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Curriculum Vitae

EDUCATION

- B.S. in Mathematics, Universidad de Sevilla, Spain. 1998
- Ph.D. in Mathematics. Universidad Carlos III de Madrid, Spain. 2007

EMPLOYMENT

- Predoctoral Fellow, Universidad Carlos III de Madrid. 2002–2007
- Visiting Professor, College of William and Mary, USA. 2007–2008
- Interim Associate Professor. Universidad of Alcalá, Spain. Since 2010

RESEARCH INTERESTS

Algebraic and Spectral Theory of Second Order Differential and/or Difference Linear Operators, Special Functions, Number Theory, Orthogonal and Multi-Orthogonal Polynomials and Linear Algebra

TEACHING EXPERIENCE AND MENTORING

- Subjects taught in Spanish, Universidad de Alcalá, Spain. 2010–2021
Didactics in Mathematics, The logic-mathematical area, Mathematics I (Teaching in Primary education), Calculus I in Engineering, Calculus II in Engineering, Linear Algebra in Engineering and Numerical calculus in Chemistry
- Subjects taught in English, Universidad de Alcalá
Calculus II in Engineering (2012–2013), Linear Algebra in Engineering (2018–2021) and Calculus I in Engineering (2019–2021)
- All the teaching during the COVID-19 period was Online
- Tutor of external practices in primary education centers (Primary schools). 2012–2020
- Subjects taught in English, College of William and Mary. 2007–2008
Calculus I – Single variable, Calculus II – Theory of integration (single variable) and Seminar on Mathematics
- Subjects taught in English, College of William and Mary. Summer 2007
Instructor of REU program in Linear Algebra
- Subjects taught in English, College of William and Mary, USA. Summer 2004
Instructor of REU program in Linear Algebra.

- Subjects taught in Spanish, Universidad Carlos III de Madrid. 2002–2007
Calculus I, Laboratory of Calculus II, Linear Algebra in Engineering, Introduction to MATLAB in Linear Algebra and Calculus, Complementary Mathematics and Laboratory of Computational Mathematics

PROFESSIONAL EXPERIENCE

- Reviewer for Mathematical Reviews (AMS). Since 2004
- Referee for publications of Elsevier, SIAM, etc. Since 2006
- Postdoctoral Fellow at University of California, Santa Barbara, USA. 2008–2010
- Editor Board of Journal of Mathematics Research. 2012–2015
- Guest Editor for the Journal Symmetry-Basel ISSN 2227-7390 (JCR Impact Factor: 2.143 (2018)). Special Volume entitled “Symmetry in Special Functions and Orthogonal Polynomials”. 2019

SERVICE

- Member of the Board of Teaching and Research Staff at Universidad de Alcalá, Spain. December 2014–2021
- Member of the Courts for the Defense of the End-of-Degree Work for Grades in Primary and Early Childhood education. 2013–2020
- Editor of Book of Abstracts of the International Meeting: RCTM’08. Santa Barbara, USA. Summer 2008
- Webmaster of the Mathematics Department, Universidad Carlos III de Madrid. 2007
- Webmaster of the *Orthogonality, Approximation Theory and Applications* group. URL: <http://gamma.uc3m.es>. August 2006
- Editor of Book of abstracts of the International meeting: Recent Trends in Constructive Approximation Theory. Leganés, Spain. Summer 2006
- Representative of Postgraduate Students in the Mathematics Department of the Universidad Carlos III de Madrid. 2005

APPOINTMENTS AND MEMBERSHIP

- Member of the Real Sociedad Matemática Española. Since 2007
- Member of the American Mathematical Society. Since June 2008
- Member of the Society for Industrial and Applied Mathematics. 2008–2012

FELLOWSHIPS

- Fullbright postdoc grant to stay at University of California (USA), Ministry of Education and Science of Spain, 2008–2010
- Carlos III Foundation Fellowship, Universidad Carlos III de Madrid, 2006–2007

RESEARCH AFFILIATIONS

- Visiting Associated Professor, College of William and Mary, VA, USA. 2007–2008
- Postdoctoral Fellow, University of California, Santa Barbara, CA, USA. 2008–2010
- Foreign Visiting Researcher, National Institute of Standard and Technology, Gaithersburg, MD, USA. 2014, 2016, 2018

OTHER RELEVANT MERITS

- ANECA positively accredited me in the figures of “Ayudante Doctor” and “Profesor de Universidad Privada”. September 2007
- I have recently applied for accreditation in ANECA for positions “Contratado Doctor” as well as for Associate professor “Profesor Titular de Universidad”. 2021
- I was member of an innovation group at Universidad de Alcalá from 2012 to 2019 in which we carry out the following innovation projects:
 - Implementation of the “Inverted class” in Telecommunication Engineering Degrees
 - Analysis of the opinion and the qualifications of the students in the degrees of Telecommunications Engineering.
 - Analysis of the opinion and qualifications of the students in the Telecommunications Engineering Degrees (Universidad de Alcalá)
 - Proposals for the improvement of the Plans of Studies of the Degrees of Engineering of Telecommunications (Universidad de Alcalá)
 - Analysis of results and comparison of study plans in the first cycle of the Degree in Telecommunications Engineering
 - Interdisciplinarity and integration of basic skills in Telecommunications Engineering degrees.
 - Interdisciplinarity and integration of knowledge in the first year of the Telecommunications Engineering degrees.

PUBLICATIONS

1. H. Cohl, R. S. Costas-Santos. *On the relation between Gegenbauer polynomials and the Ferrers function of the first kind*. Accepted in *Analysis Mathematica* (2021)
2. H. Cohl, R. S. Costas-Santos. *Utility of integral representations for basic hypergeometric functions and orthogonal polynomials*. Accepted in the *Ramanujan Journal* (2021)
3. Correction: H. Cohl, R. S. Costas-Santos and L. Ge. *Terminating basic hypergeometric representations and transformations for the Askey-Wilson polynomials*. *Symmetry* **12**(12) (2020), 2120, 2 pages.
4. H. Cohl and R. S. Costas-Santos. *Multi-integral representations for associated Legendre and Ferrers functions*. *Symmetry* **12**(10) (2020), 1598
5. H. Cohl, R. S. Costas-Santos and L. Ge. *Terminating basic hypergeometric representations and transformations for the Askey-Wilson polynomials*. *Symmetry* **12**(8) (2020), 1290
6. H. Cohl, R. S. Costas-Santos and T. V. Wakhare. *On a generalization of the Rogers generating function*. *J. Math. Anal. Appl.* **475**, no. 2 (2019), pp. 1019–1043

7. R. S. Costas Santos and A. Soria-Lorente. *Analytic properties of some basic hypergeometric-Sobolev-type orthogonal polynomials*. J. Difference Equ. Appl. **24**, no. 11 (2018), pp. 1715–1733
8. H. Cohl, R. S. Costas-Santos and T. V. Wakhare. *Some generating functions for q -polynomials*. Symmetry **10**(12), 758 (2018), 12 pages
9. M. A. Baeder, H. S. Cohl, R. S. Costas-Santos and W. Xu, *The power collection method for connection relations: Meixner polynomials*. Journal of Classical Analysis. Volume **11**, Number 2 (2017), pp. 107–128.
10. H. Cohl, R. S. Costas-Santos and W. Xu. *The orthogonality of Al-Salam-Carlitz polynomials for complex parameters*. Frontiers in Orthogonal Polynomials and q -Series, Contemporary Mathematics and its Applications: Monographs, Expositions and Lecture Notes, Eds. Zuhair Nashed and Xin Li, Vol. **1**, Chapter 8, pp. 155–167, World Scientific Publishing Company, Cambridge, MA, 2018
11. R. S. Costas-Santos and C. R. Johnson, *Matrices Totally Positive Relative to a Tree, II*. Linear Algebra Appl. **505** (2016), pp. 1–10
12. R. S. Costas-Santos and J. J. Moreno-Balcázar, *The Semiclassical-Sobolev polynomials. A general approach*. J. Approx. Theory, **163**(1) (2011), pp. 65–83
13. R. S. Costas-Santos and F. Marcellán, *The complementary polynomials and the Rodrigues operator of classical orthogonal polynomials*. Proc. Amer. Math. Soc. **140** (2012), pp. 3485–3493
14. M. J. Atia, M. Benabdallah, and R. S. Costas-Santos, *Zeros of polynomials orthogonal with respect to a signed weight*. Indagationes Mathematicae **23** (2012), pp. 26–31
15. R. S. Costas-Santos and J. F. Sánchez-Lara, *Orthogonality of q -polynomials for nonstandard parameters*. J. Approx. Theory, **163**(9) (2011), pp. 1246–1268
16. R. S. Costas-Santos and J. F. Sánchez-Lara, *Extensions of discrete classical orthogonal polynomials beyond the orthogonality*. J. Comp. Appl. Math. **225** (2009), pp. 440–451
17. R. S. Costas-Santos, *On the elementary symmetric functions of a sum of matrices*. J. Algebra Number Theory, Adv. Appl. volume **1** Number 2 (2009), pp. 99–112
18. R. S. Costas-Santos and F. Marcellán, *q -Classical orthogonal polynomial: A general difference calculus approach*. Acta Applicandae Mathematicae (2009), pp. 1–2
19. C. R. Johnson, R. S. Costas-Santos, and B. Tadmeh, *Matrices Totally Positive Relative to a Tree*. Elec. Linear Algebra **18** (2009), pp. 211–21
20. R. Álvarez-Nodarse, N. M. Atakishiyev and R. S. Costas-Santos, *Factorization of the hypergeometric-type difference equation on the uniform lattice*. Elect. Trans. Numer. Anal. **27** (2007), pp. 34–50
21. R. Álvarez-Nodarse, Y. F. Smirnov and R. S. Costas-Santos, *A q -analog of the Racah polynomials and q -algebra $SU_q(2)$ in quantum optics*. J. of Russian Laser Research **27**, Number 1 (2006), pp. 1–32
22. R. S. Costas-Santos and F. Marcellán, *Second structure relation for q -semiclassical polynomials of the Hahn Tableau*. J. Math. Anal. Appl. **329** (2006), 206–28

23. R. Álvarez-Nodarse, N M Atakishiyev and R S Costas-Santos, *Factorization of the hypergeometric-type difference equation on non-uniform lattices: dynamical algebra*. J. Phys. A: Math. Gen. **38** (2005), pp. 153–174
24. R. Álvarez-Nodarse and R. S. Costas-Santos, *Limit relations between q -Krall type orthogonal polynomials*. J. Math. Anal. Appl. **322** (2005), pp. 158–176
25. C. R. Johnson, S. Leichenauer, P. McNamara and R. Costas-Santos, *Principal minor sums of $(A + tB)^m$* . Linear Algebra and its Applications **411** (2005), pp. 386–389
26. R. Álvarez-Nodarse and R. S. Costas-Santos, *Factorization method for difference equations of hypergeometric type on nonuniform lattices*. J. Phys. A: Math. Gen. **34** (2001), pp. 5551–5569
27. R. S. Costas-Santos and F. Marcellán, *Semiclassical quasi-orthogonal polynomials. A general difference calculus approach*, 2020. Preprint
28. R. S. Costas-Santos and C. R. Johnson. *Spectra of Tridiagonal Matrices over a Field*. Submitted, 2021
29. H. S. Cohl, R. S. Costas-Santos, P. R. Hwang and T. V. Wakhare. *Generalizations of generating functions for basic hypergeometric orthogonal polynomials*. Submitted, 2021
30. R. S. Costas-Santos, A Soria and J.-M. Vilairé. *On polynomials orthogonal with respect to an inner product involving higher order differences. The Meixner case*. Submitted, 2020
31. R. S. Costas-Santos and J.S. Kelly. *Classical exceptional orthogonal polynomials: a global overview*. Submitted, 2021
32. R. S. Costas-Santos and C. R. Johnson. *The subpermanent of a sum of matrices*. Preprint, 2021
33. R. S. Costas-Santos, M. T. Perez and M Piñar. *Algebraic and orthogonality properties of some q -analogs of the Laguerre polynomials for non classical parameters*. Preprint, 2021

PLENARY TALKS

- International Conference on Mathematical Sciences. “The Connection Between the Riemann Zeta function and the Legendre Polynomials”. Nagpur, India. December 2012

TALKS AND SEMINARS

- Seminar IEMath-GR, Mathematics Department, “Basic hypergeometric transformations from symmetric and q -inverse sub-families of the Askey-Wilson polynomials in the q -Askey scheme”. Granada. January 2020
- 2nd International Conference on Symmetry, “Classical Orthogonal Polynomials: Orthogonality and duality”. Benasque, Spain. September 2019
- 15th OPSFA, “Exceptional Orthogonal Polynomials from the Semi-classical point of view”. Hagenberg, Linz, Austria. July 2019
- Pint of Science, “Curiosidades matemáticas para contar con una pinta ...o no!”. Alcalá de Henares, Spain. May 2019
- 14th OPSFA, “ q -Polynomials for non-standard parameters. Orthogonality and new identities”. Kent, UK. July 2017
- Seminar, Mathematics Department, “ q -Polynomials. Orthogonality in the complex plane”. Universidad de Granada. February 2017

- Seminar, Mathematics Department, “The orthogonality relations of the Al-Salam-Carlitz polynomials for general parameters”. Universidad de Almeria, Spain. February 9, 2017
- Gama Seminar, Mathematics Department, “Matrices totally positive relative to a tree”. Universidad Carlos III de Madrid. Leganés. December 2016
- Gama Seminar, Mathematics Department, “The orthogonality relations of the Al-Salam-Carlitz polynomials for general parameters”. Universidad Carlos III de Madrid. Leganés. October 2016
- The Real World is Complex - Congress in honor of Christian Berg, “ q -polynomials. Orthogonality in the complex plane and more”. Copenhagen, Denmark. August 2015
- V encuentro iberoamericano de polinomios ortogonales y sus aplicaciones, “Conociendo mejor a los q -polinomios”(in Spanish). Mexico, June 2015
- 13th OPSFA, “Generalizations of Generating Functions for Meixner and Krawtchouk Polynomials”. National Institute of Standard and Technology (NIST), Gaithersburg, USA. June 2015
- Seminar, Applied and Computational Mathematics Division, “Discovering Discrete Classical Polynomials: First Steps”. NIST, USA. May 2015
- International Conference on Orthogonal Polynomials and q -Series, “Extensions of discrete orthogonal polynomials beyond the orthogonality”. University of Central Florida. May 2015
- Gama Seminar, Mathematics Department, “Classical orthogonal polynomials beyond the classical parameters”. Universidad Carlos III de Madrid. March 2015
- Seminar, Applied and Computational Mathematics Division, “An overview of Classical Orthogonal Polynomials”. NIST. USA. March 2014
- RSME-Congreso de Jovenes Investigadores, “A connection between the Legendre polynomials and the Riemann Zeta function. II”. Seville. September 2013
- Workshop on Special Functions and their Application, “A connection between the legendre polynomials and the Riemann Zeta function. I”. Copenhagen, Denmark. August 2013
- 12th OPSFA, “Multiple Meixner polynomials of second type with non-classical parameters. A first study”. Sousse, Tunisia. March 2013
- Seminar, Mathematics Department, “Los polinomios ortogonales clasicos y de Sobolev: viejos y nuevos resultados”(In Spanish). Universidad de Alcalá. February 2012
- 11th OPSFA, “Old and new results on Sobolev and semi-classical orthogonal polynomials”. Leganés. August 2011
- Gama Seminar, Mathematics Department, “Orthogonality of q -polynomials for nonstandard parameters”. Universidad Carlos III de Madrid. March 2011
- International conference on CMMSE 2010, “On a degenerate version of the Favard’s theorem”. Almeria, Spain. June 2010
- Gama Seminar, Mathematics Department, “Recent results on classical orthogonal polynomials”. Universidad Carlos III de Madrid. Leganés. June 2010
- Seminar, Mathematics Department, “Extensions of discrete classical orthogonal polynomials beyond the orthogonality”. Caltech. Pasadena, USA. November 2008
- RCTM’08 Conference in honor of Robert C. Thompson. “On the determinant of a sum of matrices”. UC, Santa Barbara, USA. October 2008
- IWOPA’08 Conference in honor of Guillermo Lopez, “The semiclassical-Sobolev polynomials. A general approach”. Universidad Carlos III de Madrid. September 2008
- Seminar, Mathematics Department, “A new natural extension on classical polynomials”. College of William and Mary. October 2007
- Seminar, Mathematics Department, “Classical orthogonal polynomials. A general difference calculus approach”. College of William and Mary. September 2007
- Seminar, Mathematics Department, “Algunas propiedades algebraicas de la función Zeta

- de Riemann”. Universidad de la Rioja, Spain. May 2007
- Seminar, Mathematics Department, “Characterization theorems and Rodrigues operator. A general approach”. Universidad de Almeria, Spain. November 2006
 - Gama Seminar, Mathematics Department, “Segunda relación de estructura para q -polinomios clásicos y semiclásicos” (in Spanish). Universidad Carlos III de Madrid. October 2006
 - Recent Trends in Constructive Approximation Theory, “Classical orthogonal polynomials. A general difference calculus approach”. Leganés, Spain. August 2006
 - 9th European Workshop on Applications and Generalizations of Complex Analysis. “Limit relations between q -Krall type orthogonal polynomials”. Coimbra, Portugal. July 2006
 - Progress on Difference Equations 2006, “Limit relations between q -Krall type orthogonal polynomials”, Homburg, Germany. March 2006
 - Gama Seminar, Mathematics Department, “Sobre algunas propiedades de la función Zeta de Riemann” (in Spanish). Universidad Carlos III de Madrid. March 2006
 - International Conference on Difference equations, Special Functions and Applications, “Factorization of the hypergeometric-type difference equation on the uniform lattice”, Munich. July 2005
 - Mathematical Gama Seminar, Mathematics Department, “La función Zeta de Riemann y sus q -extensiones. Aplicaciones” (in Spanish). Universidad Carlos III de Madrid. November 2005
 - Gama Seminar, Mathematics Department, “El operador de Rodrigues y los polinomios multi-ortogonales de tipo II”. Universidad Carlos III de Madrid. March 2005
 - Gama Seminar, Mathematics Department, “El método de factorización para ecuaciones en diferencias de tipo hipergeométrico”. Universidad Carlos III de Madrid. April 2004
 - Gama Seminar, Mathematics Department, “El método de factorización de ecuaciones en diferencias de tipo hipergeométrico sobre redes no lineales”. Universidad Carlos III de Madrid. March 2004
 - Gama Seminar, Mathematics Department, “Método de Factorización de ecuaciones en diferencias de tipo hipergeométrico en redes no uniformes”. Universidad Carlos III de Madrid. May 2003
 - Workshop on Complex Analysis, “Number Theory, q -calculus. The Zeta and q -Zeta functions”. University of Coimbra, Portugal. March 2003

LANGUAGES

Spanish: Native. English (Proficient)