

# MARCELO VIANA

Professor of Mathematics  $\diamond$  Director

IMPA  $\diamond$  Estrada Dona Castorina 110, Jardim Botânico  $\diamond$  22460-320 Rio de Janeiro, Brazil

+55 21 2529 5270 viana@impa.br www.impa.br/~viana

ORCID: 0000-0001-8344-7251

## BIRTH AND CITIZENSHIP

---

March 4, 1962 in Rio de Janeiro. Brazilian and Portuguese.

## EDUCATION

---

B. Sc. – Department of Mathematics, University of Porto, 1984.

Ph. D. – Instituto de Matemática Pura e Aplicada, Rio de Janeiro, 1990.

## ADMINISTRATION

---

ABC – Brazilian Academy of Sciences: membership committee member; L’Oréal Grant for Women in Science committee member (current).

CAPES – Graduate Studies Agency of Brazil: committee for Mathematics and Statistics member; chair for Mathematics and Statistics.

CNPq – National Research Council of Brazil: chair for Mathematics and Statistics; directing council member.

FAPERJ – State of Rio de Janeiro Research Agency: chair for Mathematics and Statistics; directing council member (current)

IMPA – Instituto de Matemática Pura e Aplicada: chair for scientific activities; deputy director; director (current).

ICM – International Congress of Mathematicians: chair of organizing committee.

IMU – International Mathematical Union: executive committee member; vice-president.

MCoFA – Mathematical Council of the Americas: executive committee member (current); treasurer (current).

PROFMAT – Brazil’s nationwide master program for math teachers: co-founder; council chair.

SBM – Brazilian Mathematical Society: directing council member; vice-president; president.

SERRAPILHEIRA – private science funding organization: chair of scientific advisory board (current); board of trustees member (current).

TWAS – Academy of Sciences for the Developing World: membership committee member; membership committee chair; head of ROLAC – Regional Office for Latin America and the Caribbean.

UMALCA – Mathematical Union for Latin America and the Caribbean: scientific coordinator.

## SELECTED CONFERENCE ORGANIZATION

---

CLAM – Latin American Congresses of Mathematicians: chair of the scientific committee for CLAM 2004 and CLAM 2008.

ICM – International Congress of Mathematicians: chair of the organizing committee for ICM 2018.

MCA – Mathematical Congress of the Americas: steering committee member for MCA 2013, MCA 2017 and MCA 2021 (current).

## EDITORIAL

---

Editor for *Dynamics and Stability of Systems*, *Nonlinearity*, *Ergodic Theory & Dynamical Systems*, *Dynamical Systems: An International Journal*, *Portugaliae Mathematica*, *Discrete and Continuous Dynamical Systems*, *Stochastics and Dynamics*, *Nonlinear Differential Equations and Applications*, *Dynamics of Partial Differential Equations*, *Journal of the European Mathematical Society*, *Transactions of the London Mathematical Society* and *Bulletin of the Brazilian Mathematical Society* (Editor-in-Chief).

## GRANTS, PRIZES AND DISTINCTIONS

---

Undergraduate prizes, awarded by University of Porto: Gomes Teixeira 1983, Gomes Ribeiro 1983, Augusto Martins 1983 and Abílio Aires 1985.

Prize Eng. António José de Almeida for best undergraduate in Science, Porto, 1984.

Calouste Gulbenkian Foundation Fellowship, 1988–1990.

CNPq Research Grant, since 1991.

Guggenheim Foundation Fellowship, 1993–1994.

Plenary Speaker, International Congress of Mathematical Physics, Paris, 1994.

Invited Speaker, International Congress of Mathematicians, ICM Zurich, 1994.

Brazilian Academy of Sciences, member, elected in 1997.

Plenary Speaker, International Congress of Mathematicians, ICM Berlin, 1998.

TWAS Award in Mathematics, Academy of Sciences of the Developing World, 1998.

Cientista do Nosso Estado Grant, FAPERJ, since 1999.

National Order of Scientific Merit ("Grã Cruz"), decorated by the President of Brazil in 2000.

UMALCA Award, Mathematical Union for Latin America and the Caribbean, 2000.

TWAS - Academy of Sciences of the Developing World, member, elected in 2000.

Invited Professor, Collège de France, Paris, 2002.

Santaló Distinguished Lecturer, Universidad Complutense, Madrid, 2005.

Ramanujan Prize, International Center for Theoretical Physics, Trieste, 2005.  
Portuguese Academy of Sciences, Corresponding member, elected in 2006.  
Prize Universidade de Coimbra, 2007.  
Chilean Academy of Sciences, Corresponding member, elected in 2009.  
*Grande Cientista Brasileiro*, Universidade Federal Fluminense, 2009.  
Plenary Speaker, Latin American Congress of Mathematicians, CLAM Córdoba, 2012.  
Grand Prix Scientifique Louis D., Académie des Sciences de Paris, Institut de France, 2016.  
Prêmio Anísio Teixeira para a Educação Básica, CAPES, 2016.  
Cruz da Referência Nacional, ANCEC–Agência Nacional de Cultura, Empreendedorismo e Comunicação, 2017.  
Professor *Honoris Causa*, IEMA - Instituto Maranhense de Educação, Ciência e Tecnologia, 2018.  
National Order of Educational Merit ("Comendador"), decorated by the President of Brazil, 2018.  
CBMM Science Prize, Companhia Brasileira de Metalurgia e Mineração, 2019.  
Plenary Speaker, International Congress of Industrial and Applied Mathematics, ICIAM Valencia, 2019.  
ICTS Distinguished Lecturer, ICTS, Bangalore, 2019.

## PH.D. STUDENTS

---

Stefano Luzzatto, 1995: *Critical and singular dynamics in the Lorenz equations.*  
José Ferreira Alves, 1997: *SRB measures for nonhyperbolic systems with multidimensional expansion.*  
Maria João Costa, 1998: *Global strange attractors after collision of horseshoes with periodic sinks.*  
Isabel Lugão Rios, 1998: *Unfolding homoclinic tangencies inside horseshoes: hyperbolicity, fractal dimensions, and persistent tangencies.*  
Vítor Domingos Araújo, 1998: *Attractors and time averages for random maps.*  
Augusto Armando de Castro Júnior, 1998: *Backward inducing and exponential decay of correlations for partially hyperbolic attractors whose central direction is mostly contracting.*  
Vanderlei Minori Horita, 1999: *Hausdorff dimension of non-hyperbolic repellers derived from Anosov diffeomorphisms.*  
Alexandre Tavares Baraviera, 2000: *Robust nonuniform hyperbolicity for volume preserving maps.*  
Paulo Rogério Sabini, 2001: *Nonperiodic bifurcations at the boundary of hyperbolic systems.*  
Nivaldo Costa Muniz, 2001: *Hénon-like attractors in arbitrary dimensions: SRB measures and basin problem.*  
Jairo Bochi, 2001: *Zero Lyapunov exponents.*  
Flávio Abdenur, 2002: *Isolated transitive sets of  $C^1$  generic systems.*

Krerley Oliveira, 2002: *Equilibrium states for non-uniformly hyperbolic maps.*

Mychelle Dysman, 2003: *Hausdorff dimension of repellers of maps with holes.*

Carlos Matheus, 2004: *Contributions to the ergodic theory of non-hyperbolic systems.*

Alexander Arbieto, 2004: *Topics in conservative dynamics and related problems.*

Nuno Luzia, 2005: *A variational principle for dimension of a class of non-conformal repellers.*

Mário Bessa, 2005: *Lyapunov exponents of conservative continuous time systems.*

Martin Andersson, 2007: *Robustness of ergodic properties in partially hyperbolic dynamics.*

Jimmy Santamaria, 2007: *Cocycles over hyperbolic maps.*

Paulo Varandas, 2007: *Existence and stability of equilibrium states for non-uniformly expanding maps.*

Jiagang Yang, 2008:  *$C^1$  dynamics far from tangencies.*

Javier Solano, 2009: *Absolutely continuous invariant measures for non-uniformly expanding skew-products.*

Maria João Resende, 2009: *Exponential decay for the Teichmüller flow in the moduli space of quadratic differentials.*

Alien Herrera Torres, 2009: *Simplicity of the Lyapunov spectrum for multidimensional continued fraction algorithms.*

Carlos Bocker, IMPA, 2009: *Continuity of Lyapunov exponents for 2D random matrices.*

Mohammad Fanaee, 2010: *Simple cocycles over Lorenz attractors.*

José Régis Varão, 2012: *Absolute continuity for diffeomorphisms with non-compact center leaves.*

Michel Cambrinha, 2013: *Generic symplectic cocycles are hyperbolic.*

Vanessa Ramos, 2013: *Equilibrium states for hyperbolic potentials.*

Elaís Cidely Malheiro, 2014: *Lyapunov exponents of linear cocycles over Markov shifts.*

Ricardo Turola Bortolotti, 2014: *Physical measures for certain partially hyperbolic attractors on 3-manifolds.*

Lucas Backes, 2015: *On fiber-bunched cocycles: cohomology and Lyapunov exponents.*

Karina Marín, 2015:  *$C^r$ -density of (non-uniform) hyperbolicity for partially hyperbolic symplectic diffeomorphisms.*

Mauricio Poletti, 2016: *Simplicity of the Lyapunov spectrum for linear cocycles over certain partially hyperbolic maps.*

Andréa Midori Takai, 2017: *Perspectivas do PROFMAT: política pública em construção.*

El Hadji Yaya Tall, 2018: *Moduli of continuity of Lyapunov exponents of random  $GL(2)$ -cocycles.*

Adriana Sánchez, 2018: *Contributions to the continuity problem for Lyapunov exponents.*

Catalina Freijo, 2019: *Continuity of Lyapunov exponents for linear cocycles with a single holonomy.*

Jamerson Douglas Bezerra, 2020: *Randomness in hyperbolic dynamics.*

Sankhadip Chakraborty, 2021: *Hyperbolicity and rigidity for fibred partially hyperbolic systems*

## SELECTED INVITED LECTURES

---

- 1990 – *International Colloquium on Dynamical Systems*, ENS, Lyon. *International Conference on Dynamical Systems and Related Topics*, Nagoya.
- 1991 – *Dynamical Systems*, Mathematisches Forschungs Institut, Oberwolfach. *Workshop on Dynamical Systems*, Euler Institute, Saint-Petersburg.
- 1992 – *International Workshop on Dynamical Systems*, ICTP, Trieste. *Workshop on Dynamical Systems*, Mittag-Leffler Institute, Stockholm.
- 1993 – *Conference on Real and Complex Dynamics*, Copenhagen. *International Workshop on Dynamical Systems*, IMPA, Rio de Janeiro.
- 1994 – *International Conference on Dynamical Systems and Chaos*, Tokyo Metropolitan University. *International Conference on Dynamical Systems*, Landau Institute, Moscow.
- 1995 – *International Workshop on Dynamical Systems*, Montevideo. *International Colloquium Adrien Douady*, University of Paris-Sud.
- 1996 – *Annual Iranian Mathematical Conference*, Shiraz. *International Conference on Dynamical Systems*, Beijing. *Hyperbolic Systems with Singularities*, Schrödinger Institute, Vienna.
- 1997 – *International Congress on Dynamical Systems*, CIC, Cuernavaca. *Dynamical Systems*, Mathematisches Forschungs Institut, Oberwolfach.
- 1998 – *International Conference on Dynamical Systems*, KTH, Stockholm. *International Workshop on Dynamical Systems*, ICTP, Trieste.
- 1999 – *International Conference on Dynamical Systems*, IST, Lisboa. *EquaDiff 99*, Berlin.
- 2000 – *International Conference on Dynamical Systems*, ICMS, Edinburgh. *1st Latin-American Congress of Mathematicians*, IMPA. *International Conference on Dynamical Systems and Differential Equations*, Atlanta.
- 2001 – *Petrovskii Centenary Conference*, Moscow. *International Conference on Partial Hyperbolicity*, Northwestern University. *Dynamical Systems and Statistical Mechanics*, Erdős Center, Budapest.
- 2002 – *New Directions in Dynamical Systems*, Kyoto. *International Conference in honor of J. Mather*, Princeton. *Colloque Michael Herman*, Institut Henri Poincaré, Paris.
- 2003 – *Recent Trends in Dynamics*, Porto. *Equadiff 2003*, Hasselt.
- 2004 – *International Conference on Dynamical Systems in honor of J. Massera*, Montevideo. *Multidimensional Chaotic Systems*, Luminy. *International Conference in Honor of A. Katok*, Mathematical Sciences Research Institute.
- 2005 – *Nonlinear Science in Three Continents*, Consortium for the Americas, Santa Fe. *International Conference on Nonlinear Dynamics and Complexity*, NCTS, Taiwan. *Colloque International en Systèmes Dynamiques*, Bordeaux. *Brazil-France Inter-Academies Meeting*, Paris.
- 2006 – *Workshop on partial hyperbolicity, laminations, and Teichmüller flows*, Fields Institute, Toronto. *European Conference on Complex Systems*, Oxford. *International*

*Conference on Dynamical Systems*, Lima.  
 2007 – *Workshop on Dynamical Systems*, Penn State University.  
 2008 – *Mathematics in the World*, Hungarian Academy of Sciences, Budapest. *Santaló Conference*, Unión Matemática Argentina, Mendoza.  
 2009 – *Dynamical Trends in Analysis*, KTH, Stockholm. *Global Dynamics Beyond Uniform Hyperbolicity*, Peking University. *Encontro Brasil-França*, IMPA.  
 2010 – *Brazilian School on Dynamical Systems*, Maceió.  
 2011 – *Topological methods in Dynamical Systems*, Universidade de Campinas.  
 2012 – *International Conference on the Frontiers of Mathematics*, IMPA. *Palis-Balzan Symposium on Dynamical Systems*, IMPA.  
 2013 – *International Conference on Dynamics Beyond Uniform Hyperbolicity*, Bedlewo. *Palis-Balzan Symposium on Dynamical Systems*, Institut Henri Poincaré, Paris.  
 2014 – *ICTP 50 Years of Science for the Future*, International Centre for Theoretical Physics, Trieste.  
 2015 – *Surfing the Complexity*, Oviedo. *Joint Meeting AMS-EMS-SPM*, Porto. *Palis-Balzan Symposium*, IHP, Paris.  
 2016 – *IMU Colloquium*, RIMS, Kyoto. *Hoferfest*, ETH, Zurich.  
 2017 – *Conference in memory of J.-C. Yoccoz*, Collège de France, Paris.  
 2018 – Colloquium, University of Southern California, Los Angeles.  
 2019 – International Congress of Industrial and Applied Mathematics, Valencia. *Fields Symposium on the work of Artur Avila*, Fields Institute, Toronto.

## RESEARCH PAPERS

---

*The differentiability of the hairs of  $\exp(z)$* , Procs. A. M. S. Vol 103, 4 (1988), 1179–1184.  
*Continuity of Hausdorff dimension and limit capacity for horseshoes*, with J. Palis, *Dynamical Systems*, Lect. Notes in Math. 1331, 150–160, Springer Verlag (1988).  
*Discontinuity of Hausdorff dimension and limit capacity on arcs of diffeomorphisms*, with L. J. Díaz, *Ergod. Th. & Dynam. Sys.* 9 (1989), 403–425.  
*Abundance of strange attractors*, with L. Mora, *Acta Math.* 171 (1993), 1–71.  
*Strange attractors in higher dimensions*, *Bull. Braz. Math. Soc.* 24 (1993), 13–62.  
*High dimension diffeomorphisms displaying infinitely many periodic attractors*, with J. Palis, *Annals of Math.* 140 (1994), 207–250.  
*Discontinuity of the Hausdorff dimension of hyperbolic sets*, with C. Bonatti and L. J. Díaz, *C.R.A.S.* 320, série I (1995), 713–718.  
*Strange attractors in saddle-node cycles: prevalence and globality*, with L. J. Díaz and J. Rocha, *Invent. Math.* 125 (1996), 37–74.

- Strong stochastic stability and rate of mixing for unimodal maps*, with V. Baladi, Annales Sci. E.N.S. série 4, t-29 (1996), 483–517.
- Multidimensional nonhyperbolic attractors*, Publ. Math. IHES. 85 (1997), 63–96.
- Lorenz-like attractors with arbitrary unstable dimension*, with C. Bonatti and A. Pumarino, C.R.A.S. 325, série I (1997), 883–888.
- Infinite-modal maps with global chaotic behavior*, with M. J. Pacifico and A. Rovella, Annals of Math. 148 (1998), 1–44.
- Positive Lyapunov exponents for Lorenz-like families with criticalities*, with S. Luzzatto, Astérisque 261 (2000), 201–237.
- SRB measures for partially hyperbolic systems whose central direction is mostly contracting*, with C. Bonatti, Israel Journal of Math. 115 (2000), 157–193.
- SRB measures for partially hyperbolic systems whose central direction is mostly expanding*, with J. F. Alves and C. Bonatti, Invent. Math. 140 (2000), 351–398.
- Solution of the basin problem for Hénon-like attractors*, with M. Benedicks, Invent. Math. 143 (2001), 375–434.
- Homoclinic bifurcations and fractal invariants in arbitrary dimension*, with C. G. Moreira and J. Palis, C.R.A.S. 333 (2001), 475–480.
- Hausdorff dimension for non-hyperbolic repellers I. Maps with holes*, with V. Horita, J. Statistical Physics 105 (2001), 835–862.
- Statistical stability for a robust class of maps with non-uniform expansion*, with J. F. Alves, Ergod. Th. & Dynam. Sys. 22 (2002), 1–32.
- Uniform (projective) hyperbolicity or no hyperbolicity: a dichotomy for generic conservative systems*, with J. Bochi, Annales Sci. Inst. Henri Poincaré - Analyse Non-Linéaire 19 (2002), 113–123.
- Généricité d'exposants de Lyapunov non-nuls pour des produits déterministes de matrices*, with C. Bonatti and X. Gomez-Mont, Annales Sci. Inst. Henri Poincaré - Analyse Non-Linéaire 20 (2003), 579–624.
- Parameter exclusions in Hénon-like systems*, with S. Luzzatto. Russian Math. Surveys 58 (2003), 1053–1092.
- Lyapunov exponents with multiplicity 1 for deterministic products of matrices*, with C. Bonatti, Ergod. Th. & Dynam. Sys. 24 (2004), 1295–1330.
- Abundance of stable ergodicity*, with C. Bonatti, C. Matheus, A. Wilkinson, Commentarii Math. Helvetici 79 (2004), 753–757.

*The Lyapunov exponents of generic volume preserving and symplectic systems*, with J. Bochi, *Annals of Mathematics* 161 (2005) 1423–1485.

*Hausdorff dimension for non-hyperbolic repellers II: DA diffeomorphisms*, with V. Horita, *Discrete & Continuous Dynamical Systems* 13 (2005), 1125–1152.

*Dynamics in the moduli space of Abelian differentials*, with A. Avila, *Portugaliae Mathematica* 62 (2005) 531–547.

*Random perturbations and statistical properties of Hénon-like maps*, with M. Benedicks, *Annales Sci. Inst. Henri Poincaré - Analyse Non-Linéaire* 23 (2006), 713–752.

*Ergodic theory of interval exchange maps*, *Revista Matemática Complutense* 19 (2006), 7–100.

*Existence and uniqueness of maximizing measures for robust classes of local diffeomorphisms*, with K. Oliveira, *Discrete & Continuous Dynamical Systems* 15 (2006), 225–236.

*Simplicity of Lyapunov spectra: a sufficient criterion*, with A. Avila, *Portugaliae Mathematica* 64 (2007) 311–376.

*Simplicity of Lyapunov spectra: proof of the Zorich-Kontsevich conjecture*, with A. Avila, *Acta Mathematica* 198 (2007), 1–56.

*Lyapunov exponents of Teichmüller flows*, *Fields Institute Communications* 51 (2007) 139–201.

*Almost all cocycles over any hyperbolic system have non-zero Lyapunov exponents*, *Annals of Mathematics* 167 (2008), 643–680.

*Thermodynamical formalism for an open class of potentials and non-uniformly hyperbolic systems*, with K. Oliveira, *Ergod. Th & Dynam. Sys.* 28 (2008), 501–533.

*Singular hyperbolic attractors are chaotic*, with V. Araújo, M. J. Pacifico, E. Pujals, *Trans. Amer. Math. Soc.* 361 (2009), 2431–2485.

*Invariant measures for interval maps with critical points and singularities*, with V. Araújo and S. Luzzatto, *Advances in Mathematics* 221(2009), 1428–1444.

*Existence, uniqueness, and stability of equilibrium states for non-uniformly expanding maps*, with P. Varandas, *Annales Sci. Inst. Henri Poincaré - Analyse Non-Linéaire* 27(2010), 555–593.

*Extremal Lyapunov exponents: an Invariance Principle and applications*, with A. Avila, *Inventiones Mathematicae* 181(2010), 115–189.



- Entropy conjecture for diffeomorphisms away from tangencies*, with G. Liao and J. Yang, Journal of the European Mathematical Society 15 (2013), 2043–2060.
- Physical measures and absolute continuity for one-dimensional center direction*, with J. Yang, Annales Sci. Inst. Henri Poincaré - Analyse Non-Linéaire 30 (2013), 845–877.
- Cocycles over partially hyperbolic maps*, with A. Avila, J. Santamaria, and A. Wilkinson, Astérisque 358 (2013) 1–12.
- Holonomy invariance: rough regularity and applications to Lyapunov exponents* with A. Avila and J. Santamaria, Astérisque 358 (2013) 13–74.
- Absolute continuity, rigidity, and Lyapunov exponents I: geodesic flows*, with A. Avila, A. Wilkinson, Journal of the European Mathematical Society 17 (2015), 1435–1462.
- Lyapunov exponents of linear cocycles over Markov shifts*, with Elaís C. Malheiro, Stochastics & Dynamics 15 (2015), 1550020, 27 pp.
- Geometric and measure-theoretical structures of maps with mostly contracting center*, with D. Dolgopyat and J. Yang, Comm. Math. Physics. 341 (2016), 991–1014.
- Equilibrium states for hyperbolic potentials*, with V. Ramos, Nonlinearity 30 (2017), 825847.
- Measure-theoretical properties of center foliations*, with J. Yang, Contemporary Math. 692 (2017), 291–320.
- Continuity of Lyapunov exponents for 2D random matrices*, with C. Bocker, Ergod. Th. & Dynam. Syst. 37 (2017), 1413–1442.
- Lyapunov exponents of probability distributions with non-compact support*, with A. Sánchez, preprint 2018.
- Continuity of Lyapunov exponents in the  $C^0$  topology*, with J. Yang, Israel J. of Math. 229 (2019), 461–485.
- Simple Lyapunov spectrum for certain linear cocycles over partially hyperbolic maps*, with M. Poletti, Nonlinearity 32 (2019), 238–284.
- Moduli of continuity for the Lyapunov exponents of random  $GL(2)$ -cocycles*, with E. Y. Tall, Trans. Amer. Math. Soc. 373 (2020), 1343–1383.
- (Dis)continuity of Lyapunov exponents*. Ergod. Th. & Dynam. Sys. 40 (2020), 577–611.
- Stable accessibility with 2-dimensional center*, with A. Avila, Astérisque 416 (2020), 301–320.
- Maximal entropy measures of diffeomorphisms of circle fiber bundles*, with R. Ures and J. Yang, Journal of the London Math. Soc., 103 (2021), 1016–1034.

*Partially volume expanding diffeomorphisms*, with S. Gan, M. Li and J. Yang, *Annales Henri Poincaré*, 22 (2021), 331–346.

*Absolute continuity, rigidity, and Lyapunov exponents II: systems with compact center leaves*, with A. Avila and W. Wilkinson, *Ergod. Th. & Dynam. Sys.* 42 (2022), 437–490.

*Thermodynamical  $u$ -formalism I: measures of maximal  $u$ -entropy for maps that factor over Anosov*, with R. Ures, F. Yang and J. Yang, preprint 2020.

*Hyperbolicity and rigidity for fibred partially hyperbolic systems*, with S. Chakraborty, preprint 2022.

## BOOKS

---

*Stochastic dynamics of deterministic systems*, 196 pages, XXI Braz. Math. Colloq., IMPA, Rio de Janeiro, 1997. ISBN 978-852-4401-26-8.

*Lecture notes on attractors and physical measures*, 102 pages, monograph XIII ELAM, IMCA-Lima, 1998.

*Geometric methods in Dynamics (I)*, with W. de Melo and J.-C. Yoccoz (ed), *Astérisque* 286 (2003), xxviii+308 pages. ISBN 978-285-6291-38-2

*Geometric methods in Dynamics (II)*, with W. de Melo and J.-C. Yoccoz (ed), *Astérisque* 287 (2003), xxii+272 pages. ISBN 978-285-6291-39-9

*Dynamics beyond uniform hyperbolicity: A global geometric and probabilistic perspective*, with C. Bonatti and L. J. Díaz. *Encyc. Math. Sciences*, vol 102, xviii+384 pages, Springer Verlag, 2004. ISBN 978-3-540-26844-4.

*Fundamentos da Teoria Ergódica*, xvi + 496 pages, with K. Oliveira, *Coleção Fronteiras da Matemática*, Sociedade Brasileira de Matemática, 2014. ISBN 978-85-8337-119-9.

*Lectures on Lyapunov exponents*, x + 202 pages, Cambridge University Press, 2014. ISBN 978-110-7081-73-4

*Dynamics, games and science*, with J.-P. Bourguignon, R. Jeltsch and A. A. Pinto (ed), *CIM Series in Mathematical Sciences* 1, xviii+772 pages, Springer Verlag, 2015. ISBN 978-3-319-16118-1.

*Mathematics of energy and climate change*, with J.-P. Bourguignon, R. Jeltsch and A. A. Pinto (ed), *CIM Series in Mathematical Sciences* 2, xvi+430 pages, Springer Verlag, 2015. ISBN 978-3-319-16121-1.

*Foundations of Ergodic Theory*, with K. Oliveira, Cambridge University Press, xvi + 530 pages, 2016. ISBN 978-131-6422-60-1.

*Proceedings of the International Congress of Mathematicians, ICM 2018 Rio de Janeiro*, with B. Sirakov and P. N. de Souza (ed), vols 1–4, Brazilian Mathematical Society & World Scientific, 2019. ISBN 978-981-3272-87-3.

*Fundamentos da Teoria Ergódica*, approx. 500 pages, with K. Oliveira, 2<sup>a</sup> edição, Coleção Fronteiras da Matemática, Sociedade Brasileira de Matemática, 2019. ISBN 978-85-8337-017-8.

*Differential equations: a dynamical systems approach to theory and practice*, approx. 500 pages, with J. Espinar and the collaboration of G. T. Goedert and H. Mesa, Graduate Studies in Mathematics, Volume 212, American Mathematical Society, 2021. ISBN 978-1-4704-5114-1.

## PROCEEDINGS, SURVEYS, ENCYCLOPEDIA ARTICLES

---

*Persistence of strange attractors when unfolding homoclinic tangencies*, in Dynamical Systems and Related Topics, K. Shiraiwa (ed.), Advanced Series in Dynamical Systems 9, 539-549, World Scientific 1990.

*Prevalence of Hénon-like attractors in the unfolding of saddle-node cycles*, Procs. XVIII Braz. Math. Colloquium, IMPA, Rio de Janeiro, 1991.

*Homoclinic bifurcations and strange attractors*, in Real and Complex Dynamical Systems, B. Branner, P. Hjorth (eds.), NATO ASI Series C-464, 231-264, Kluwer Academic Publishers, Dordrecht, 1995.

*Chaotic dynamical behaviour*, in Procs. XI International Congress of Mathematical Physics ICMP94 Paris, D. Iagolnitzer (ed.), 142-154, International Press, Boston, 1995.

*Homoclinic bifurcations and persistence of nonuniformly hyperbolic attractors*, in Procs. International Congress of Mathematicians, ICM94 Zurich, 1221-1229, Birkhäuser, Basel, 1995.

*Global attractors and bifurcations*, in Nonlinear Dynamical Systems and Chaos, H.W. Broer, S.A. van Gils, I. Hoveijn, F. Takens (eds.), Progress in Nonlinear Partial Differential Equations and Applications (PNLDE no 19), 299-324, Birkhäuser, 1996.

*The statistics of attractors*, Procs. 27th Annual Iranian Mathematical Conference (1996), Shiraz University, Iran, 305–318.

*Dynamics: a probabilistic and geometric perspective*, Documenta Mathematica - ICM98 Berlin vol. 2 (1998), 557-578.

*Towards a theory of chaotic dynamics*, 1998 Award Lecture, Procs. Third World Academy of Sciences, 2000.

*What's new on Lorenz strange attractors ?*, Math. Intelligencer 22-3 (2000), 6-19.

*Lorenz attractors with arbitrary expanding dimension*, with C. Bonatti and A. Pumarino, International Conference on Differential Equations, Vol. 1, 2 (Berlin, 1999), 39–44, World Sci. Publishing, 2000.

*Dynamical Systems: moving into the next century*, in Mathematics Unlimited: 2001 and Beyond, 1167–1178. Springer Verlag.

*The intermittency route to chaotic dynamics*, with L. J. Díaz and I. L. Rios, in Global Analysis of Dynamical Systems (F. Takens Festschrift), H. Broer, B. Krauskopf, G. Vegter (eds.), 309–327, IOP Publ., 2001.

*Pisa lectures on Lyapunov exponents*, with J. Bochi, in Dynamical Systems. Part II: Topological, geometrical and ergodic properties of dynamics, 23–47. Scuola Normale Superiore, Pisa, 2004.

*Lyapunov exponents and strange attractors*, Encyclopedia of Mathematical Physics, eds. J.-P. Francoise, G.L. Naber and Tsou S.T., Elsevier, 2006, volume 3, page 349.

*Géométrie et dynamique des surfaces plates*, Images des Mathématiques 2006, 147–154.

*Hyperbolic dynamical systems*, with V. Araújo, Encyclopedia of Complexity and Systems Science, Ed. Robert M. Meyers, Springer Verlag, 2008, 4723–4737.

## POPULARIZATION, MAGAZINES, NEWSPAPERS

---

*Avaliação objetiva (?) da Ciência*, Jornal da Ciência, July 7, 2008.

*Jornadas de IC: realizações, desafios e oportunidades*, with H. N. Lopes, R. I. Oliveira, W. Santos. Matemática Universitária 44 (2008), 34–38.

*Mathematical Congress of the Americas*, with S. Friedlander, Notices of the A.M.S., February 2012.

*Geometria e dinâmica das superfícies planares*, Revista Matemática Universitária 52/53 (2012), Sociedade Brasileira de Matemática, 2015.

*Math in Brazil: sowing the seeds*, Notices of the A.M.S., March, 2017.

*Teoremas e emoções*, Magazine Quatro Cinco um, October 2020.

Folha de São Paulo newspaper, weekly column since March 3, 2017.