and inspired by the research going on this area, we introduce hybrid viscosity methods for finding a common solution of a general system of variational inequalities (GSVI) and a fixed point problem (FPP) of an infinite family of nonexpansive self-mappings on. Here the hybrid viscosity methods are based on Korpelevich’s extragradient method, viscosity approximation method and Mann iteration method. We purpose and consider three-step iterative schemes by hybrid viscosity methods for solving the GSVI and the FPP. Under appropriate conditions we derive strong convergence theorems for three-step iterative schemes. In addition, we also give weak convergence theorems for three-step iterative schemes to solve the GSVI and the FPP in the case of a Hilbert space. The results presented in this paper improve, extend, supplement and develop the corresponding results announced in the earlier and very recent literature; see e.g., [1-5].
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Positivity VII is made possible by the generous support of:

- The Royal Netherlands Academy of Arts and Sciences (KNAW)
- The Netherlands Organisation for Scientific Research (NWO)
- Foundation Compositio
- Leiden University Fund (LUF)
- National Research Cluster for Nonlinear Dynamics in Natural Systems (NDNS+)
- National Research Cluster for Geometry and Quantum Theory (GQT)
- Royal Mathematical Society (KWG)
- Universiteit Leiden
- Mathematical Institute of Leiden University
- Delft Institute of Applied Mathematics