

## Rafael S. González D'León

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Docente Investigador  
Universidad Sergio Arboleda  
Programa de Matemáticas  
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### Research interests

My research interests are in the areas of algebraic and topological combinatorics. I am interested in the study of algebras and operads using combinatorial tools and techniques coming from poset topology. I have great interest and I am currently working on projects related to representation theory, combinatorial Hopf algebras, symmetric and quasisymmetric functions, matroid theory, flow polytopes and Catalan combinatorics.

### Education

Ph.D. in Mathematics, August 8 2014.  
*University of Miami, Coral Gables, FL, USA.*  
Thesis: *On the combinatorics of the free Lie algebra with multiple brackets.*  
Advisor: Michelle Wachs.

M.Sc. in Mathematics, May 2011.  
*University of Miami, Coral Gables, FL, USA.*

M.Sc. in Mathematics, June 2009.  
*KTH - Royal Institute of Technology, Stockholm, Sweden.*  
Thesis: *Representing matroids by polynomials with the half-plane property.*  
Advisor: Petter Brändén.

Electrical Engineering, March 2006.  
*UPB University, Medellín, Antioquia, Colombia.*  
Thesis: *Enhancement of fiber optics network and design of the SDH information transport system of Metro de Medellín.*

### Academic Employment

Docente Investigador (assistant professor).  
July 2017 – Present.  
Universidad Sergio Arboleda, Bogotá, Colombia.

Director of masters program in applied mathematics.  
July 2018 – Present.  
Universidad Sergio Arboleda, Bogotá, Colombia.

Postdoctoral Visitor.  
Starting August 2017 – December 2017.  
York University. Toronto, ON, Canada.

Postdoctoral Scholar.  
August 2014 – June 2017.  
University of Kentucky. Lexington, KY, USA.

Research Assistant (NSF funded).  
June 2012 – July 2014.  
University of Miami. Coral Gables, FL, USA.

Adjunct Instructor.  
January 2006 – June 2007.  
UPB University. Medellín, Antioquia, Colombia.

### Preprints and Publications

*The Whitney duals of a graded poset* (with J. Hallam) (submitted).  
<https://arxiv.org/abs/1803.03151>.

*Signature Catalan Combinatorics* (with C. Ceballos) (submitted).  
<https://arxiv.org/abs/1805.03863>.

*A combinatorial model for computing volumes of flow polytopes* (with C. Benedetti, C. R. H. Hanusa, P. E. Harris, A. Khare, A. H. Morales, M. Yip) (accepted for publication in Trans. Amer. Math. Soc.). <https://arxiv.org/abs/1801.07684>.

*A family of symmetric functions associated with Stirling permutations* (accepted for publication in J. Comb.). <http://arxiv.org/abs/1506.01628>.

*The colored symmetric and exterior algebras.*  
J. Algebra 496 (2018), 187-215.

*On the free Lie algebra with multiple brackets.*  
Adv. Appl. Math. 79 (2016): 37-97.

*On the (co)homology of the poset of weighted partitions* (with M. L. Wachs).  
Trans. Amer. Math. Soc. 368 (2016) 6779-6818.

*A note on the  $\gamma$ -coefficients of the tree Eulerian polynomial.*  
Electron. J. Combin. Volume 23, Issue 1 (2016) #P1.20

*On the half-plane property and the Tutte-group of a matroid* (with P. Brändén).  
J. Combin. Theory Ser. B. 100-2010.

### Refereed conference proceedings

*Whitney labelings and 0-Hecke algebra actions on graded posets* (with J. Hallam) (Proceedings FPSAC 2018).

*The volume of the caracol polytope* (with C. Benedetti, C. R. H. Hanusa, P. E. Harris, A. Khare, A. H. Morales, M. Yip) (Proceedings FPSAC 2018).

*Whitney duals of geometric lattices* (with J. Hallam) (FPSAC 2017).  
Sém. Lothar. Combin. 78B (2017), Art. 82, 12 pp.

*The colored symmetric and exterior algebras (extended abstract).*  
Proceedings of FPSAC 2016.

*On the poset of weighted partitions* (with M. L. Wachs).  
DMTCS Proceedings 01 (2013): 1029-1040.

### Thesis

*On the Combinatorics of the Free Lie Algebra With Multiple Brackets* (Ph.D. thesis).  
UM 2014. [http://scholarlyrepository.miami.edu/oa\\_dissertations/1246](http://scholarlyrepository.miami.edu/oa_dissertations/1246)

*Representing matroids by polynomials with the half-plane property* (master thesis).  
KTH 2009.

### Current students

Yeison Quiceno (masters) - U. Nacional de Colombia sede Medellín. Topic: Whitney duals of graded posets.

Francisco Mayorga (undergraduate) - U. Sergio Arboleda. Topic: Volumes of flow polytopes.

Carlos Mayorga (undergraduate) - U. Sergio Arboleda. Topic: Whitney duals of graded posets.

Cesar Orozco (undergraduate) - U. Sergio Arboleda. Topic: Whitney duals of graded posets.

Nicolás Rodríguez (undergraduate) - U. Sergio Arboleda. Topic: Catalan combinatorics.

### Talks and Posters

In conferences and meetings:

July 26-29, 2018 ICM Satellite Conference: A Pan-Hemispheric Celebration of Mathematics in Miami. University of Miami, Coral Gables, FL, US.

July 16-20, (Poster) 2018 Formal Power Series and Algebraic Combinatorics FPSAC 2018. Dartmouth College, Hanover NH, USA.

July 17-28, 2017, (Minicourse) Días de Combinatoria DIAS 2017. Universidad Pontificia Bolivariana. Medellin, Colombia.

April 2, 2017 Special Session on Algebraic and Enumerative Combinatorics with Applications. AMS Sectional Meeting. Indiana University, Bloomington, IN.

September 24, 2016. Special Session on Plethysm and Kronecker Products in Representation Theory. AMS Sectional Meeting. Bowdoin College, Brunswick, ME.

July 14, 2016. V Congreso Latinoamericano de Matematicos. Universidad del Norte. Barranquilla, Colombia.

July 5, 2016. (Poster) FPSAC'16 The 28th International Conference on Formal Power Series and Algebraic Combinatorics. Vancouver, BC, Canada.

October 17, 2015. Special Session on Topological Combinatorics. AMS Sectional Meeting. University of Memphis. Memphis, TN.

October 3, 2015. Special Session on Enumerative Algebraic and geometric combinatorics. AMS Sectional Meeting. Loyola University. Chicago, IL.

August 28, 2015. Algebraic Combinatorics and Applications, The first annual Kliakhandler Conference. Michigan Technological University, Houghton, MI, USA

April 18, 2015. Special Session on Algebro-Geometric Methods in Graph Theory. AMS Sectional Meeting. U. of Nevada. Las Vegas, NV.

March 27, 2015. Colloquium-Graduate Students Combinatorics Conference. U. of Kentucky, Lexington, KY.

March 14, 2015. Special Session on Algebraic Combinatorics. AMS Sectional Meeting. Michigan State University, East Lansing, MI.

January 5, 2015. Conference in honor of Michelle Wachs. U. of Miami. Miami, FL.

October 26, 2014. Special Session on Topological Combinatorics and Combinatorial Commutative Algebra. AMS Sectional Meeting. SFSU, San Francisco, CA.

July 12, 2014. Cuarto Encuentro Colombiano de Combinatoria ECCO2014. Universidad de los Andes, Bogotá, Colombia.

October 19, 2013. Special Session on Topological Combinatorics. AMS Sectional Meeting. Washington University, St. Louis, MO.

June 17, 2013. The 11th Nordic Combinatorial Conference (NORCOM). KTH, Stockholm, Sweden.

June 24, 2013. (Poster) FPSAC'13 The 25th International Conference on Formal Power Series and Algebraic Combinatorics. Paris, France.

October 14, 2012. Special Session on Algebraic and Topological Combinatorics. AMS Sectional Meeting. Tulane University, New Orleans, LA.

In seminars:

September 17, 2018. Seminario Sabanero de Combinatoria. Bogotá, Colombia.

August 22, 2018. Coloquio Universidad Sergio Arboleda. Bogotá, Colombia.

March 5, 2018. Seminario Sabanero de Combinatoria. Bogotá, Colombia.

November 27, 2017. Applied Algebra Seminar. York University. Toronto, Canada.

October 30, 2017. Discrete CATS seminar. U. of Kentucky, Lexington, KY.

September 25, 2017. Applied Algebra Seminar. York University. Toronto, Canada.

June 21, 2017. Combinatorics Seminar. University of Miami, Coral Gables, FL.

April 21, 2017. Combinatorics Seminar. Wake Forest University, Winston-Salem, NC.

April 3, 2017. Discrete CATS seminar. U. of Kentucky, Lexington, KY.

November 16, 2016. Algebra-Geometry-Combinatorics seminar at SFSU, San Francisco, CA.

November 14, 2016. Algebra and Discrete Mathematics seminar at UC Davis, Davis, CA.

October 24, 2016. Discrete CATS seminar. U. of Kentucky, Lexington, KY.

April 4, 2016. Discrete CATS seminar. U. of Kentucky, Lexington, KY.

September 14, 2015. Discrete CATS seminar. U. of Kentucky, Lexington, KY.

May 13, 2015. Combinatorics seminar. U. of Washington. Seattle, WA.

November 24, 2014. Applied Algebra Seminar. York University. Toronto, Canada.

October 31, 2014. Discrete CATS seminar. U. of Kentucky, Lexington, KY.

October 2, 2010. Combinatorics Seminar. U. of Miami, Coral Gables, FL.

March 2, 2010. Combinatorics Seminar. U. of Miami, Coral Gables, FL.

May 27, 2009. Combinatorics Seminar. KTH-The Royal Institute of Technology, Stockholm, Sweden.

## Teaching Experience

As Instructor:

*Partially ordered sets.* Fall 2018. U. Sergio Arboleda, Bogotá, Colombia.

*Analysis.* Fall 2018. U. Sergio Arboleda, Bogotá, Colombia.

*Combinatorics and Graph Theory.* Spring 2018. U. Sergio Arboleda, Bogotá, Colombia.

*Topology.* Spring 2018. U. Sergio Arboleda, Bogotá, Colombia.

*Abstract algebra.* Spring 2018. U. Sergio Arboleda, Bogotá, Colombia.

*Poset cohomology and combinatorial species (MA 714).* Spring 2017. U. of Kentucky, Lexington, KY.

*Calculus 2 (MA 114).* Fall 2016. U. of Kentucky, Lexington, KY.

*Calculus 1 (MA 113).* Spring 2016. U. of Kentucky, Lexington, KY.

*Combinatorics and Graph Theory (MA/CS 415G)*. Fall 2015 - Fall 2016. U. of Kentucky, Lexington, KY.

*Calculus 4 (MA 214)*. Spring 2015. U. of Kentucky, Lexington, KY.

*Matrix Algebra and Its Applications (MA 322)*. Fall 2014 -Spring 2015-Spring 2016. U. of Kentucky, Lexington, KY.

*Calculus 2 (MTH 162)*. Spring 2012. U. of Miami, Coral Gables, FL.

*Calculus 1 (MTH 161)*. Fall 2010 - Fall 2011. U. of Miami, Coral Gables, FL.

*Precalculus 1 (MTH 107)*. Spring 2011. U. of Miami, Coral Gables, FL.

*Computer Networks*. Spring/Fall 2006 - Spring 2007. UPB university, Medellín, Antioquia, Colombia.

*Data Networks Lab*. Spring 2007. UPB university, Medellín, Antioquia, Colombia.

## Industrial Experience

*Fluidsignal Group*

*Medellín, Antioquia, Colombia*

*Project Engineer*

*August 2005–August 2007*

Network design and implementation with open source software tools, information security advisory, project leading in the deployment of a colombian ISP and many other network infrastructure projects, project leading in network security and intrusion testing projects, responsible for risk identification, assessment and mitigation within the organization under the scheme of ISO/IEC 27001, OCTAVE and AS/NZS 4360 standards.

*Metro de Medellín*

*Bello, Antioquia, Colombia*

*Engineering Intern*

*July 2004–January 2005*

Design of a metropolitan transport network backbone with SDH standard for the interconnection of all the metro stations and headquarters. Design of new links of optical fiber to enhance the scope over the physical network.

## Conferences

December 2-7, Matemáticas en el cono sur. Universidad de la República, Montevideo, Uruguay.

November 12-16, AIM SQuaRE: Computing volumes and lattice points of flow polytopes. American Institute of Mathematics, San Jose, CA, US.

July 26-29, 2018 ICM Satellite Conference: A Pan-Hemispheric Celebration of Mathematics in Miami. University of Miami, Coral Gables, FL, US.

July 16-20, 2018 Formal Power Series and Algebraic Combinatorics FPSAC 2018. Dartmouth College, Hanover NH, USA.

6th Encuentro Colombiano de Combinatoria ECCO 2018. Universidad del Norte. Barranquilla, Colombia. June 5-16, 2018.

April 29- May 6, 2018 BIRS Focussed Research Group on Algebraic Structure of Cyclic Combinatorial Objects The Banff Centre, Banff, Alberta, Canada.

Días de Combinatoria DIAS 2017. Universidad Pontificia Bolivariana. Medellin, Colombia. July 17-28, 2017.

Special Session on Algebraic and Enumerative Combinatorics with Applications. AMS Sectional Meeting. Indiana University, Bloomington, IN, April 1-2, 2017 .

AMS Special Session on Applications of Partially Ordered Sets in Algebraic, Topological, and Enumerative Combinatorics. 2017 Joint Mathematics Meetings, Atlanta, GA, USA. January 4-7, 2017.

Workshop "Polyhedral geometry and partition theory". American Institute of Mathematics, San Jose, CA. November 7-11, 2016.

Special Session on Plethysm and Kronecker Products in Representation Theory. AMS Sectional Meeting. Bowdoin College, Brunswick, ME. September 24-25, 2016.

V Congreso Latinoamericano de Matematicos. Universidad del Norte. Barranquilla, Colombia. July 11-15, 2016.

FPSAC 2016. Vancouver, British Columbia, Canada. July 4-8, 2016.

5th Encuentro Colombiano de Combinatoria ECCO 2016. Universidad de Antioquia. Medellin, Colombia. June 13-24, 2016.

Special Session on Topological Combinatorics. AMS Sectional Meeting. University of Memphis. Memphis, TN, USA. October 17-18, 2015.

Special Session on Enumerative Algebraic and geometric combinatorics. AMS Sectional Meeting. Loyola University. Chicago, IL, USA. October 3-4, 2015.

Algebraic Combinatorics and Applications, The first annual Kliakhandler Conference. Michigan Technological University, Houghton, MI, USA. August 26-30, 2015.

Special Session on Algebro-Geometric Methods in Graph Theory. AMS Sectional Meeting. University of Nevada. Las Vegas, NV, USA. April 18-19, 2015.

Special Session on Algebraic Combinatorics. AMS Sectional Meeting. Michigan State University in East Lansing, MI, USA. March 14-15, 2015.

Conference in honor of Michelle Wachs. University of Miami. Miami, FL, USA. January 6-9, 2015.

IMA Annual Program Year Workshop Geometric and Enumerative Combinatorics. IMA University of Minnesota. Minneapolis, MN, USA. November 10-14, 2014.

Special Session on Topological Combinatorics and Combinatorial Commutative Algebra. AMS Sectional Meeting. SFSU, San Francisco, CA, USA. October 25-26, 2014.

Cuarto Encuentro Colombiano de Combinatoria ECCO2014. Universidad de los Andes, Bogotá, Colombia. June 2-13, 2014.

Bijjective and Algebraic Combinatorics: In honor of Bruce Sagan's 60th birthday. University of Florida, Gainesville, Florida. March 24-25, 2014.

Special Session on Topological Combinatorics. AMS Sectional Meeting. Washington University, St. Louis, MO, USA. October 18-20, 2013.

FPSAC'13 The 25th International Conference on Formal Power Series and Algebraic Combinatorics. Paris, France. June 24-28, 2013.

The 11th Nordic Combinatorial Conference (NORCOM). KTH, Stockholm, Sweden. June 17-19, 2013.

Triangle Lectures in Combinatorics (TLC), Seventh meeting. Wake Forest University, Winston-Salem, NC, USA. February 9, 2013.

Special Session on Algebraic and Topological Combinatorics. AMS Sectional Meeting. Tulane University, New Orleans, LA, USA. October 13-14, 2012.

MSRI Summer Graduate Workshop - Cluster Algebras and Cluster Combinatorics. Mathematical Sciences Research Institute, Berkeley, CA, USA. August 1-12, 2011.

Ninth Annual Graduate Student Topology and Geometry Conference. Michigan State University, East Lansing, MI, USA. April 2-3, 2011.

Eighth Annual Graduate Student Topology and Geometry Conference. University of Michigan, Ann Arbor, MI, USA. April 10-11, 2010.

AMS Fall Southeastern Meeting. Florida Atlantic University, Boca Raton, FL, USA. October 30-31, 2009.

## Organized conferences and sessions

Coorganizer of the 7th Encuentro Colombiano de Combinatoria ECCO 2020. Universidad Sergio Arboleda y Universidad de los Andes. Bogotá, Colombia. June, 2020.

Coorganizer of Días de Combinatoria DIAS 2019. Universidad del Cauca, Popayán, Colombia. June, 2019.

Coorganizer of Seminario Sabanero de Combinatoria SeSaCo. Bogotá, Colombia. 2018.

Coorganizer of the CIMPA research school: 6th Encuentro Colombiano de Combinatoria ECCO 2018. Universidad del Norte. Barranquilla, Colombia. June 5-16, 2018.

Coorganizer of Días de Combinatoria DIAS 2017. Universidad Pontificia Bolivariana, Medellín, Colombia. July 17-28, 2017.

Coorganizer of AMS special session on applications of Partially Ordered Sets in Algebraic, Topological, and Enumerative Combinatorics at the 2017 Joint Mathematics Meetings. Atlanta, GA. January 4-7, 2017.

Coorganizer of special session on algebraic combinatorics, Hopf algebras and tensor categories at the V Congreso Latinoamericano de Matemáticas. Universidad del Norte. Barranquilla, Colombia. July 11-15, 2016.

Coorganizer of the CIMPA research school: 5th Encuentro Colombiano de Combinatoria ECCO 2016. Universidad de Antioquia. Medellín, Colombia. June 13-24, 2016.

## Awards and honors

*Outstanding graduate student in Mathematics* May 2014. University of Miami, Coral Gables, FL, USA.

*Colciencias doctorate fellowship* 2012-2014. Administrative Department of Science, Technology and Innovation (Colciencias), Bogotá, Colombia.

*College of Arts and Sciences Dean's summer research fellowship* Summer 2011. University of Miami, Coral Gables, FL, USA.

## Other Activities

Faculty co-advisor for the Math Club. University of Kentucky, Fall 2016-Spring 2017.

Cofounder and coorganizer of the UM Math Graduate Students Seminar. Fall 2010 to Spring 2012.

Students delegate on the faculty counsel of Electrical Engineering and on the Engineering School 2003-2004. UPB University, Medellín, Colombia.

## Skills

*Languages:* Spanish (native), English (fluent).

*Operating Systems:* GNU/Linux and WINDOWS.

*Computer Languages:* Python, MATLAB, Maple, Sage Math.

*Other technology topics:* LAN and TCP/IP networking.

## References

*Available on request*