

Carlos Henrique Grossi Ferreira

CONTACT AND PERSONAL INFORMATION

Institute of Mathematical and Computer Sciences
Department of Mathematics
University of São Paulo
Av. Trabalhador São-Carlense 400
São Carlos, São Paulo 13566 Brazil

Email: grossi@icmc.usp.br
Phone: +55 16 993572569
Born: May 1980
Citizenship: Brazilian

RESEARCH INTERESTS

Geometric structures on manifolds, especially (complex) hyperbolic structures on low-dimensional manifolds; natural classification/moduli problems in classic geometries; geometry at infinity; volume-related problems in three-dimensional real hyperbolic geometry.

EDUCATION

State University of Campinas, Campinas, Brazil

Ph. D. in Mathematics, Sept. 2006

- Thesis: Elementary tools for classic and complex hyperbolic geometries
- Advisor: Alexander Anan'in

B. Sc. in Mathematics, 2001.

PROFESSIONAL HISTORY

Associate professor at the University of São Paulo
(ICMC USP São Carlos)

since Jan. 2016

Assistant professor at the University of São Paulo
(ICMC USP São Carlos)

Feb. 2011 to Dec. 2015

VISITING POSITIONS

Guest at the Max-Planck-Institut für Mathematik
(MPIM, Bonn, Germany)

1–31 Dec. 2012

Postdoctoral fellow at the Max-Planck-Institut für
Mathematik (MPIM, Bonn, Germany)

1 Jan. –31 Dec. 2009

Guest at the Institut des Hautes Études Scien-
tifiques (IHES, France)

1–31 Dec. 2008

Visiting assistant professor at the Federal Univer-
sity of the ABC (UFABC, Brazil)

1 Jan. –31 Sept. 2008

Postdoctoral fellow at the University of Minas
Gerais (UFMG, Brazil)

1 Dec. 2006–31 Nov. 2007

HONORS AND AWARDS

Guest of honor of the Mathematics Class of 2019 (to give the Commencement Speech
31 Jan. 2020)

Teaching Award “Horácio Carlos Panepucci” 2017 (for a course delivered to the Physical and Biomolecular Sciences Class in the first semester of 2017)

Teaching Award “Horácio Carlos Panepucci” 2017 (for a course delivered to the Computational Physics Class in the first semester of 2017)

Teaching Award “Horácio Carlos Panepucci” 2015 (for a course delivered to the Theoretical Physics Class in the first semester of 2014)

Teaching Award 2011 (for a course delivered to the Computer Engineering Class in the first semester of 2011)

Level 2 researcher of the National Council for Scientific and Technological Development (CNPq, Brazil) from Mar. 2013 to Feb. 2015

PAPERS AND
PUBLICATIONS

- [1] F. A. Franco, C. H. Grossi
Special elliptic isometries, relative $SU(2, 1)$ -character varieties, and bendings,
submitted for publication. Available at arXiv:1908.10434
- [2] Y. Vaz, R. F. de Mello, C. H. Grossi
Coarse-refinement dilemma: on generalization bounds for data clustering,
submitted for publication. Available at arXiv:1911.05806
- [3] S. Anan'in, C. H. Grossi, J. Lee, J. dos Reis jr
Hyperbolic 2-spheres with cone singularities,
submitted for publication. Available at arXiv:1801.00465
- [4] O. Cussy, C. H. Grossi,
Seidel's conjectures in hyperbolic 3-space,
Transformation Groups, accepted for publication (2019)
- [5] R. F. de Mello, Y. Vaz, C. H. Grossi, A. Bifet
On Learning Guarantees to Unsupervised Concept Drift Detection on Data Streams,
Expert Systems with Applications **117** (2018), 90–102
- [6] S. Anan'in, C. H. Grossi, E. C. B. Goncalves
Grassmannians and conformal structures on absolutes,
Adv. Appl. Clifford Algebr. **29** (2018), 1–10
- [7] C. H. Grossi
Complex hyperbolic bundles and the turnover,
Habilitation Thesis
University of São Paulo, 2015 (in Portuguese)
- [8] S. Anan'in, C. H. Grossi, J. C. C. da Silva
Poincaré's polyhedron theorem for cocompact groups in dimension 4,
Mosc. Math. J. **14** (2014), 645–667
- [9] S. Anan'in, C. H. Grossi
Differential geometry of grassmannians and Plücker map,
Cent. Eur. J. Math. **10** (2012), No. 3, 873–884
- [10] S. Anan'in, C. H. Grossi
Coordinate-free classic geometries,
Mosc. Math. J. **11** (2011), No. 4, 633–655

- [11] S. Anan'in, C. H. Grossi,
Yet another Poincaré's polyhedron theorem,
 Proc. Edinburgh Math. Soc. **54** (2011), 297–308
- [12] S. Anan'in, C. H. Grossi, N. Gusevskii,
Complex hyperbolic structures on disc bundles over surfaces,
 Int. Math. Res. Not. **2011** (2010), 4295–4375
- [13] S. Anan'in, C. H. Grossi,
Basic coordinate-free non-Euclidean geometry,
 Draft of a book (2011). Available at arXiv:1107.0346
- [14] C. H. Grossi
On the type of triangle groups,
 Geom. Dedicata **130** (2007), 137–148

REMARKS

In [4], we solved a conjecture published by J. J. Seidel in 1986.

In [14], we solved a conjecture published by R. E. Schwarz in 2002 (in the Proceedings of the International Congress of Mathematicians 2002).

SELECTED TALKS

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| <i>The “lume” of hyperbolic tetrahedra: a proof of Seidel’s conjectures</i> | May 2018 |
| SP Geometry Seminar UNICAMP, Campinas, Brazil | |
| <i>Spherical and hyperbolic 2-spheres</i> | Nov. 2016 |
| IME-USP Dynamical Systems Seminar USP, São Paulo, Brazil | |
| <i>Complex hyperbolic bundles and the Kalashnikov</i> | Oct. 2015 |
| Workshop on geometric structures, Hitchin Components, and Representation Varieties KIAS, Seoul, Republic of Korea | |
| <i>Coordinate-free aspects of hyperbolic geometries</i> | Oct. 2015 |
| Workshop on geometric structures, Hitchin Components, and Representation varieties KIAS, Seoul, Republic of Korea | |
| <i>Complex hyperbolic geometry, disc bundles, and the Kalashnikov</i> | Sept. 2015 |
| Brazilian Mathematical Colloquium IMPA, Rio de Janeiro, Brazil Video (in Portuguese) available at https://www.youtube.com/watch?v=dyh72AweCMA | |
| <i>Complex hyperbolic bundles and the turnover</i> | Oct. 2012 |
| Geometry Seminar IMPA, Rio de Janeiro, Brazil | |
| <i>Poincaré’s polyhedron theorem for compact 4-manifolds</i> | Aug. 2012 |
| The Fourth Geometry Meeting (dedicated to the centenary of A. D. Alexandrov) EIMI, Saint Petersburg, Russia | |

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| <i>Constructing (complex) hyperbolic manifolds</i> | Jul. 2011 |
| LMS EPSRC Symposium Geometry and Arithmetic of Lattices Durham University, Durham, England Video available at http://www.maths.dur.ac.uk/events/Meetings/LMS/2011/GAL11/talks.html | |
| <i>Complex hyperbolic disc bundles</i> | Feb. 2010 |
| Staff Colloquium University of Utrecht, Utrecht, Netherlands | |
| <i>A local form of Poincaré's Polyhedron Theorem</i> | Sept. 2009 |
| Topics in Topology Seminar MPIM, Bonn, Germany | |
| <i>Complex hyperbolic disc bundles</i> | Aug. 2009 |
| Geometry at Lisbon IST, Lisbon, Portugal | |
| <i>Some geometrical structures in classic geometries</i> | Jul. 2009 |
| Oberseminar MPIM, Bonn, Germany | |
| <i>How to build complex hyperbolic disc bundles</i> | Apr. 2009 |
| Oberseminar Differentialgeometrie MPIM, Bonn, Germany | |
| <i>Complex hyperbolic disc bundles</i> | Jul. 2007 |
| Brazilian Mathematical Colloquium IMPA, Rio de Janeiro, Brazil | |

OTHER TALKS

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| <i>Classic Geometries: physicists needed! (Part I)</i> | Sept. 2019 |
| Coffee with Physics IFSC-USP, São Carlos | |
| <i>Classic Geometries: physicists needed! (Part II)</i> | Sept. 2019 |
| Coffee with Physics IFSC-USP, São Carlos | |
| <i>Invariants of (complex) hyperbolic manifolds</i> | Dec. 2014 |
| First Brazilian Meeting of Young Researchers in Mathematics and Applied Mathematics IME-USP São Paulo | |
| <i>Constructing hyperbolic manifolds (not necessarily real ones)</i> | Oct. 2014 |
| North Region Mathematical Colloquium UFAM, Manaus, Brazil | |
| <i>Complex hyperbolic bundles and the turnover</i> | Oct. 2013 |
| Geometry Seminar at IME-USP USP, São Paulo, Brazil | |
| <i>Natural constructions in classic geometries</i> | Sept. 2013 |
| Second Mathematics Week IMECC-UNICAMP, Campinas, Brazil | |
| <i>Some simple structures in classic geometries</i> | Sept. 2011 |
| XXII Mathematics Week UEM, Maringá, Brazil | |

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| | <i>A brief introduction to classic geometries</i> XXII Mathematics Week UEM, Maringá, Brazil | Sept. 2011 |
| | <i>Classic geometries, hyperbolic manifolds, and the turnover</i> MAP Department Colloquium USP, São Paulo, Brazil | Mar. 2013 |
| | <i>Linear methods in classic geometries</i> II Workshop in Complex Hyperbolic Geometry ma non tanto UFMG, Belo Horizonte, Brazil | Dec. 2008 |
| | <i>Complex hyperbolic bundles</i> II Workshop in Complex Hyperbolic Geometry ma non tanto UFMG, Belo Horizonte, Brazil | Dec. 2008 |
| | <i>Natural constructions in classic geometries</i> Graduate Seminar UFABC, Santo André, Brazil | Oct. 2008 |
| | <i>An approach to classic geometries with applications</i> First Scientific Meeting of Graduate Students IMECC-UNICAMP, Campinas, Brazil | Oct. 2004 |
| | <i>Gauge theory - from physics to mathematics and vice-versa</i> Young Researchers Meeting IFGW-UNICAMP, Campinas, Brazil | Sept. 2004 |
| | <i>Quaternions and real hyperbolic geometry</i> Groups, Rings and Group Rings Ubatuba, Brazil | Jul. 2004 |
| | <i>Complex hyperbolic structures on disc bundles over surfaces</i> Brazilian Topology Meeting UNICAMP, Campinas, Brazil | Jul. 2004 |
| | <i>Geometry, topology, and physics: the Aharonov-Bohm effect and other bagatelles</i> Graduate Seminar of the Physics Institute Gleb Wataghin IFGW-UNICAMP, Campinas, Brazil | Mar. 2004 |
| | <i>An introduction to classic geometries</i> Mathematics Week IMECC-UNICAMP, Campinas, Brazil | Mar. 2004 |
| | <i>Building complex hyperbolic manifolds</i> Ivan Chestakov's Group Seminar IME-USP, São Paulo, Brazil | Aug. 2002 |
| GENERAL AUDIENCE TALKS | <i>The basic sciences in the age of artificial intelligence</i> Invited lecture at a Medal Ceremony of a Mathematics Olympiad IECJ, Bragança Paulista, Brazil | Nov. 2019 |
| | <i>Golden ratio and Fibonacci numbers in music and arts</i> Invited talk at the São Carlos City Theatre Joint with pianist and professor Caio Pagano (Arizona State) Video (in Portuguese) available at https://www.youtube.com/watch?v=tQyliD2HWdk&t=2996s São Carlos, Brazil | Jul. 2016 |

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| $1 + 2 + 3 + \dots = -1/12?$ The Seminar of Cool Stuff ICMC-ISP, São Carlos | April 2015 |
| <i>Nature (is) in the morphisms</i> “Philosophysics” Seminar IFSC-USP, São Carlos | May 2014 |
| <i>Mathematics and Physics: two sciences in front of a mirror?</i> “Philosophysics” Seminar IFSC-USP, São Carlos | Oct. 2014 |
| <i>Dr. Strangelove or: How I Learned to Stop Worrying and to Look for the Bomb</i> The Seminar of Cool Stuff (The subject was the Elitzur-Vaidman bomb tester in quantum mechanics) ICMC-USP, São Carlos | April 2014 |
| <i>Can you make a tetrahedron out of a cube?</i> Undergraduate Mathematics Meeting ICMC-USP São Carlos | Jun. 2014 |
| <i>Exotic Smoothness or Smooth Exoticness?</i> The Seminar of Cool Stuff ICMC-USP São Carlos | Apr. 2013 |
| <i>Paradoxes?</i> The Seminar of Cool Stuff ICMC-USP São Carlos | Mar. 2013 |
| <i>Euclidean Geometry (way) after Euclides</i> The Seminar of Cool Stuff ICMC-USP São Carlos | Apr. 2012 |
| <i>Solving a math problem through democracy</i> The Seminar of Cool Stuff ICMC-USP São Carlos | May 2011 |

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| OTHER EVENTS | Algebraic Geometry and Hyperbolic Geometry - New Connections Cabo Frio, Rio de Janeiro, Brazil | 2013 |
| | Differentialgeometrie im Grossen MFO, Oberwolfach, Germany | 2009 |
| | Geometry Master Class IRMA, Strasbourg, France | 2009 |
| | Matematische Arbeitstagung MPIM, Bonn, 2009 | 2009 |
| | Séminaire M. A. T. : autour des travaux d’A. Grothendieck University of Montpellier, Montpellier, France | 2009 |
| | The Geometry Summer School IST, Lisbon, 2009 | 2009 |

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| CONFERENCE ORGANIZATION | <p><i>Hyperbolicity 2015</i> Ilhabela, Brazil Organizing committee: S. Anan'ın, I. Chel'tsov, C. H. Grossi Scientific committee: M. V. Belolipetsky, F. Bogomolov, M. Jardim, J. V. Pereira, M. Verbitsky, A. Zorich</p> <p><i>New interactions of combinatorics and probability - CIMPA School</i> ICMC-USP, São Carlos, Brazil Organizing committee: P. A. F. da Veiga, C. H. Grossi, I. Onnis, P. M. Rodriguez Scientific committee: K. Ebrahimi-Fard, P. A. F. da Veiga, L. R. G. Fontes, A. Guionnet, H. Munthe-Kaas, A. Wiese, R. Speicher</p> | Jan. 2015 Aug. 2015 |
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| THESIS ADVISED | <p><i>On spaces of special elliptic n-gons</i> Felipe de Aguilar Franco Doctoral thesis</p> <p><i>Disc bundles over surfaces uniformized by the holomorphic bidisc</i> Sidnei Furtado Costa Doctoral thesis</p> <p><i>A proof of Seidel's conjectures on the volume of ideal tetrahedra in hyperbolic 3-space</i> Omar Chavez Cussy Master's thesis</p> <p><i>On Coxeter-Toda lattices</i> Eber Daniel Chuño Vizarreta Co-advised with Igor Mencattini, Doctoral Thesis</p> | 2018 2017 2017 2016 |
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| PRESENT STUDENTS | <p><i>Manifolds uniformized by the holomorphic 2-ball</i> Hugo Cattarucci Botós Ph. D. student</p> <p><i>Hyperbolic polyhedra: volume and hyperbolic 3-manifolds</i> Omar Chavez Cussy Ph. D. student</p> <p><i>Classic geometries on Grassmannians</i> Clarissa Bergo Andrade Ph. D. student</p> <p><i>Life in arrows: an introduction to applied category theory</i> Violeta Martins de Freitas M. Sc. student Defense scheduled for December 17 2019</p> <p><i>Hyperbolic spheres with cone singularities</i> João dos Reis Jr. M. Sc. student Defense planned for January 2020</p> <p><i>Special relativity and hyperbolic geometry</i> Rafael Ferreira Pereira M. Sc. student</p> | |

Defense planned for February 2020

Real hyperbolic disc bundles over surfaces and the Gromov-Lawson-Thurston conjecture

Philippe Valdeci Chiovetto

M. Sc. student

Defense planned for March 2020

Geometric structures on manifolds

André Ricardo Rios Baylon

M. Sc. student

An introduction to QTFT

Christian Vilas Boas Lemos

M. Sc. student

UNDERGRADUATE
STUDENTS
ADVISED

An introduction to projective models in classic geometries

José Augusto dos Santos

CNPq (in progress)

An introduction to schemes

Frederico Rossetto Bianchini

FAPESP (in progress)

An introduction to Riemann surfaces and to hyperbolic geometry

Caio Oliveira da Silva

PUB-USP (2018)

Negative curvature and the Gromov, Lawson, and Thurston conjecture

Gabriel Nogueira Malta

FAPESP (2017)

An introduction to classic geometries

Maíra Duran Baldissera

CNPq (2017)

Metric functors in classic geometries

Rafael Ferreira Pereira

FAPESP (2016)

Elements of topology, analysis, and algebra

Gabriel Nogueira Malta

CNPq (2015)

Connections in principal bundles and the Aharonov-Bohm effect

Iago Israel

FAPESP (2015)

Differential geometry of surfaces

Ricardo Domingos dos Santos Júnior

CNPq (2014)

Hyperbolic geometry and special relativity

Alisson Almeida Bueno

CNPq (2014)

Causal structure of the anti de Sitter space

Matheus do Carmo Teodoro

FAPESP (2012)

Passion for math: square wheeled bicycle
Leonardo Soares de Oliveira and Natalia Ribeiro Iniesta
FUSP (2011)

General relativity and hyperbolic geometry 2017
Rafael Ferreira Pereira
Undergraduate thesis

Geometric structures on the absolute 2017
Henrique Pimenta Marçal
Undergraduate thesis

COURSEWORK

Undergraduate coursework is marked with a “U” and graduate coursework is marked with a “G”. A subject indicated twice means that two different classes of that same subject were taught at the corresponding semester.

University of São Paulo - ICMC USP São Carlos

- ❑ First semester 2011
 - Discrete Mathematics II (U)
 - Analytic Geometry (U)
- ❑ Second semester 2011
 - Analytic Geometry (U)
 - Affine and Projective Geometry (U)
- ❑ First semester 2012
 - Calculus I (U)
 - Axiomatic Geometry (U)
- ❑ Second semester 2012
 - An Introduction to Lie Groups (U)
 - Lie Groups (G)
- ❑ First semester 2013
 - Differential Geometry (U)
 - Smooth manifolds (G)
- ❑ Second semester 2013
 - Calculus II (U)
 - Differential Geometry of Surfaces (G)
- ❑ First semester 2014
 - Calculus I (U)
 - Calculus I (U)
- ❑ Second semester 2014
 - Affine and Projective Geometry (U)
- ❑ First semester 2015
 - Analytic Geometry (U)
 - Algebra I: Group theory (U)
 - Geometric structures on manifolds (G)
 - Hyperbolic Geometry (G)
- ❑ Second semester 2015
 - Linear Algebra (U)

- ❑ First semester 2016
 - Introduction to Lie Groups (U)
 - The course was (poorly) recorded and is available at the channel https://www.youtube.com/channel/UCc_VvbBr-sp7_5Gn-gCyjFg
 - Smooth manifolds (G)
 - ❑ Second semester 2016
 - Topics in Mathematics: Riemann Surfaces (U)
 - Geometric structures on manifolds (G)
 - ❑ First semester 2017
 - Linear Algebra and Analytic Geometry (U)
 - Linear Algebra and Analytic Geometry (U)
 - ❑ Second semester 2017
 - Geometry I (G)
 - ❑ First semester 2018
 - Differential Geometry (U)
 - Calculus III (U)
 - ❑ Second semester 2018
 - Calculus II (U)
 - Calculus III (U)
 - Hyperbolic Geometry (G)
 - ❑ First semester 2019
 - Topics in Mathematics: Riemann Surfaces (U)
 - Riemannian Geometry (G)
 - ❑ Second semester 2019
 - Topics in Mathematics: Category Theory (U)
 - Quantum Mechanics for Mathematicians (U)
 - Geometry I (G)
 - Categories, Homological Algebra, and Derived Categories (G)
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Federal University of the ABC - UFABC

- ❑ First semester 2008
 - Calculus I (U)
 - ❑ Second semester 2008
 - Advanced Calculus (U)
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Federal University of Minas Gerais - UFMG

- ❑ Second semester 2007
 - Modern Geometry (U)
-

State University of Campinas - UNICAMP

- ❑ First semester 2003
 - Calculus II (U)
- ❑ First semester 2002
 - Calculus I (U)

UNDERGRADUATE
COURSEWORK

- Advanced Calculus
 - Affine and Projective Geometry
 - Algebra I (Group Theory)
 - Analytic Geometry
 - Axiomatic Geometry
 - Calculus I
 - Calculus II
 - Calculus III
 - Category Theory (Topics in Mathematics)
 - Differential Geometry
 - Discrete Mathematics
 - Introduction to Lie Groups
 - Linear Algebra
 - Linear Algebra and Analytic Geometry
 - Modern Geometry
 - Quantum Mechanics for Mathematicians
 - Riemann Surfaces (Topics in Mathematics)
-

GRADUATE
COURSEWORK

- Categories, Homological Algebra, and Derived Categories
 - Differential Geometry of Surfaces
 - Geometric Structures on Manifolds
 - Geometry I
 - Hyperbolic Geometry
 - Lie groups
 - Riemannian Geometry
 - Smooth manifolds
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LANGUAGES

English (fluent), French (good command), Portuguese (native)