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# Operator Algebras, Operator Theory and Applications

Maria Amélia Bastos  
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# Contents

Editorial Introduction .....	vii
Program .....	ix
List of Participants of WOAT 2006 .....	xi

## Summer School: Lecture Notes

<i>S.C. Power</i> Subalgebras of Graph $C^*$ -algebras .....	3
<i>B. Silbermann</i> $C^*$ -algebras and Asymptotic Spectral Theory .....	33
<i>H. Upmeyer</i> Toeplitz Operator Algebras and Complex Analysis .....	67

## Workshop: Contributed Articles

<i>F.P. Boca</i> Rotation Algebras and Continued Fractions .....	121
<i>G. Bogveradze and L.P. Castro</i> On the Fredholm Index of Matrix Wiener-Hopf plus/minus Hankel Operators with Semi-almost Periodic Symbols .....	143
<i>L.P. Castro and D. Kapanadze</i> Diffraction by a Strip and by a Half-plane with Variable Face Impedances .....	159
<i>A.C. Conceição and V.G. Kravchenko</i> Factorization Algorithm for Some Special Matrix Functions .....	173
<i>E. Gots and L. Lyakhov</i> On a Radon Transform .....	187
<i>R. El Harti</i> Extensions of $\sigma$ - $C^*$ -algebras .....	201
<i>A.Y. Karlovich</i> Higher-order Asymptotic Formulas for Toeplitz Matrices with Symbols in Generalized Hölder Spaces .....	207

<i>Yu.I. Karlovich</i>	
Nonlocal Singular Integral Operators with Slowly Oscillating Data .....	229
<i>Y.I. Karlovich and L.V. Pessoa</i>	
Poly-Bergman Projections and Orthogonal Decompositions of $L^2$ -spaces Over Bounded Domains .....	263
<i>V. Kokilashvili and S. Samko</i>	
Vekua's Generalized Singular Integral on Carleson Curves in Weighted Variable Lebesgue Spaces .....	283
<i>V. Manuilov</i>	
On Homotopical Non-invertibility of $C^*$ -extensions .....	295
<i>S. Mendes</i>	
Galois-fixed Points and $K$ -theory for $GL(n)$ .....	309
<i>K.M. Mikkola and I.M. Spitkovsky</i>	
Spectral Factorization, Unstable Canonical Factorization, and Open Factorization Problems in Control Theory .....	321
<i>K. Nourouzi</i>	
Compact Linear Operators Between Probabilistic Normed Spaces ....	347
<i>V.S. Rabinovich and S. Roch</i>	
Essential Spectra of Pseudodifferential Operators and Exponential Decay of Their Solutions. Applications to Schrödinger Operators .....	355
<i>V.S. Rabinovich, S. Roch and B. Silbermann</i>	
On Finite Sections of Band-dominated Operators .....	385
<i>H. Rafeiro and S. Samko</i>	
Characterization of the Range of One-dimensional Fractional Integration in the Space with Variable Exponent .....	393
<i>C.C. Ramos, N. Martins and P.R. Pinto</i>	
Orbit Representations and Circle Maps .....	417
<i>N. Samko and B. Vakulov</i>	
On Generalized Spherical Fractional Integration Operators in Weighted Generalized Hölder Spaces on the Unit Sphere .....	429

# Editorial Introduction

This volume is devoted to the International Summer School and Workshop on Operator Algebras, Operator Theory and Applications, WOAT 2006, held at Instituto Superior Técnico in Lisbon, Portugal on 1–5 September 2006. WOAT 2006 was a satellite conference of the International Congress of Mathematicians 2006 that was held in Madrid, Spain.

Operator Algebras and Operator Theory are important areas of Mathematics that play an important role in different mathematics areas and its applications, particularly in Mathematical Physics and Numerical Analysis. The main aim of WOAT 2006 was to bring together researchers in the Operator Algebras and Operator Theory areas.

This volume contains three lecture notes of the Summer School courses and nineteen articles, contributions to the workshop of the WOAT 2006. The lecture notes, written by leading experts in the fields, are focused on:

- *Subalgebras of Graph  $C^*$ -Algebras (S. Power)*

A self contained introduction to two novel classes of non self-adjoint operator algebras, namely the generalized analytic Toeplitz algebras associated with the Fock spaces of a directed graph and subalgebras of graph  $C^*$  algebras, are given. The topics are independent but in both cases the focus is on techniques and problems related to classifying isomorphism types and to the recovery of underlying foundational structures, be they graphs or groupoids.

- *$C^*$ -Algebras and Asymptotic Spectral Theory (B. Silbermann)*

An introduction to asymptotic spectral theory is presented using the elementary theory of  $C^*$  algebras. Given a bounded sequence of matrices with increasing size the spectra,  $\varepsilon$ -pseudospectra and the singular values of these matrices are characterized. Three fundamental notions are discussed: stability, fractality and Fredholm sequences. The theory is applied to finite sections of quasideagonal operators, Toeplitz operators, and operators with almost periodic diagonals.

- *Toeplitz Operator Algebras and Complex Analysis (H. Upmeyer)*

Recent investigations are presented concerning Hilbert spaces of holomorphic functions on hermitian symmetric domains of arbitrary rank and dimension, in relation to operator theory (Toeplitz  $C^*$ -algebras and their representations), harmonic analysis (discrete series of semi-simple Lie groups) and quantization (covariant functional calculi and Berezin transformation).

The articles were based contributions to the workshop, the majority of them being centered on the main topics of the workshop:

- Crossed product  $C^*$ -algebras.  $C^*$ -algebras of operators on Hardy and Bergman spaces. Invertibility theory for non-local  $C^*$ -algebras. Von Neumann algebras.
- Approximate methods in operator algebras. Asymptotic properties of approximation operators.
- Toeplitz, Hankel, and convolution type operators and algebras. Symbol calculi. Invertibility and index theory.
- Operator theoretical methods in diffraction theory. Factorization theory and integrable systems. Applications to Mathematical Physics.

The organizers gratefully acknowledge the support of the WOAT 2006 sponsors: the Portuguese Foundation for Science and Technology, Center for Mathematics and its Applications, Center for Mathematical Analysis, Geometry and Dynamical Systems, Research Project FCT/FEDER/POCTI/MAT/59972/2004, as well as Caixa Geral de Depósitos, Câmara Municipal de Lisboa, Fundação Calouste Gulbenkian, Embassy of Germany in Portugal, Fundação Luso-Americana, and Reitoria da Universidade Técnica de Lisboa.

Lisbon, September 2007

The Editorial Board



**WOAT 2006 – Program**  
**Friday, 1 September 2006**

<b>Workshop – Room ACI</b>	
09:00–09:30	<i>Registration</i>
09:30–09:50	<i>Opening Session</i>
	Session W1
09:55–10:45	Nikolai Nikolski
10:50–11:10	<i>Coffee break</i>
11:10–12:00	David Evans
12:05–12:55	Lewis Coburn
13:00–14:00	<i>Lunch</i>
<b>Summer School – Room ACI</b>	
14:00–15:30	<i>Course A/Lecture 1</i> Stephen Power
15:30–15:45	<i>Break</i>
15:45–17:15	<i>Course B/Lecture 1</i> Konrad Schmüdgen
17:15–17:30	<i>Coffee break</i>
17:30–19:00	<i>Course C/Lecture 1</i> Bernd Silbermann

**Saturday, 2 September 2006**

<b>Workshop</b>			
Session W2 – Room QA02.3			
09:00–09:50	Ilya Spitkovsky		
09:55–10:45	Vladimir Manuilov		
10:50–11:05	<i>Coffee break</i>		
	Session W3 Room QA1.1	Session W4 Room QA1.2	Session W5 Room QA1.3
11:05–11:30	D. Mushtari	M. Ptak	E. Gots
11:35–12:00	I. Todorov	H. Kaptanoglu	P. Lopes
12:05–12:30	R. Popescu	M.C. Câmara	A. Montes-Rodríguez
12:35–13:00	V. Strauss	A. Karlovich	H. Rafeiro
13:00–14:00	<i>Lunch</i>		
<b>Summer School – Room ACI</b>			
14:00–15:30	<i>Course D/Lecture 1</i> Harald Upmeyer		
15:30–15:45	<i>Break</i>		
15:45–17:15	<i>Course A/Lecture 2</i> Stephen Power		
17:15–17:30	<i>Coffee break</i>		
17:30–19:00	<i>Course B/Lecture 2</i> Konrad Schmüdgen		

Course A: Subalgebras of Graph  $C^*$ -algebras

Course B:  $C^*$ -algebras – Selected topics

Course C:  $C^*$ -algebras and Asymptotic Spectral Theory

Course D: Toeplitz Operator Algebras and Multivariable Complex Analysis

**WOAT 2006 – Program**  
**Monday, 4 September 2006**

<b>Workshop</b>			
	Session W6 – Room QA1.1		Session W7 – Room QA1.2
09:00–09:50	Florin Boca		Yuri Karlovich
	Session W8 – Room QA1.1		Session W9 – Room QA1.2
09:55–10:20	A. Katavolos		R. Duduchava
10:25–10:50	L. Marcoux		L. Castro
10:50–11:05	<i>Coffee break</i>		
	Session W10 Room QA1.1	Session W11 Room QA1.2	Session W12 Room QA1.3
11:05–11:30	M. Dritschel	J. Rodriguez	A. Conceição
11:35–12:00	H. Tandra	R. Marreiros	C. Diogo
12:05–12:30	E. Lopushanskaya	K. Nourouzi	T. Malheiro
12:35–13:00	H. Mascarenhas		M.C. Martins
13:00–14:00	<i>Lunch</i>		
<b>Summer School – Room ACI</b>			
14:00–15:30	<i>Course C/Lecture 2</i>	Bernd Silbermann	
15:30–15:45	<i>Break</i>		
15:45–17:15	<i>Course D/Lecture 2</i>	Harald Upmeyer	
17:15–17:30	<i>Coffee break</i>		
17:30–19:00	<i>Course A/Lecture 3</i>	Stephen Power	

**Tuesday, 5 September 2006**

<b>Workshop</b>			
	Session W13 – Room QA1.1		Session W14 – Room QA1.2
09:00–09:50	Mikhail Agranovich		Steffen Roch
09:55–10:45	Nikolai Rabinovich		Stefan Samko
10:50–11:05	<i>Coffee break</i>		
	Session W15 – Room QA1.1		Session W16 – Room QA1.2
11:05–11:30	C. Fernandes		N. Samko
11:35–12:00	R. El Harti		L. Pessoa
12:05–12:30	C. Ramos		G. Bogveradze
12:35–13:00	S. Mendes		A. Nolasco
13:00–14:00	<i>Lunch</i>		
<b>Summer School – Room ACI</b>			
14:00–15:30	<i>Course B/Lecture 3</i>	Konrad Schmüdgen	
15:30–15:45	<i>Break</i>		
15:45–17:15	<i>Course C/Lecture 3</i>	Bernd Silbermann	
17:15–17:30	<i>Coffee break</i>		
17:30–19:00	<i>Course D/Lecture 3</i>	Harald Upmeyer	

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