Mercedes S. Pérez Millán

Contact Information

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Research Interests

Algebraic Methods for studying biochemical reaction networks: computational algebra, algebraic geometry, real algebraic geometry, biochemical reaction systems, mass-action kinetics, identifiability, discrete modeling, finite dynamical systems, combinatorics.

Current Positions

IMAS–CONICET

Assistant Researcher (Investigadora asistente) **Since July 2017**

Dto. de Matemática–FCEyN–UBA

Profesora Adjunta (simple, interino) **August 2021 to July 2022**

Education

Universidad de Buenos Aires, Buenos Aires, Argentina

Ph.D., Mathematical Sciences, March 2012

Thesis Topic: *Algebraic Methods for the study of biochemical networks.* **Advisor:** Alicia Dickenstein. **Area of Study:** Applications of Algebraic Geometry.

Licenciatura, Mathematical Sciences, March 2007

Thesis Topic: *Algebraic Methods in Systems Biology.* **Advisor:** Alicia Dickenstein. **Area of Study:** Applications of Algebraic Geometry.

Academic Grants

- **Postdoctoral Researcher - CONICET** (2012–2014), "Modelado discreto de redes de interacciones proteicas: Aplicación al camino de transducción de señales celulares mediados por MAPKs". Mentors: Adrián Turjanski, Alicia Dickenstein.
- **Doctoral Fellow - UBA** (2007–2012), "Métodos algebraicos en sistemas biológicos". Supervisor: Alicia Dickenstein.

Refereed Journal Publications

[1] *Parameter regions that give rise to* $2\lfloor n/2 \rfloor + 1$ *positive steady states in the n-site phosphorylation system*, with A. Dickenstein, M. Giaroli and R. Rischter, Math. Biosci. Eng., 16:6, pp. 7589–7615 (2019).

[2] *Identifiability from a few species for a class of biochemical reaction networks*, with G. Jeronimo and P. Solernó. B. Math. Biol., 81:7, pp. 2133–2175 (2019).

[3] *Multistationarity in structured reaction networks*, with A. Dickenstein, A. Shiu and X. Tang. B. Math. Biol., 81:5, pp. 1527–1581 (2019).

[4] *The structure of MESSI biological systems*, with A. Dickenstein. SIAM J. Appl. Dyn. Syst., 17:2, pp. 1650–1682 (2018).

[5] *Implicit dose-response curves*, with A. Dickenstein, J. Math. Biol., 70, pp. 1669–1684 (2015).

[6] *Steady States of MESSI biological systems*, with A. Dickenstein. Revista MACI Vol. 5, pp. 21–24 (2015).

[7] *MAPK's networks and their capability for multistationarity due to toric steady states*, with A. Turjanski. Math. Biosciences, 262, pp. 125–137 (2015).

[8] *Cotas no triviales en estados estacionarios* (in Spanish), with A. Dickenstein. Revista MACI Vol. 4, pp. 9–12 (2013).

[9] *Complex-linear invariants of biochemical networks*, with R. Karp, T. Dasgupta, A. Dickenstein and J. Gunawardena. J. Theor. Biol., 311, pp. 130–138 (2012).

[10] *Chemical reaction systems with toric steady states*, with A. Dickenstein, A. Shiu and C. Conradi. B. Math. Biol., 74:5, pp. 1027–1065 (2012).

[11] *How far is complex balancing from detailed balancing?*, with A. Dickenstein. B. Math. Biol., 73:4, pp. 811–828 (2011).

[12] *Una introducción al uso del álgebra computacional para el estudio de redes biológicas* (in Spanish), with A. Dickenstein. Actas de la Academia Nacional de Ciencias de Argentina, tomo XIV, 2008.

Other Publications

[13] *Métodos algebraicos para el estudio de redes bioquímicas.* PhD thesis, Departamento de Matemática, Facultad de Ciencias Exactas y Naturales Universidad de Buenos Aires, 2012.
Available online at
http://digital.bl.fcen.uba.ar/Download/Tesis/Tesis_5103_PerezMillan.pdf

[14] *Métodos algebraicos en sistemas biológicos.* Licenciate thesis, Departamento de Matemática, Facultad de Ciencias Exactas y Naturales Universidad de Buenos Aires, 2007.
Available online at
http://cms.dm.uba.ar/academico/carreras/licenciatura/tesis/pmillan.pdf

Papers in Preparation

[15] *Absolute concentration robustness: algebra and geometry*, with L. Garca Puente, E. Gross, H. Harrington, M. Johnston, N. Meshkat and A. Shiu.

[16] *Detecting the Multistationarity Structure in Enzymatic Networks*, with A. Dickenstein, M. Giaroli and R. Rischter.

[17] *Beyond Boolean networks*, with A. Dickenstein, J. García Galofre and R. Laubenbacher.

[18] *Algebraic study of hydrogen peroxide metabolism in mitochondria*, with L. Boechi, R. Radi and M. Trujillo.

[19] *A MESSI system analyzer (python implementation of the algorithm in The structure of MESSI biological systems, by A. Dickenstein and M. Pérez Millán (2018))*, with A. Dickenstein and G. Mosse.

Some Lectures and Communications

- "Multistationarity and structure in enzymatic networks" (invited talk). In the "Symbolic Computation: Theory, Algorithms and Applications" session of the Mathematical Congress of the Americas 2021, Argentina. (2021)
- "Equilibrios y constantes de reacción: un enfoque algebraico" (invited talk in Spanish). EMALCA 2019, Universidad Nacional de la Patagonia San Juan Bosco, Comodoro Rivadavia, Chubut, Argentina. (2019)

- "Algebraic methods in biochemical reaction networks" (invited talk). Mathematical Methods and Modeling in Engineering and Life Sciences, V International Conference on Applied Mathematics, Design and Control, Universidad Nacional de San Martín, Buenos Aires, Argentina. (2018)
- "Identifiability from a few variables in biochemical reaction networks" (invited talk). SIAM conference on the Life Sciences (LS18), Minneapolis, Minnesota, USA. (2018)
- "Checking multistationarity in MESSI systems" (invited talk). Workshop on Mathematical Analysis of Biological Interaction Networks (17w5099), BIRS, Banff, Alberta, Canada. (2017)
- "The structure of MESSI biological systems" (invited talk). XXI Coloquio Latinoamericano de Álgebra, Universidad de Buenos Aires, CABA, Argentina. (2016)
- "Mixed and basic MESSI biological systems" (invited talk). Central Fall Sectional Meeting of the American Mathematical Society, Loyola University Chicago, Chicago, Illinois, USA. (2015)
- "Steady states of MESSI biological systems" (invited talk). SIAM Conference on Applied Algebraic Geometry (AG15), Daejeon, Korea. (2015)
- "La geometría algebraica en las redes de reacciones bioquímicas" (invited lecture in Spanish). VII National School of Algebra, La Falda, Córdoba, Argentina. (2014)
- "MAPK's y multiestacionariedad vía estados estacionarios tóricos" (poster in Spanish). Sixth Argentinian School on Mathematics and Biology, La Falda, Córdoba, Argentina. (2014)
- "Cotas no triviales en estados estacionarios" (oral communication in Spanish). 4th Conference on Applied, Computational and Industrial Mathematics, Buenos Aires, Argentina. (2013)
- "Sequential and Distributive Multisite Phosphorylations Have Toric Steady States" (invited talk). SIAM Conference on Applied Algebraic Geometry (AG11), North Carolina State University, USA. (2011)

Conferences planning

- Co-coordinator of the session "Aplicaciones de la Matemática y Física Matemática" of the Annual Meeting of the Argentinian Mathematical Union together with the Chilean Mathematical Society (SUMA): Mendoza, Mendoza, Argentina. (September 2019)
- Co-chair of the Biomathematics session of the 6th and 7th *Congreso de Matemática Aplicada, Computacional e Industrial*: Comodoro Rivadavia, Chubut, Argentina (May 2017) and Río Cuarto, Córdoba (May 2019).
- Coorganizer of the Conference Computational Algebra, Algebraic Geometry and Applications (CoAlAGA), in honor of Alicia Dickenstein's academic trajectory. (August 2016)

Coordination of working groups

- Co-coordinator, together with Alicia Dickenstein, of the working group "Multiestacionariedad en redes biológicas" of the workshop *Matemáticas en el Cono Sur*, since November 2017.

Courses at conferences

- *Métodos algebraicos en redes bioquímicas.* EMALCA 2019, Universidad Nacional de la Patagonia San Juan Bosco, Comodoro Rivadavia, Chubut, Argentina. (October 2019)
- *Introducción al modelado de sistemas biológicos con Sistemas de Álgebra Computacional*, together with Magalí Giaroli. A systems approach to biology School, Buenos Aires, Argentina. (June 2018)
- *Herramientas Computacionales para Álgebra Conmutativa*, together with Santiago Laplagne. First joint meeting of the Royal Spanish Mathematical Society (RSME) and the Argentinian Mathematical Union (UMA), Buenos Aires, Argentina. (December 2017)

Teaching Experience

Dto. de Matemática–FCEyN–UBA

Profesora Adjunta (simple, interino) **August 2021 to July 2022**

- Courses: Matemática II *(Numerical Calculus and Data Analysis for Biology students).*

Previous positions: Jefe de Trabajos Prácticos (exclusiva - regular - en licencia; FCEyN-UBA) (2014-2023), *Profesora Adjunta (simple - interino; CBC-UBA)* (2014-2020), *Profesora Adjunta (semiexclusiva - interino; CBC-UBA)* (2012-2014), *Jefe de Trabajos Prácticos (simple - interino; CBC-UBA)* (2011-2012), *Ayudante de Primera (simple - interino; CBC-UBA)* (2007-2011), *Ayudante de Segunda (simple - interino; FCEyN-UBA)* (2005-2007), *Ayudante de Segunda (simple - interino; CBC-UBA)* (2004-2007).

Other

- Development of a library of functions for the distribution of political advertising in audiovisual media for electoral campaigns, according to laws n°26215 and n°26571. It was used for the national elections 2017. Working group: S. Laplagne, M. Pérez Millán.

Languages

- English: Certificate of Proficiency in English (December 2001, degree from the University of Cambridge).

More Information

More information and auxiliary documents can be found at `http://cms.dm.uba.ar/Members/mpmillan`.