Carlos Alejandro Alfaro Montúfar

CONTACT INFORMATION	Banco de México Mexico City, México. email: alfaromontufar@gmail.com web–page: https://alfaromontufar.github.io
CITIZENSHIP	Mexican
RESEARCH INTEREST	Algebraic combinatorics, optimization, and statistics.
EDUCATION	Ph.D. in Mathematics, 2014. Centro de Investigación y de Estudios Avanzados del I.P.N. **Dissertation:** *Critical ideals of a graph and Dimension reduction in Tree space.* **Advisor:** Ph.D. Carlos E. Valencia M.Sc. in Mathematics, 2010. Centro de Investigación y de Estudios Avanzados del I.P.N. **Thesis:** *The sandpile group of a multigraph.* **Advisor:** Ph.D. Carlos E. Valencia B.Sc. in Applied Mathematics, minor in Economics, 2008 Universidad Autónoma del Estado de Hidalgo. **Final Project:** *Knot theory and its applications to DNA.* **Advisors:** Ph.D. Olivia C. Gutú and Ph.D. Roberto López
PROFESSIONAL EXPERIENCE	Researcher Banco de México, Mexico City, Mexico. Since April 2014. Visiting Researcher Hewlett-Packard Laboratories, Palo Alto, CA, USA. January 2011 – August 2012.
ACADEMIC EXPERIENCE	Adjunct Professor Unidad Profesional Interdisciplinaria de Biotecnología. Instituto Politécnico Nacional. Mexico City, Mexico. September 2010–January 2011. Courses: Numerical methods and Computer Science Adjunct Professor Unidad Profesional Interdisciplinaria de Biotecnología. Instituto Politécnico Nacional. Mexico City, Mexico. September 2009–January 2010. Courses: Calculus and Computer Science

Adjunct Professor
Programa de Ingeniería en Mecatrónica.
Universidad Politécnica de Pachuca. Pachuca, Hidalgo, Mexico.
September–December 2007
Courses: Physics

PATENT

(with B. Aydin, K. Guler, and C. E. Valencia) Selection of data paths,
US patent application publication. US 2014/0032605 A1

JOURNAL
PAPERS

(with Christian Rubio-Montiel and Adrián Vázquez-Ávila) On two-quotient
strong starters for $\mathbb{F}_q$. To appear in Utilitas Mathematica.

(with G. Araujo-Pardo, C. Rubio-Montiel, A. Vázquez-Avila) On transversal
and 2-packing numbers in uniform linear systems. To apper in
AKCE International Journal of Graphs and Combinatorics.

On graphs with two trivial distance ideals. Linear Algebra Appl. 597 (2020) 69–85.

(with L. Taylor) Distance ideals of graphs. Linear Algebra Appl. 584 (2020) 127–144.

(with Jephian C.-H. Lin) Critical ideals, minimum rank and zero forcing number.
Applied Mathematics and Computation. 358 (2019) 305–313.

Graphs with real algebraic co-rank at most two. Linear Algebra Appl. 556 (2018) 100–107.

(with Carlos E. Valencia and Adrián Vázquez-Ávila) Digraphs with at most
one trivial critical ideal. Linear and Multilinear Algebra 66 (2018) 2036–2048.

(with Alan Arroyo, Marek Dernar and Bojan Mohar) The crossing number of the
cone of a graph. SIAM J. of Discrete Math. 32 (2018) 2080–2093.

(with Carlos E. Valencia) Small clique number graphs with three trivial critical
ideals. Spec. Matrices 6 (2018) 122–154.

(with Hugo Corrales and Carlos E. Valencia) Critical ideals of signed graphs
with twin vertices, Advances in Applied Mathematics 86 (2017) 99–131.

(with Carlos E. Valencia) Graphs with two trivial critical ideals,
Discrete Appl. Math. 167 (2014) 33–44.

(with B. Aydin, E. Bullitt, A. Ladha and C.E. Valencia) Dimension Reduction
in Principal Component Analysis for Trees.
Computational Statistics & Data Analysis 74 (2014) 157–179.

(with Carlos E. Valencia) On the sandpile group of the cone of a graph,
Linear Algebra Appl. 436 5 (2012) 1154–1176.

CONFERENCE
PAPERS

(with Carlos E. Valencia) Graphs with few trivial critical ideals,
Electronic Notes in Discrete Mathematics 50 (2015) 391–396. Presented at LAGOS'15

(with Alan Arroyo, Marek Dernar and Bojan Mohar) The crossing number of the cone
of a graph. Lecture Notes in Computer Science vol. 9801. Presented at Graph Drawing'16.

(with Carlos E. Valencia and Adrián Vázquez-Ávila) Critcal ideals of digraphs.
Matemática Contemporanea 45 (2017) 31–39. Presented in VII Latin American Workshop on
Cliques in Graphs.

Outperforming Several Heuristics for the Multidimensional Assignment Problem
(with S.L. Peréz, C.E. Valencia, M.C. Vargas and F.J. Zaragoza), in 2018 15th International
Conference on Electrical Engineering, Computing Science and Automatic Control (CCE).

Critical ideals and applications. Matemática Contemporanea 46 (2019) 74–82.
Presented in VIII Latin American Workshop on Cliques in Graphs.

TALKS

Title: *"Minimum rank and critical ideals"*
Einstein Workshop on Polytopes and Algebraic Geometry
Freie Universität Berlin, Germany, December 2-4, 2019.

Title: *"Critical ideals and applications"*
VIII Latin American Workshop on Cliques in Graphs
Rio de Janeiro, Brazil, August 9-11, 2018.

Title: *"Critical ideals and applications"*
Linear Algebra and its Applications Workshop 2018
Niterói, Rio de Janeiro, Brazil, July 30-31, 2018.

Title: *"Data analysis in tree spaces"*
Seminario de matemáticas, ITAM
Mexico City, Mexico, January 30th 2018.

Title: *"Critical Ideals of Digraphs"*
VII Latin American Workshop on Cliques in Graphs
La Plata, Argentina, November 8-11, 2016.

Title: *"Optimizing the production costs of mintage"*
Seminario de matemáticas, ITAM
Mexico City, Mexico, September 30th 2016.

Title: *"On the crossing number of the cone of a graph"*
XXXI Coloquio Víctor Neumann-Lara de Teoría de Gráficas, Combinatoria y sus Aplicaciones
Guanajuato, Guanajuato, Mexico, February 28 - March 4 2016.

Title: *"A sandpile group characterization problem"*
BIRS-CMO "Sandpile groups" workshop
Oaxaca, Oaxaca, Mexico, November 15-20 2015.

Title: *"Graphs with few critical ideals"*
VIII Latin-American Algorithms, Graphs and Optimization Symposium
Praia das Fontes, Beberibe, Ceará, Brazil, May 11-15 2015.

Title: *"Principal component analysis for trees"*
Escuela Nacional de Optimización y Análisis Numérico,
Villahermosa, Tabasco, Mexico, 2012

Title: *"Principal component analysis for trees"*
XVI Escuela Latinoamericana de Verano en Investigación de Operaciones,
Vale dos Vinhedos, Bento Goncalves, Rio Grande do Sul, Brazil, 2012

POSTERS

(with Hugo Corrales and Carlos E. Valencia) γ-critical graphs.
Mathematical Congress of the Americas, Guanajuato, Mexico, August 2013.

(with Carlos E. Valencia) Graphs with a large number of minimal generators of
the critical group. International Workshop Combinatorial and Computational
Aspects of Optimization, Topology and Algebra, Playa del Carmen, Mexico, 2010.

(with Olivia C. Gutú and Roberto López) Knots and their applications to DNA.
Hidalgo State Mathematics Week, Universidad Autónoma del Estado de Hidalgo,
Pachuca, Mexico 2006.

(with Olivia C. Gutú and Roberto López) Knots and their applications to DNA.
XXXIX Congreso Nacional de la Sociedad Matemática Mexicana,
Tabasco, Mexico, 2006.

GRANTS & AWARDS	Open arms grant (Instituto de Matemática Pura e Aplicada, Sociedade Brasileira de Matemática and International Mathematical Union) to attend the International Congress of Mathematicians 2018. Rio de Janeiro, Brazil.

Grant to attend the 2018 Graduate Research Workshop in Combinatorics
hosted by Iowa State University in Ames, Iowa, U.S.A. From May 21-June 1, 2018.

Grant to attend the pre-workshop on Careers in Mathematical Sciences
hosted by Institute for Mathematics and its Applications in Minneapolis, Minnesota, U.S.A.
May 17-18, 2018.

Grant to attend the Mathematics Research Communities (MRC) conference on
Beyond Planarity: Crossing Numbers of in Snowbird, Utah, U.S.A. on June 11-17, 2017.

CONACyT SNI level 1. 2019 – up today.

CONACyT SNI Candidate. 2016 – 2018.

CONACyT Scholarship for PhD studies. March 2010 – February 2014.

CONACyT Scholarship for Master studies. March 2008 – February 2010.

Honorable Mention. ACM ICPC Central America Programming Contest, 2005.

First place. Programming Contest organized by the Mathematics Research Center
Universidad Autónoma del Estado de Hidalgo, 2005.

First place. ZERO-ONE Programming Contest
organized by the Computer Engineering department
Universidad Autónoma del Estado de Hidalgo 2004.

WORKSHOPS Beyond Planarity: Crossing Numbers of Graphs
AMS-Mathematics Research Communities
Snowbird, USA, June 11 – 17, 2017.

VII Latin American Workshop on Cliques in Graphs
La Plata, Argentina, November 8-11, 2016.

Third Discrete Mathematics Workshop
UNAM Juriquilla, Queretaro
Queretaro, Mexico, June 19 – 24, 2016.

Sandpile Groups
Banff International Research Station for Mathematical Innovation and Discovery (BIRS)
Oaxaca, Mexico, November 15 – 20, 2015.

Modern Techniques in Discrete Optimization
Banff International Research Station for Mathematical Innovation and Discovery (BIRS)
Oaxaca, Mexico, November 2 – 6, 2015.

Crossing Numbers Workshop 2013
Guanajuato, Mexico, February 11–15, 2013.

Schools
PASI: Commutative Algebra and Its Interactions with Algebraic Geometry,
Representation Theory, and Physics. CIMAT, Guanajuato, Mexico, 2012

XXII Escuela Nacional de Optimización y Análisis Numérico,
Villahermosa, Tabasco, Mexico, 2012

XVI Escuela Latinoamericana de Verano en Investigación de Operaciones,
Vale dos Vinhedos, Bento Goncalves, Rio Grande do Sul, Brazil, 2012

First Mexican Winter School in Discrete Mathematics,
CIMAT, Guanajuato, Mexico, 2010

Skills
Knowledge of the following Computer Programs and Languages: C++, Java, Java3D
Python, SageMath, LaTeX, Macaulay2, R, GLPK, and SCIP.

Language
Skills
Spanish (native language) and English (fluent)

Referee of
Journals
Ars Combinatoria, Information Sciences, Boletín de la SMM, Discrete and Applied Mathematics