

Curriculum Vitae

Mónica Moreno Rocha

Postal Address: Callejon San Javier, 3-A, Guanajuato, Gto. 36020, Mexico.

Telephone: +52 473 119.3498.

Email address: mmoreno@ciamat.mx, mmoreno.cimat@gmail.com.

Web page: www.cimat.mx/~mmoreno/

Academic Training

Education:

- 1998–2002** Ph.D. in Pure Mathematics.
Boston University, Boston, Massachusetts, EE.UU.
Dissertation: On indecomposable subsets of the Julia set for unstable exponentials.
Advisor: Dr. Robert L. Devaney, Boston University.
- 1995–1997** M. Sc. in Applied Mathematics.
Centro de Investigacion en Matematicas, A.C., Guanajuato, Mexico.
- 1988–1992** B. Sc. in Applied Mathematics.
Universidad Juarez del Estado de Durango, Durango, Mexico.
Thesis: Mathematical programming on non-directed graphs over the euclidean space applied to computer design.
Asesor: M.Sc. Sergio Santana, Instituto de Investigaciones Electricas, Morelos.

Postdoctoral positions:

- 2006** Fields Institute for Research in Mathematical Sciences, Toronto, Canada.
Research program: Holomorphic Dynamics, Laminations and Hyperbolic Geometry.
Senior researchers: Dr. Mikhail Lyubich, Dr. Michael Yampolsky.
Dates: January – May, 2006.
- 2005** Universitat Autònoma de Barcelona, Bellaterra, Catalunya, Spain.
Research program: Indecomposable continua in holomorphic dynamics.
Senior researchers: Dr. Xavier Jarque, Dr. Jaume Llibre.
Dates: July – December , 2005.

Professional Experience

2006–Present Centro de Investigacion en Matematicas, A.C.

Since: July 16, 2006.

Division: Pure Mathematics.

Appointment: Profesor Investigador Titular A (associate professor), since January 1, 2009.

Previous Appt.: Profesor Investigador Asociado C (assistant professor), July 16, 2006 – December 31, 2008.

Address: Callejon Jalisco S/N, Mineral de Valenciana, Guanajuato, Gto., 36240, Mexico.

Teaching duties: Undergraduate and graduate courses (see Teaching and Mentoring for further information).

2002–2005 Tufts University.

Division: Department of Mathematics.

Appointment: Assistant Professor.

Periodo: August 2002 – May 2005.

Address: 503 Boston Avenue, Medford, MA 02155, EE.UU.

Teaching duties: Undergraduate courses: Linear Algebra, Differential Equations, Calculus II, Calculus III, Calculus for the Social Sciences, Complex Variables.

Graduate course: Topics in Complex Analysis.

2001–2002 Boston University.

Division: Summer School.

Appointment: Instructor.

Periodo: Verano del 2001, verano del 2002.

Address: 111 Cummington Street, Boston, MA 02215, EE.UU.

Teaching duties: Undergraduate courses: Linear Algebra, Complex Variables.

1998 Universidad Tecnologica de la Mixteca.

Division: Instituto de Fisica y Matematicas.

Appointment: Profesor Asociado B (associate professor).

Periodo: January – August 1998.

Address: Km. 9 Carretera a Acatlima, Huajuapán de León, Oax., 69000, Mexico.

Teaching duties: Undergraduate courses: Differential Equations II, Linear Algebra I.

Research

Research Area: *Dynamical Systems and Holomorphic Dynamics*

Research Proposals

Approved proposals:

- 2011–2014** *Semigroups in holomorphic dynamics: representations, deformations and quasiconformal surgery.* Pure Science Research Call Proposal, CONACyT CB-2010-01. Participant. Head researcher: Dr. Peter Makienko, IA-UNAM Cuernavaca.
- 2007–2010** *Landing of external rays for a subclass of entire maps.* Pure Science Research Call Proposal, CONACyT CB-2006-01. Head researcher.
- 2007–2008** *Hausdorff dimension for Julia sets.* Your Researchers Call Proposal, CONCyTEG 2007-02. Head researcher.
- 2006–2007** *Rational families and local connectivity.* Consolidation of Academic Groups Program, "Reparación", CONACyT 2006.

Publications:

Research articles in peer-reviewed journals

- 2011** *Non-landing hairs in Sierpiński curve Julia sets of transcendental entire maps.* A. Garijo, X. Jarque y M. Moreno Rocha. *Fundamenta Mathematicæ*, **214**, 2, (2011), 135–160.
- 2010** *Joining polynomial and exponential combinatorics for some entire maps.* A. Garijo, X. Jarque, M. Moreno Rocha. *Publicacions Matemàtiques*, **54**, 1, (2010), 113–136.
- 2007** *Rational maps with generalized Sierpinski gasket Julia sets.* R. L. Devaney, M. Moreno Rocha, S. Siegmund. *Topology and its Applications*, **154**, 1, (2007), 11–27.
- 2005** *Indecomposable continua and Misiurewicz points in exponential dynamics.* R. L. Devaney, X. Jarque, M. Moreno Rocha. *International Journal of Bifurcation and Chaos*, **15**, 10, (2005), 3281–3294.
- 2004** *Playing catchup with iterated exponentials.* R. L. Devaney, A. Frumosu, K. Josic, M. Moreno Rocha *et. al.* *American Mathematical Monthly*, **11**, 8, (2004), 704–709.
- 2003** *Existence of indecomposable continua for unstable exponentials.* M. Moreno Rocha. *Topology Proceedings*, **26**, 1, (2003), 233–244.
- 2002** *A semilinear model for exponential dynamics and topology.* R. L. Devaney, M. Moreno Rocha. *Topology Proceedings*, **26**, 1, (2002/01), 153–167.
- 2002** *Geometry of the bulbs in the Mandelbrot set.* R. L. Devaney, M. Moreno Rocha. *Fractals*, **10**, 1, (2002), 39–46.
- 2001** *Accessible points in the Julia set of stable exponentials.* R. Bhattacharjee, R. L. Devaney, R.E.L. Deville, K. Josic, M. Moreno Rocha. *Discrete Contin. Dyn. Syst. Ser. B.*, **1**, 3, (2001), 299–318.

Research articles in peer-reviewed proceedings

- 2008 *Singular perturbations of z^n* . R. L. Devaney, M. Holtzer, D. M. Look, M. Moreno Rocha, D. Uminsky. *Transcendental Dynamics and Complex Analysis. Lecture Notes Series*. Editors: P. J. Rippon & G. Stallard. Cambridge University Press, 2008, 111–137. ISBN 978-0-521-68372-2.
- 2006 *Sierpinski carpets and gaskets as Julia sets of rational maps*. P. Blanchard, R. L. Devaney, D. Look, M. Moreno Rocha *et. al.* *Dynamics on the Riemann Sphere: A Bodil Branner Festschrift*. Editors: P. G. Hjorth & C. L. Petersen. European Mathematical Society, 2006, 97–119. ISBN 3-03719-001-6.

Expository articles and course notes

- 2011 *Ecuaciones diferenciales en el plano \mathbb{R}^2* . Course notes. Winter school in Differential Equations: from the deterministic and stochastic viewpoint. Universidad de El Salvador, San Salvador. To appear.
- 2011 *Conjuntos de Julia racionales y empaques de Sierpinski generalizados*. *Revista de Ciencias Básicas, UJAT*. **9**, 2, (2011), 9–16.
- 2007 *Dimension y conjuntos de Julia*. (Dimension and Julia sets.) *Gaceta Ideas Concyteg*, **2**, 25, (2007), 18–27.

Preprints

- 2011 *A combinatorial invariant for escape time Sierpiński rational maps*. Manuscript.
- 2012 *Satellite parabolic perturbations in exponential dynamics*, con A. Benini. In preparation.

All publications are available on

www.cimat.mx/~mmoreno/research/

Presentations:

Since 2000, I have given more than 50 research talks, 10 expository talks and 8 short courses. Listed below are those presentations given since I began working at CIMAT.

Conferences and workshops

- 2006
1. *External rays and Cantor bouquets*. Midwest Dynamical Systems Meeting. IUPUI, Indiana University Purdue University Indianapolis, Indianapolis, IN, U.S.A. October 13 – 15, 2006.
 2. *Ramilletes de Cantor como rayos externos para cierta familia entera*. Encuentro de Jóvenes en Sistemas Dinámicos. Facultad de Matemáticas, Universidad de Guanajuato, Guanajuato, Gto. October 30, 31 y November 1 – 3, 2006.
- 2007
3. *Gluing together exponential and polynomial dynamics*. Spring Topology and Dynamical Systems Conference. University of Missouri–Rolla, Rolla, MO, U.S.A. March 29 – 31, 2007.
 4. *Rational maps and Sierpiński gaskets*. First Joint International Meeting of the American Mathematical Society and Polskie Towarzystwo Matematyczne, Complex Dynamics Session. Uniwersytet Warszawski, Warsaw, Poland. July 31 – August 3, 2007.

5. *Modelos topologicos en la dinamica holomorfa*. XL Congreso Nacional de la SMM, Sesión de Topología General. Universidad Autónoma de Nuevo León, Monterrey, N.L. October 14 – 19, 2007.
 6. *Piezas de rompecabezas para una familia racional*. Dias Dinamicos en Cuernavaca, Unidad Cuernavaca, Instituto de Matematicas, UNAM. Cuernavaca, Mor. November 21 – 23, 2007.
 7. *Modelos topologicos en la dinamica holomorfa*. Taller de Sistemas Dinamicos Holomorfos, Facultad de Ciencias Fisico Matematicas, Benemerita Universidad Autónoma de Puebla, Puebla, Pue. December 6 – 7, 2007.
- 2008**
8. *Conexidad local y el conjunto de Mandelbrot*. V Coloquio de Geometria, Facultad de Matematicas, Universidad Autónoma de Yucatan, Merida, Yuc. January 23, 2008.
 9. *Rayos externos para funciones enteras*. V Coloquio de Geometria, Facultad de Matematicas, Universidad Autónoma de Yucatan, Merida, Yuc. January 25, 2008.
 10. *A story of two families*. Complex Dynamics and Topology (in honor of R.L. Devaney 60th anniversary). Tossa de Mar, Girona, Spain. April 21 – 25, 2008.
- 2009**
11. *Dinamica de funciones Speiser*. Taller de Sistemas Dinamicos Discretos, Facultad de Ciencias Fisico Matematicas, Benemerita Universidad Autónoma de Puebla, Puebla. March 13, 2009.
 12. *Hausdorff dimension and rational maps*. Holomorphic Dynamics in Boston, Boston University, Boston, MA, U.S.A. June 3 – 5, 2009.
 13. *Combinatorial description of Sierpinski Julia sets of rational maps*. Joint meeting of the American mathematical society and the Korean mathematical society, Ewha University, Seoul, South Korea. December 16 – 20, 2009.
- 2010**
14. *A combinatorial description of Sierpiński Julia sets*. Eighth AIMS International Conference on Dynamical Systems and Differential Equations, Technical University Dresden, Dresden, Germany. May 25 – 28, 2010.
 15. *Conjuntos de Julia racionales y empaques de Sierpiński*. Escuela Matematica de America Latina y el Caribe, Universidad Juarez del Estado de Tabasco, Villahermosa, Tab. August 2 – 13, 2010.
- 2011**
16. *Nonlanding hairs in transcendental entire dynamics*. Trends in Complex Dynamics, Clay Mathematics Institute Workshop, Clay Institute, Cambridge, MA, EE.UU. May 18, 2011.
 17. *Las antenas del conjunto de Mandelbrot*. XLIV Congreso Nacional de la Sociedad Matemática Mexicana, UASLP, San Luis Potosí, México. Octubre 13, 2011.
- 2012**
18. *Combinatorial description of Sierpinski curve Julia sets of rational maps*. Join meeting of the Royal Spanish Mathematical Society and the Mexican Mathematical Society. Torremolinos, Spain. January 16 – 20, 2012.

Colloquia and seminars

- 2006**
1. *Rayos externos y el ramillete de Cantor*. Seminario de Matematicas Aplicadas y Sistemas Computacionales. IPICYT, San Luis Potosí, SLP. September 15, 2006.
 2. *External rays and Cantor bouquets*. Dynamical System Seminar. Boston University, Boston, MA, U.S.A. October 10, 2006.

3. *Puzzle pieces for rational maps*. Holomorphic Dynamics Seminar. Boston University, Boston, MA, U.S.A. October 11, 2006.
- 2007 4. *Rayos externos para funciones enteras*. Coloquio del Centro de Investigacion en Matematicas, CIMA, Universidad Autonoma de Hidalgo, Pachuca, Hgo. March 1, 2007.
5. *Rayos externos para funciones enteras*. Coloquio del Insituto de Matematicas, Unidad Morelia, UNAM, Morelia, Mich. June 20, 2007.
- 2008 6. *El triangulo de Sierpiński y conjuntos de Julia*. Ciclo de Primavera del Seminario Discreto. Facultad de Ciencias, Departamento de Matematicas, Universidad Autonoma de Mexico, Mexico, D.F. May 8, 2008.
7. *Conexidad local y el conjunto de Mandelbrot*. Ciclo de Seminarios "Dr. Alberto Rubio". Facultad de Ciencias, Fisica y Matematicas, Universidad Autonoma de Baja California, Ensenada, B.C. June 11, 2008.
- 2009 8. *Conjectures in holomorphic dynamics*. Seminar at Korean Institute of Advance Study, Seoul, South Korea. December 21, 2009.
- 2010 9. *Symblic dynamics of Sierpiński Julia sets*. Institut de Matemàtiques, Universitat de Barcelona, Barcelona, Spain. June 7, 2010.

Short courses

- 2006 1. *Teoria del continuo y dinamica de funciones transcendentales*. Escuela de Verano de Geometria y Sistemas Dinamicos. CIMAT, Guanajuato, Gto. August 7 – 11, 2006.
- 2007 2. *Introduccion a la dinamica holomorfa*. XL Congreso Nacional de la SMM. Universidad Autonoma de Nuevo Leon, Monterrey, N.L. October 14 – 19, 2007.
- 2009 3. *Topological models in holomorphic dynamics*. Encuentro de Sistemas Dinamicos, UABC, Ensenada, B.C., July 28 – August 1, 2009.
- 2010 4. *El Baile de los fractales: continuidad de conjuntos de Julia*. Escuela de verano, CIMAT, Guanajuato, Gto., July 5 – 9, 2010.
5. *Implosion parabolica de conjuntos de Julia*. Universidad Nacional de Colombia, Bogota, Colombia. August 31 y September 2, 2010.
- 2011 6. *Ecuaciones Diferenciales en el Plano \mathbb{R}^2* . Escuela de verano *Ecuaciones Diferenciales: aspectos determinísticos y estocásticos*, Universidad de El San Salvador, San Salvador, El Salvador, Diciembre 5 – 9, 2011.

Expository talks

- 2006 1. *¿Que son los fractales? (What is a fractal?)* An expository account addressed to general public. CIMAT, Guanajuato, Gto. October 19, 2006.
- 2008 2. *Iteracion de funciones: caos y fractales*. (Iteration of maps: chaos and fractals.) Expository talk addressed to second and third year undergraduate students from Universidad Tecnologica de la Mixteca. CIMAT, Guanajuato, Gto. June 18, 2008.

- 2009 3. *Holomorphic dynamics in a nutshell*. Introductory talk addressed to undergraduate and graduate students in mathematics. Workshop in Holomorphic Dynamics, CIMAT, Guanajuato, Gto. August 17, 2009.
- 2010 4. *La geometría fractal y Benoît Mandelbrot*. (Fractal geometry and Benoît Mandelbrot) Interview done by undergraduate students from ITESM, Campus Leon. CIMAT, Guanajuato, Gto. November 19, 2010.
- 2011 5. *El conjunto de Mandelbrot y la aritmética de Farey*. (Farey's arithmetic and the Mandelbrot set.) Charla dirigida a estudiantes de los últimos semestres de licenciatura en matemáticas. Universidad Autónoma de Aguascalientes, Aguascalientes, Ags. May 26, 2011.

Teaching and Mentoring

Master's thesis advising

- 2010 Jonny Ardila Ardila. *Dimension de Hausdorff y conjuntos de Julia polinomiales*. (Hausdorff dimension and polynomial Julia sets.) Universidad Nacional de Colombia, Bogota, Colombia. Exam date: September 1, 2010.
- Remarks: His thesis received a *Mencion Meritoria (Cum Meritum)* by the evaluating committee. This is the highest recognition that may be awarded to a master's thesis by his university.
- 2011 Pablo Pérez Lucas. *Dinámica de funciones elípticas*. (Dynamics of elliptic functions.) Centro de Investigación en Matemáticas, Guanajuato, México. In preparation.
- 2011 Humberto Bautista Serrano. *Modelación matemática de los mecanismos de regulación en enfermedades autoinmunes*. (Mathematical modeling of regulation mechanisms for autoimmune disease.) Centro de Investigación en Matemáticas, Guanajuato, México. In preparation.

Other research projects with students

- 2009 Cynthia H. Sanchez Tapia. *On the topology of analytic self-maps in \mathbb{C}^** . Analysis of the topology of Julia sets for families of analytic self-maps. Preprint.
- 2010 Adrian Esparza Amador. *Deformaciones de funciones enteras con dominio de Baker*. (Deformation of entire maps with Baker domains.) Analysis of Teichmuller space and deformations for entire maps (following N. Fagella and C. Henriksen). Presentation given at Deformation Workshop, IA-UNAM Cuernavaca, October 26, 2010.

Courses taught at CIMAT

- 2006 1. Dynamical systems I (Discrete Dynamics). Master's program in Pure Mathematics.
- 2007 2. Dynamical systems II (Holomorphic Dynamics). Master's program in Pure Mathematics.
3. Dynamical systems I (Ergodic Theory). Master and PhD programs in Pure Mathematics.

- 2008** 4. Mathematics and analytic geometry. Bachelor's degree in Mathematics, FAMAT, Universidad de Guanajuato.
5. Dynamical systems I (Continuous Dynamics). Master's program in Pure Mathematics.
- 2009** 6. Dynamical systems II (Holomorphic Dynamics). Master's program in Pure Mathematics.
7. Ordinary Differential Equations. Master's programs in Pure and Applied Mathematics.
- 2010** 8. Topics in Dynamical Systems (Dynamics of Rational Maps). Master's program in Pure Mathematics.
9. Topics in Dynamical Systems (Quasiconformal maps in holomorphic dynamics). Master's program in Pure Mathematics, CIMAT and Bachelor's degree in Mathematics, FAMAT, Universidad de Guanajuato.
- 2011** 10. Ordinary Differential Equations. Master's programs in Pure and Applied Mathematics.
11. Complex variables I. Master's programs in Pure Mathematics.
- 2012** 12. Complex variables II. Master and PhD programs in Pure Mathematics.

Course descriptions, notes and assignments can be found in
www.cimat.mx/~mmoreno/teaching/

Other Academic Activities

Evaluations and reviews

1. I have been a reviewer for the following journals: Boletín de la Asociación Matemática Venezolana (ISSN: 1315-4125), Discrete and Continuous Dynamical Systems (ISSN: 1078-0947), Divulgaciones Matemáticas (ISSN: 1315-2068), Dynamical Systems: An International Journal (ISSN: 1468-9367), Fractals (ISSN: 0218-348X), Journal of Difference Equations and Applications (ISSN: 1023-6198), Physics Letters A (ISSN: 0375-9601), Proceedings of the American Mathematical Society (ISSN: 0002-9939).
2. I have evaluated several research proposals for the program Fondo Mixto, Sectorial e Institucional, CONACyT 2007. April – May, 2008.
3. I have been an external evaluator of a research proposal for Universidad Juarez Autonoma de Tabasco. September, 2008.
4. I have evaluated several research proposals for the program Young Researches Call Proposal, Pure Sciences, CONACyT 2009. May – June 2010.

Recognitions

- 2008** Member of the National Researchers Organization, SNI, Level 1. January 2008 – December 2010.
- 2009** Associate Professor (Profesor Investigador Titular A) Centro de Investigacion en Matematicas, A.C., Guanajuato, Gto. January 2009.
- 2011** Member of the National Researchers Organization, SNI, Level 1. January 2011 – December 2014.

Academic visits

- 2006** 1. Beijing University, Beijing, China. From 1 to 16 of June, 2006. Hosted by Dr. Jiazhong Yang.
- 2007** 2. University of Warwick, U.K.. From 3 to 7 of March, 2008. Hosted by Dr. Carlos Cabrera. Grant CONCyTEG, 07-02-K662-069 A02.
- 2008** 3. Universitat Rovira i Virgil, Tarragona, Spain. From 5 to 10 of October, 2008. Hosted by Dr. Antonio Garijo Real. Grant CONACyT, CB-2006-01.
4. Host of Dr. Xavier Jarque, Universitat de Barcelona and Dr. Antonio Garijo, Universitat Rovira i Virgil. From 23 of August to September 7, 2008. Grant CONACyT, CB-2006-01.
- 2009** 5. Host of Dr. Robert L. Devaney, Boston University. From 16 to 22 of August, 2009. Grant CONACyT, CB-2006-01.
6. Korean Institute for Advance Study. From 16 to 22 of December, 2009. Hosted by Jong-Yup Lee.
- 2010** 5. Boston University, Boston, MA, U.S.A. From 15 to 23 of September, 2010. Hosted by Dr. Robert L. Devaney.
- 2011** 6. Host of Dr. Anna Benini, IMATE, Cuernavaca. From 12 to 16 of June, 2011.
7. Host of Dr. Pablo Dávalos, IMPA. From 10 to 12 of November, 2011.

Internal committees

1. Member of the library committee for Pure Mathematics Division, CIMAT. September – October, 2007.
2. Member of the admission committee for undergraduate program in mathematics, Universidad de Guanajuato. Summer 2007, 2008, 2009 and 2010.
3. Member of the admission committee for graduate program in mathematics, CIMAT. May 2009.
4. Writing and evaluation of preliminary examinations, master's program in pure and applied mathematics, CIMAT. Fall 2006 through Winter 2012.

Organization of conferences and seminars

- 2006** 1. Co-organizer of the Young Researchers in Dynamical Systems Meeting. FAMAT, Universidad de Guanajuato, Guanajuato, Gto. October 30, 31 and November 1 – 3, 2006.
- 2007** 2. Mexican organizer of the special session “Holomorphic Dynamics on the Riemann Sphere: In honor of Adrien Douady”, Joint meeting of the Sociedad Matematica Mexicana and the American Mathematical Society. Zacatecas, Zac. May 23 – 26, 2007.
- 2009** 3. Organizer of the Workshop in Holomorphic Dynamics. CIMAT, Guanajuato, Gto. August 17 and 18, 2009.
4. CIMAT's colloquium organizer. August 2009 – August 2010.

5. Head of CIMAT's Graduate Students Seminar, since August 2009.

2010 5. Organizer of CIMAT's 1st Alumni Meeting. CIMAT, Guanajuato, Gto. August 19 – 21, 2010.

**Guanajuato, Mexico
February 1, 2012**