Manuel Domínguez de la Iglesia **15/02/2024**

CONTACT INFORMATION

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RESEARCH INTERESTS

Approximation Theory, Bispectral Problems, Fourier and Harmonic Analysis, Markov and Stochastic Processes, Orthogonal Polynomials, Quantum Walks and Quantum Markov Chains, Riemann-Hilbert Problems, Special Functions.

EDUCATION

- Ph.D. Mathematics, Universidad de Sevilla, Sevilla, Spain — February 2008
  Thesis Advisor: Antonio J. Durán
- M.S. Mathematics, Universidad de Sevilla, Sevilla, Spain — September 2005
- B.A. Mathematics, Universidad de Sevilla, Sevilla, Spain — June 2003

HONORS AND AWARDS

Premio Extraordinario de Doctorado. Universidad de Sevilla (2008).

POSITIONS

- Coordinador del Programa de Maestría y Doctorado en Ciencias Matemáticas y de la Especialización en Estadística Aplicada, Universidad Nacional Autónoma de México (March 2022 - present).
- Investigador Titular B. Instituto de Matemáticas, Universidad Nacional Autónoma de México (September 2020 - present).
- Investigador Titular A (tenured) Instituto de Matemáticas, Universidad Nacional Autónoma de México (April 2017 - September 2020).
- Investigador Asociado C. Instituto de Matemáticas, Universidad Nacional Autónoma de México (March 2014 - April 2017).
- Postdoctoral fellowship in Mathematics. Departamento de Análisis Matemático, Universidad de Sevilla (January 2011 - February 2014).
- Postdoctoral fellowship in Mathematics. Courant Institute of Mathematical Sciences, University of New York (January 2009 - December 2010).
- Postdoctoral fellowship in Mathematics. Katholieke Universiteit Leuven (May 2008 - December 2009).
- Ph.D. graduate fellowship in Mathematics. Universidad de Sevilla (May 2004 - May 2008).

BOOKS

1. *Orthogonal polynomials in the spectral analysis of Markov processes. Birth-death models and diffusion*, Encyclopedia of Mathematics and its Applications **181**, Cambridge University Press, 2022.

RESEARCH ARTICLES

1. *QBD processes associated with Jacobi-Koornwinder bivariate polynomials and urn models* (with L. Fernández), Mediterr. J. Math. **20** (2023), no.6, Paper No. 290, 23 pp.
2. *The bilateral birth-death chain generated by the associated Jacobi polynomials* (with C. Juarez), Stud. Appl. Math. **151** (2023) 616–642.

3. *Quantum Markov chains on the line: matrix orthogonal polynomials, spectral measures and their statistics* (with C. Lardizabal and N. Loebens), Quantum Inf. Process. **22** (2023), no. 1, Paper No. 60, 57 pp.

4. *Birth-death chains on a spider: spectral analysis and reflecting-absorbing factorization* (with C. Juarez), J. Math. Anal. Appl. **517** (2023), Paper No. 126624, 20 pp.

5. *Spectral analysis of bilateral birth-death processes: some new explicit examples*, Adv. Appl. Prob. **54** (2022), 1193–1221.

6. *An urn model for the Jacobi-Piñeiro polynomials*, (with F.A. Grünbaum), Proc. Amer. Math. Soc. **150** (2022), 3613–3625.

7. *Bispectral Jacobi type polynomials* (with A.J. Durán), Adv. Appl. Math. **136** (2022), Paper No. 102322, 35 pp.

8. *Absorbing-reflecting factorizations for birth-death chains on the integers and their Darboux transformations*, (with C. Juarez), J. Approx. Theory **266** (2021), Paper No. 105583, 27 pp.

9. *Quasi-birth-and-death processes and multivariate orthogonal polynomials*, (with L. Fernández), J. Math. Anal. Appl. **499** (2021), Paper No. 125029, 33 pp.

10. *The spectral matrices associated with the stochastic Darboux transformations of random walks on the integers*, (with C. Juarez), J. Approx. Theory **258** (2020), Paper No. 105458, 32 pp.

11. *Bispectral Laguerre type polynomials*, (with A.J. Durán), Integral Transforms and Special Functions **31** (2020), 133–151.

12. *Stochastic Darboux transformations for quasi-birth-and-death processes and urn models*, (with F.A. Grünbaum), J. Math. Anal. Appl. **478** (2019), 634–654.

13. *Stochastic LU factorizations, Darboux transformations and urn models*, (with F.A. Grünbaum), J. Appl. Prob. **55** (2018), 862-886.

14. *On difference operators for symmetric Krall-Hahn polynomials*, (with A.J. Durán), Integral Transforms and Special Functions **29** (2018), 699-718.

15. *The Toda and Painlevé systems associated with semiclassical matrix-valued orthogonal polynomials of Laguerre type*, (with M. Cafasso), SIGMA Symmetry Integrability Geom. Methods Appl. **14** (2018), Paper No. 076, 17 pages.

16. *Some bivariate stochastic models arising from group representation theory*, (with P. Román), Stoch. Proc. Appl. **128** (2018), 3300–3326.

17. *Differential equations for discrete Jacobi-Sobolev orthogonal polynomials*, (with A.J. Durán), J. Spectral Theory **8** (2018), 191–234.

18. *Constructing Krall-Hahn orthogonal polynomials* (with A.J. Durán), J. Math. Anal. Appl. **424** (2015), 361–384.

19. *Constructing bispectral orthogonal polynomials from the classical discrete families of Charlier, Meixner and Krawtchouk* (with A.J. Durán), Constr. Approx. **41** (2015), 49–91.

20. *Differential equations for discrete Laguerre-Sobolev orthogonal polynomials* (with A.J. Durán), J. Approx. Theory **195** (2015), 70–88.

21. *Non-commutative Painlevé equations and Hermite-type matrix orthogonal polynomials* (with M. Cafasso), Commun. Math. Phys. **326** (2014), 559–583.

22. *Principal dynamical components* (with E.G. Tabak), Comm. Pure Appl. Math. **66** (2013), no. 1, 48–82.

23. *Spectral methods for bivariate Markov processes with diffusion and discrete components and a variant of the Wright-Fisher model*, J. Math. Anal. Appl. **393** (2012), 239–255.

24. *Properties of matrix orthogonal polynomials via their Riemann-Hilbert characterization* (with F.A. Grünbaum and A. Martínez-Finkelshtein), SIGMA Symmetry Integrability Geom. Methods Appl. **7** (2011), Paper No. 098, 31 pages.

25. *Some examples of matrix-valued orthogonal functions having a differential and an integral operator as eigenfunctions*, J. Approx. Theory **163** (2011), No. 5, 663–687.

26. *A note on the invariant distribution of a quasi-birth-and-death process*, J. Phys. A: Math. Theor. **44** (2011) Paper No. 135201, 9pp.

27. *Second order differential operators having several families of orthogonal matrix polynomials as eigenfunctions* (with A.J. Durán), Internat. Math. Research Notices, Vol. 2008, Article ID rnn084, 24 pages.

28. *Matrix valued orthogonal polynomials arising from group representation theory and a family of quasi-birth-and-death processes* (with F.A. Grünbaum), SIAM J. Matrix Anal. Applic. **30** (2008), No. 2, 741–761.

29. *Some examples of orthogonal matrix polynomials satisfying odd order differential equations* (with A.J. Durán), J. Approx. Theory **150** (2008), No. 2, 153–174.

30. *Matrix valued orthogonal polynomials related to $SU(N+1)$, their algebras of differential operators and the corresponding curves* (with F.A. Grünbaum), Exp. Math. **16** (2007), No. 2, 189–207.

Grants

As principal investigator

- Research grant IN106822 from the PAPIIT program of the DGAPA, UNAM (2022-2024). Total budget: $\sim$ \$32, 200 USD.
- Research grant A1-S-16202 from Consejo Nacional de Ciencia y Tecnología (CONACYT), México (2019-2021). Total budget: $\sim$ \$28, 500 USD.
- Research grant IN104219 from the PAPIIT program of the DGAPA, UNAM (2019-2021). Total budget: $\sim$ \$26, 500 USD.
- Research grant IA102617 from the PAPIIT program of the DGAPA, UNAM (2017-2018). Total budget: $\sim$ \$16, 000 USD.
- Research Grant CN-16-84 (with F. Alberto Grünbaum) from UC-MEXUS CONACYT (07/2016-12/2017). Total budget: $\sim$ \$16, 700 USD.
- Research grant IA100515 from the PAPIIT program of the DGAPA, UNAM (2015-2016). $\sim$ \$18, 200 USD.

As participant

- Research grant A-FQM-246-UGR20 from the University of Granada (2021-2023).
- Research grant MTM2015-65888-C4-1-P from the Government of Spain (2016-2019).
- Research grant MTM2012-36732-C03-03 from the Government of Spain (2013-2016).
- Research grant P11-FQM-7276 from the Junta de Andalucía (2013-2017).
- Research grant P09-FQM-4643 (as a postdoc) from the Junta de Andalucía (2010-2014).
- Research grant MTM2009-12740-C03-02 from the Government of Spain (2010-2012).
- Research grant P06-FQM-01735 from the Junta de Andalucía (2007-2010).
- Research grant MTM2006-13000-C03-01 (as a PhD student) from the Government of Spain (2006-2009).

- Research grant 2008/FQM-262 from the Junta de Andalucía (2009-2011).
- Research grant 2007/FQM-262 from the Junta de Andalucía (2007-2010).

Editorial Experience

- Associate Editor for the *Boletín de la Sociedad Matemática Mexicana* (March 2022-present).

Teaching Experience

Universidad de Sevilla, Sevilla, Spain

Graduate Student Instructor September 2006 - February 2008

- Mathematical Analysis at Physics Department, Fall 2006 (30 hours), Fall 2007 (23 hours).
- Mathematical Methods in the Physical Sciences at Physics Department, Fall 2006 (30 hours).

Instructor September 2011 - December 2013

- Mathematical Analysis at Physics Department, Fall 2011 (30 hours), Fall 2012 (50 hours), Fall 2013 (50 hours).
- Calculus at Mathematics Department, Fall 2011 (38 hours).
- Mathematics at Chemistry Department, Fall 2012 (28 hours), Fall 2013 (40 hours).

Instituto de Matemáticas, Universidad Nacional Autónoma de México (UNAM), México

Instructor March 2014 - present

- Complex Variables, Master's Course, Spring 2014.
- Fourier Analysis, Undergraduate Course, Fall 2014.
- Stochastic Processes, Undergraduate Course, Spring 2015, Fall 2015.
- Spectral Analysis of Stochastic Processes, Master's Course, Spring 2016.
- Probability, Master's Course, Fall 2016.
- Stochastic Processes II, Undergraduate Course, Fall 2016.
- Probability I, Undergraduate Course, Fall 2017.
- Probability II, Undergraduate Course, Spring 2018.
- Stochastic Processes and Orthogonal Polynomials, Master's Course, Fall 2018, Spring 2023, Spring 2024.
- Applied Mathematical Analysis, Undergraduate Course, Spring 2019, Spring 2022.
- Mathematical Methods in the Physical Sciences, Undergraduate Course, Spring 2020, Fall 2020, Spring 2021, Spring 2023.
- Special Functions and Orthogonal Polynomials, Master's Seminar, Fall 2022.
- Random Matrices and Riemann-Hilbert Problems, Master's Seminar, Fall 2023.

Graduated Students

Undergraduate students

- Alfredo Valverde de Loyola. B. A. Mathematics, UNAM, September 2016.
- Claudia Ivonne Juárez Gallegos. B. A. Actuarial Sciences, UNAM, April 2017.
- José Luis Armenta Trejo. B. A. Mathematics, UNAM, January 2018.

- Luis Javier Velázquez Cerda. B. A. Mathematics, UNAM, May 2018.
- Andrea Monserrat Ruiz Gómez. B. A. Mathematics, UNAM, April 2019.
- José Francisco Fernández Arcos. B. A. Mathematics, UNAM, August 2019.
- Ayrton Pablo Almada Jiménez. B. A. Applied Mathematics, UNAM, April 2022.
- José Ramón Tuirán Rangel. B. A. Mathematics, UNAM, June 2022.
- Ramón Poo Ramos. B. A. Mathematics, UNAM, June 2022.
- Néstor Alexis Peña Montes. B. A. Mathematics, UNAM, August 2022.
- Emiliano Labastida Oropeza. B. A. Actuarial Sciences, UNAM, November 2023.
- Roxana Canal Valdivieso. B. A. Mathematics, UNAM, June 2024 (expected).

Master's students

- Claudia Ivonne Juárez Gallegos. M. S. Mathematics, UNAM, October 2019.

PhD students

- Claudia Ivonne Juárez Gallegos. Ph. D. in Mathematics, UNAM, December 2023.

Organized Events

Conferences or schools

- *Escuela de Invierno de Análisis.* Instituto de Matemáticas, UNAM (México). December 2022.
- *Quantum Walks and Information Tasks.* Workshop at Banff International Research Station (Canada). April 2019.
- *75 years of Mathematics in Mexico.* Instituto de Matemáticas, Ciudad Universitaria, UNAM (México). December 2017.
- *Selected Topics in Mathematical Physics (in honor of Prof. Natig Atakishiyev).* Instituto de Matemáticas, Cuernavaca, UNAM (México). November 2016.
- *Encuentro Nacional de Jóvenes Investigadores en Matemáticas (ENJIM).* Instituto de Matemáticas, CU, UNAM (México). December 2015.
- *V Encuentro Iberoamericano de Polinomios Ortogonales y Aplicaciones (EIBPOA 2015).* Instituto de Matemáticas, CU, UNAM (México). June 2015.

Special Sessions

- *Special Functions and Orthogonal Polynomials* at IX European Congress of Mathematics, July 2024.
- *Funciones especiales, polinomios ortogonales y teoría de aproximación* at VI Congreso Latinoamericano de Matemáticas, September 2021 (online).
- *Special Functions, Orthogonal Polynomials and Applications* at III Congress of the Pacific Rim Association. Universidad Tecnológica de Oaxaca (México). August 2017.
- *Funciones especiales, polinomios ortogonales y aplicaciones* at IV Encuentro Conjunto RSME-SMM. Universidad de Valladolid (Spain). June 2017.
- *Funciones especiales, polinomios ortogonales y teoría de aproximación* at V Congreso Latinoamericano de Matemáticos. Universidad del Norte, Barranquilla (Colombia). July 2016.
- *Funciones Especiales/Polinomios Ortogonales* at III Encuentro Conjunto RSME-SMM. Universidad de Zacatecas (México). September 2014.

- *Teoría de aproximación, funciones especiales y polinomios ortogonales* at II Congreso de Jóvenes Investigadores RSME. Universidad de Sevilla (Spain). September 2013.

Conference Presentations

- 16th International Symposium on Orthogonal Polynomials, Special Functions and Applications (OPSFA 16), Montreal, Canada, June 2022 (online).
- Baylor Analysis Fest, Waco, TX, USA, May 2022.
- Mathematical Congress of the Americas, Buenos Aires, Argentina, July 12-23 2021 (online).
- V Encuentro Conjunto de la Real Sociedad Matemática Española (RSME) y la Sociedad Matemática Mexicana (SMM), Guanajuato, Mexico, June 14-18 2021 (online).
- Operator Theory, Analysis and Mathematical Physics (OTAMP 2020), Mexico City, January 2020.
- Bath-UNAM-CIMAT Meeting XVI (BUC XVI), Mexico City, September 2019.
- 15th International Symposium on Orthogonal Polynomials, Special Functions and Applications (OPSFA 15), Hagenberg, Austria, July 2019.
- II Summer School in Mathematical Analysis. Instituto de Matemáticas, UNAM (México), August 2018.
- VII Iberoamerican Workshop on Orthogonal Polynomials and Applications. Universidad Carlos III de Madrid (Spain), July 2018.
- 14th International Symposium on Orthogonal Polynomials, Special Functions and Applications (OPSFA 14). Canterbury (United Kingdom), July 2017.
- VI Iberoamerican Workshop on Orthogonal Polynomials and Applications. Uberaba (Brazil), May 2017.
- XII International Conference in Approximation and Optimization in the Caribbean, Universidad de La Habana (Cuba), June 2016.
- First Joint International Meeting of the Israel Mathematical Union and the Mexican Mathematical Society, Oaxaca (México), September 2015.
- Workshop on Orthogonal and Multiple Orthogonal Polynomials, BIRS-CMO, Oaxaca (México), August 2015.
- 13th International Symposium on Orthogonal Polynomials, Special Functions and Applications (OPSFA 13). NIST, Gaithersburg, MD, USA, June 2015.
- XLVII Congreso Nacional de la Sociedad Matemática Mexicana. Durango, México, October 2014.
- IV Iberoamerican Workshop on Orthogonal Polynomials and Applications. Bogotá, Colombia, June 2014.
- Constructive Functions 2014. Nashville, Tenneessee, USA, May 2014.
- International Conference on Approximation Theory and Applications. Hong Kong, China, May 2013.
- III Iberoamerican Workshop on Orthogonal Polynomials and Applications. São José do Rio Preto, Brazil, May 2013.
- Primer Encuentro de la Red de Polinomios Ortogonales y Teoría de Aproximación ORTHONET 2013. Logroño, Spain, February 2013.
- Congreso de la Real Sociedad Matemática Española 2013. Santiago de Compostela, Spain,

January 2013.

- Orthogonal Polynomials and Special Functions: a Complex Analytic Perspective. Copenhague, Denmark, June 2012.
- 1st Joint Conference of the Belgian, Royal Spanish and Luxembourg Mathematical Societies. Liège, Belgium, June 2012.
- 11th International Symposium on Orthogonal Polynomials, Special Functions and Applications. Universidad Carlos III de Madrid, September 2011.
- Congreso de la Real Sociedad Matemática Española 2011. Ávila, February 2011.
- I Spanish Young Researchers Meeting in Mathematics. I Spanish Young Researchers Meeting in Mathematics. Universidad de Sevilla, Spain. September 2010.
- International Congress of Mathematicians. Hyderabad, India. August 2010.
- 13th International Conference in Approximation Theory. San Antonio, Texas. March, 9 2010.
- XI Encuentros de Análisis Real y Complejo. Chinchón, Madrid. May 2009.
- International workshop on orthogonal polynomials and approximation theory. Universidad Carlos III de Madrid. Leganes, Madrid, September 2008.
- Workshop on orthogonal polynomials and special functions. Katholieke Universiteit Leuven. Leuven, May 2008.
- 3emes Journees Approximation. Universite de Lille 1. Lille, May 2008.
- XX Congreso de Ecuaciones Diferenciales y Aplicaciones. X Congreso de Matemática Aplicada. Sevilla, September 2007.
- Special Functions, Information Theory and Mathematical Physics. Granada, September 2007.
- 2007 AMS Spring Western Section Meeting. Tucson, Arizona (USA), April 2007.
- 12th International Conference in Approximation Theory. San Antonio, Texas (USA). March 2007.
- Recent trends in Constructive Approximation Theory. Universidad Carlos III de Madrid. August, 30-31, September 2006.

Seminars

- Coloquio de Matemáticas Aplicadas del IIMAS, UNAM, February 15th 2024.
- Seminario Iberoamericano de Análisis Matemático y Matemática Aplicada, February 11th 2022 (online).
- Seminario Grupo GOYA, Granada, Spain, May 28th 2021 (online).
- Coloquio del Instituto de Matemáticas, UNAM, Sede CU, México, August 13th 2019.
- CINVESTAV, Mexico City, May 22nd 2019.
- Hablando de Matemáticas, IMATE-UNAM, March 21st 2019.
- Centro de Ciencias Matemáticas, UNAM, Morelia, México, March 2018.
- Universidad de Colima, México, November 2017.
- Universidad Autónoma de Aguascalientes, México, March 2017.
- Instituto Tecnológico Autónomo de México (ITAM), México, October 2016.
- Probability and Stochastic Processes Seminar, IMATE (UNAM), México, September 2016.
- Universidad Autónoma Metropolitana (UAM), Iztapalapa, México, February 2016.

- Centro de Investigación en Matemáticas (CIMAT), Guanajuato, México, April 2015.
- Instituto de Matemáticas, Cuernavaca (UNAM). Cuernavaca, México, January 2015.
- IIMAS (UNAM). México DF, México, January 2015.
- Instituto de Matemáticas, CU (UNAM). México DF, México, May 2014.
- Instituto de Matemáticas, CU and Cuernavaca (UNAM). México, June 2013.
- City University of Hong Kong (twice). Hong Kong, China, May 2013.
- Instituto Nacional de Matemática Pura e Aplicada (IMPA). Rio de Janeiro, Brazil, May 2013.
- Universidad Tecnológica de Panamá. Panamá, September 2012.
- Université d'Angers. Angers, June 2012.
- Katholieke Universiteit Leuven. Leuven, November 2008.
- Katholieke Universiteit Leuven. Leuven, June 2008.
- Courant Institute of Mathematical Sciences. New York, March 2008.

LONG-TERM VISITS

- Courant Institute of Mathematical Sciences, New York University March 2008 - April 2008
- University of California at Berkeley, Berkeley, California USA February 2007 - July 2007
- Universidad Nacional de Córdoba, Córdoba, Argentina March 2006 - June 2006
- University of California at Berkeley, Berkeley, California USA February 2005 - May 2005

LANGUAGES

English, Spanish

LINKS

Home Page:

`https://www.matem.unam.mx/~mdi29/`

MathScinet:

`https://mathscinet.ams.org/mathscinet/MRAuthorID/818520`

Google Scholar:

`https://scholar.google.com.mx/citations?user=BwQsoWcAAAAJ&hl=es`