WOPA-Porto-2018
Workshop on Orthogonal Polynomials and Applications
dedicated to Pascal Maroni

Analysis Areas

Center of Mathematics of University of Porto (CMUP)

Center of Mathematics of University of Coimbra (CMUC)

Mathematics Department of Faculty of Sciences of University of Porto

Porto, July 23rd, 2018

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The *WOPA-Porto-2018, Workshop on Orthogonal Polynomials and Applications* is a one day meeting organized, this year, by both Analysis Areas of Center of Mathematics of University of Porto (CMUP) and Center of Mathematics of University of Coimbra (CMUC) and is dedicated to Pascal Maroni due to his important contributions to this field of research. This event will be held at Mathematics Department of Faculty of Sciences of University of Porto.

This workshop takes place following the past five similar meetings held in Porto in 2003, 2006, 2007, 2016 and 2017 that gathered PhD and Post-Doc students and their supervisors, members of CMUP and some researchers from other universities of Portugal and from other countries, working in this field of research.

We would like to thank Pascal Maroni for accepting our invitation and all the speakers who make this event possible.

This workshop will be divided into two parts. In the morning, we have the tribute session to Pascal Maroni and in the afternoon take place six talks.

We hope this workshop will be a celebration for all and the participants.

The organizers, **Kenier Castillo and Zélia da Rocha**

Venue: FC1 Maths Building
Place: Room FC1.031
Shedule: Monday, July 23rd

10h	Registration	
10h 30m	**Tribute Session to Pascal Maroni**	
	Director of FCUP Professor António Fernando Silva	
	Director of DM-FCUP Professor João Nuno Tavares	
	Analysis area of CMUP	
	Professors Semyon Yakubovich and Sílvio Gama	
10h 45m	Zélia *da Rocha*	DM-FCUP, CMUP, Porto
11h	José Luís *Cardoso*	UTAD, Vila Real
11h 10m	Kenier *Castillo*	CMUC, Coimbra
11h 15m	**Coffee break**	
11h 30m	**Interview to Pascal *M*aroni** **by Kenier *C*astillo and Zélia *d*a Rocha**	
12h 30m	**Lunch**	
14h 30m	Francisco *J. García-Pacheco*	UCA, Spain
15h	Miguel *Tierz*	GFM, ULisboa
15h 30m	Manuel *Guerra*	ISEG, CEMAPRE, ULisboa
16h	Ruben *Sousa*	CMUP, Porto
16h 30m	**Coffee break**	
17h	Kenier *Castillo*	CMUC, Coimbra
17h 30m	Zélia *da Rocha*	DM-FCUP, CMUP, Porto
18h	**Closing**	

Programme

- **10h Registration**

- **10h 30m Tribute Ceremony to Pascal Maroni**

- **10h30m - 10h45m**

  Director of Faculty of Sciences of University of Porto
  Professor António Fernando Silva

  Director of Department of Mathematics of Faculty of Sciences of University of Porto Professor João Nuno Tavares

  Analysis Area of Center of Mathematics of University of Porto Professors Semyon Yakubovich and Sílvio Gama

- **10h45m - 11h**

  Scientific Activities of Pascal Maroni by Zélia da Rocha - Department of Mathematics of Faculty of Sciences of University of Porto

- **11h - 11h 10m**

  José Luís Cardoso - Department of Mathematics of University of Trás-os-Montes e Alto Douro

- **11h - 11h 10m**

  Kenier Castillo - Center of Mathematics of University of Coimbra

- **11h 15m - 11h 30 Coffee Break**

- **11h 30m - 12h 30m**

  Interview to Pascal Maroni by Kenier Castillo and Zélia da Rocha

- **12h 30m - 14h 30m Lunch at Circulo Universitário**

Conferences

- **14h 30m - 15h**

  Francisco J. García-Pacheco, Full Professor, UCA, Cadiz, Spain

  Recent advances on Ricceri's Conjecture

- **15h - 15h 30m**

  Miguel Tierz, Researcher FCT, GFM, ULisboa

  Minors of Toeplitz matrices, symmetric functions and random matrix ensembles

- **15h 30m - 16h**

  Manuel Guerra, Assistant Professor, ISEG, CEMAPRE, ULisboa

  On controlled Kolmogorov equations

- **16h - 16h 30m**

  Ruben Sousa , PhD Student, DM-FCUP, CMUP, UPorto

  Product formulas, generalized convolutions and integral transforms

- **16h 30m - 17h Coffee Break**

- **17h - 17h 30m**

  Kenier Castillo, FCT Postdoctoral Fellow, DM, CMUC, UCoimbra

  A paper of A. Markov revisited

- **17h 30m - 18h**

  Zélia da Rocha, Assistant Professor, DM-FCUP, CMUP, UPorto

  Automatic symbolic construction of some transformations of orthogonal polynomials

- **18h Closing**

Abstracts

- *Recent advances on Ricceri's Conjecture*

Francisco Javier Garca Pacheco

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Full Professor, University of Cadiz, Spain

Abstract:

A subset of a metric space is called anti-proximinal provided that the distance from any point in the complementary to the subset is never attained. A subset of a real vector space is called totally anti-proximinal provided that it is anti-proximinal for every norm on the vector space. A Hausdorff locally convex topological vector space is said to verify the anti-proximinal property if every totally anti-proximinal convex subset is not rare. Ricceri's Conjecture establishes the existence of a non-complete normed space satisfying the anti-proximinal property. We will present the most recent advances on this conjecture.

- *Minors of Toeplitz matrices, symmetric functions and random matrix ensembles*

Miguel Tierz

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Researcher FCT - Lisboa

Abstract:

We study minors of Toeplitz matrices, using the theory of symmetric functions. The symbols of the Toeplitz matrices can either be in the Szegö class or have Fisher-Hartwig singularities and the results apply both to minors of finite and of large dimension. As an application, also using results on inverses of Toeplitz matrices, we obtain explicit formulas for a Selberg-Morris integral and for specializations of certain skew Schur polynomials. We also discuss the intimate relationship with random matrix theory and the ensuing applications.

- *On controlled Kolmogorov equations*

Manuel Guerra

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Assistant Professor, ISEG and CEMAPRE, University of Lisboa

Abstract:

Kolmogorov equations are evolution equations describing the transition probabilities of stochastically continuous Markov processes.

Controlled versions of such equations are interesting objects both from a theoretical and applied point of views.

We discuss some relations between controlled Kolmogorov equations and classical problems of deterministic and stochastic control, and between the structure of the operators occurring in the equation and the properties of the resulting control system.

- *Product formulas, generalized convolutions and integral transforms*

Ruben Sousa

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PhD Student, DM, CMUP, Faculty of Sciences of University of Porto

Abstract:

It is well-known that the ordinary convolution is closely related with the Fourier transform. It is therefore natural to ask: for other important integral transforms, can we define generalized convolution operators having analogous properties? Actually, the answer depends on the existence of a product formula for the kernel of the integral transform. In this talk, I will explain the general connection between product formulas, generalized convolutions and integral transforms. Emphasis will be given to convolution structures related with families of orthogonal polynomials (such as the Jacobi and the Bessel polynomials). I will report on recent progress in constructing the product formula and convolution associated with the index Whittaker transform. The probabilistic motivation behind this work will also be discussed.

- *A paper of A. Markov revisited*

Kenier Castillo

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FCT Postdoctoral Fellow, University of Coimbra

Abstract:

In his monograph [Classical and quantum orthogonal polynomials in one variable, Cambridge University Press, 2005], Ismail collected several open problems which are amongst the most challenging involving polynomials. One of them is related with the extension of A. Markov's theorem on monotonicity of zeros of orthogonal polynomials. In this talk, we will use the original A. Markov's ideas to solve this problem.

- *Automatic symbolic construction of some transformations of orthogonal polynomials*

Zélia da Rocha

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Assistant Professor, DM, Faculty of Science of University of Porto

Abstract:

Our main goal is to explore the capabilities of a symbolic language like *Mathematica*® to overcome the large amount of recursive algebraic computations involved in some transformations of orthogonal polynomials, when the order or the number of parameters is substantial and to achieve explicit results. Among those transformations we consider the shifting, the association, the perturbation, the inversion, the multiplication by a polynomial (direct and inverse problems), the division by a factorized polynomial, as well as the quadratic and cubic polynomial decompositions of classical, semi-classical, second degree and Laguerre-Hahn forms. In some of these cases, by means of symbolic algorithms, we derived and demonstrated new closed formulas for some characteristic elements of transformed forms such as moments, recurrence coefficients, connection coefficients, generating function, Stieltjes function, functional equation, Stieltjes equation, structure or differential equations. In other cases, the symbolic computations of the first characteristic elements up to a fixed order allow to infer the closed formulas, that we should prove by different means, or to obtain negative results and consequently to direct or redirect the theoretical study.

I present examples concerning Shohat-Favard and Chebyshev algorithms, connection coefficients, perturbed second degree forms, in particular perturbed Chebyshev polynomials and general quadratic and cubic polynomial decompositions.