PROGRAM

SPECIAL FUNCTIONS' DAY AT UBI

08 April 2026, UBI/Covilhã

09:00 - 09:40 Edmundo J. Huertas (University of Alcalá, Spain)

Mixed-Type Multiple Orthogonal Laurent Polynomials on the Unit Circle

Abstract: In this work we construct mixed-type multiple orthogonal Laurent polynomials on the unit circle. The construction employs a CMV-type ordering for the moment matrix together with its Gauss–Borel factorization, and uses a multiple extension of the CMV ordering. We present a systematic analysis of the associated orthogonality and biorthogonality relations, and examine the degrees of the resulting Laurent polynomials. Recurrence relations expressed in terms of banded matrices are obtained, which in turn provide the foundation for Christoffel–Darboux kernels and formulas, as well as for an ABC-type theorem. Additionally, we develop the theory of diagonal Christoffel and Geronimus perturbations for the matrix of measures, deriving explicit Christoffel formulas in both cases. This is a joint work with Manuel Mañas (UCM).

09:40 - 10:20 Carlos Hermoso (University of Alcalá, Spain)

Connecting Higher-Order Recurrences and Jacobi Matrices for Sobolev-Type Orthogonal Polynomials

Abstract: It is known that Sobolev-type orthogonal polynomials with respect to measures on the real line satisfy higher-order recurrence relations, which can be encoded in a $(2N+1)$-banded symmetric semi-infinite matrix. In this talk we explore the connection between these banded matrices and the classical Jacobi matrices that arise from the three-term recurrence relation satisfied by the orthonormal polynomials associated with a 2-iterated Christoffel transformation of the original measure. We will present the explicit link between both matrix structures and discuss the underlying factorization techniques.

10:20 - 11:00 Juan J. Moreno-Balcázar (University of Almería, Spain)

Nevai-Sobolev orthogonal polynomials

Abstract: In this talk, we tackle the Nevai–Sobolev orthogonal polynomials, which are defined with respect to a Sobolev inner product involving the Nevai–Freud weight $\exp(-x^4)$. We derive their local asymptotic behavior, commonly referred to as Mehler–Heine asymptotics. By applying the classical Hurwitz theorem, we obtain the asymptotic distribution of the corresponding scaled zeros and critical points. Finally, we address the problem of computing the zeros of this family of polynomials.

11:00 - 11:20 COFFEE BREAK

11:20 - 12:00 Cristina Rodríguez Perales (University of Almería, Spain)

Difference equations for orthogonal and quasi-orthogonal polynomials

Abstract: Abstract: In this talk, we tackle the study of the quasi-orthogonal polynomials of order one $\{s_n\}_{n\geq 0}$ given by $s_n(x) = p_n(x) + c_n p_{n-1}(x)$, where $p_n(x)$ are the orthonormal polynomials related to the Hahn difference operator and c_n is a sequence of real numbers. In particular, we obtain the second-order difference equation satisfied by these polynomials. For this purpose, we begin by deriving the ladder operators and the second-order difference equation for the polynomials $p_n(x)$. These results allow us to unify and generalize some known results in the literature, as well as some recent results concerning semiclassical families of orthogonal polynomials.

12:00 - 12:40 Juan F. Manãs-Mañas (University of Almería, Spain)

Second-order difference equation for quasi-orthogonal polynomials: Algorithm and symbolic program

Abstract: In this talk, we will focus on providing an algorithm to construct the second-order difference equation for quasi-orthogonal polynomials. We will show that it is sufficient to know the coefficients of the three-term recurrence relation, as well as the coefficients of the structure relation of the associated orthogonal polynomials, in order to obtain this difference equation. Finally, we will present a symbolic computation program based on Mathematica that generates the coefficients of this equation.

12:40 - 13:20 Víctor Soto-Larrosa (Universidad Europea Madrid, Spain)

Polynomial Solutions of Generalized Classical Equations via Moment Differentiation

Abstract: We introduce a second-order moment differential operator ∂_m, defined via a sequence of positive real numbers $(m(p))_{p\geq 0}$, which simultaneously generalizes the classical derivative, the Caputo fractional derivative, and the Jackson q-difference operator. For each classical family — Laguerre, Hermite, Jacobi, and Bessel — we construct, for every non-negative integer n, a second-order equation of the form $\sigma(x)\partial_m^2 y+\tau(x)\partial_m y+\lambda_{n,m}\, y = 0$ admitting an explicit polynomial solution of degree n. We show that as the moment sequence converges to the factorial or $q-factorial$ sequences both the equations and their polynomial solutions converge pointwise to the corresponding classical families.