Curriculum vitae

Diego Conti

Vita

- 28/03/2017: obtained National Scientific Qualification (ASN) for full professor, S.C. 01/A2
- From 11/6/2015: Member of the Board for the Joint Doctorate Programme in Mathematics INdAM – Milano Bicocca – Pavia.
- From 1/10/2014: Associate professor at Università di Milano Bicocca, S.S.D. MAT/03 (geometry).
- 24/12/2013: obtained National Scientific Qualification (ASN) for associate professor, S.C. 01/A2
- From 15/12/2008 to 30/9/2014: Tenured fellow (ricercatore a tempo indeterminato) at Università di Milano Bicocca, S.S.D. MAT/03.
- From 1/1/2006 to 14/12/2008: Post-doc at Università di Milano Bicocca.
- 24/5/2005: obtained PHD Diploma from Scuola Normale Superiore di Pisa. Advisor: Prof. Simon Salamon. Title of the thesis: Special holonomy and hypersurfaces. Score: 70/70 cum laude.
- 3/12/2002: Diploma in Mathematics from Scuola Normale Superiore di Pisa. Score: 70/70 cum lode.
- 23/10/2001: Degree in Mathematics from Università di Pisa. Advisor: Prof. Riccardo Benedetti. Title of the thesis: Sul teorema di uniformizzazione. Score: 110/110 cum laude.
- 1997: High schoold diploma from Liceo Scientifico Ulisse Dini, Pisa. Score: 60/60.

Research interests

I am interested in Einstein metrics, both in the Riemannian and pseudoriemannian setting, in particular special holonomy metrics and more general geometries associated to a special holonomy group.

More specifically I have been working on the geometries associated to a generalized Killing spinor, in particular hypo[1] and half-flat[2], which arise naturally as hypersurfaces in manifolds with special holonomy; since the special holonomy metric is essentially determined uniquely, this point of view gives a constructive way to produce explicit metrics with special holonomy, particularly of cohomogeneity one[3]. I am currently pursuing a similar approach in the Lorentzian context (joint work with my PHD student Romeo Segnan Dalmasso) and that of holonomy Spin(7) (joint work with Thomas Madsen and my PHD student Daniel Perolini).

I am also interested in quaternionic geometry, both from the point of view of special holonomy $\mathrm{Sp}(n)\mathrm{Sp}(1)$ (i.e. quaternion-Kähler), and that of quaternionic-contact manifolds, which arise as conformal infinities of asymptotycally symmetric quaternion-Kähler metrics. My main contribution to the field has been the construction of new examples[4][5] and a characterization of quaternionic-contact geometry in the language of intrinsic torsion[6]

Another line of research that I am pursuing is the construction of Einstein left-invariant pseudoriemannian metrics on nilpotent or solvable Lie groups. Ricci-flat examples have been known for a while, and indeed recent work shows that, at least in low dimension, all nilpotent Lie groups admit an invariant Ricci-flat metric[7]. Examples with nonzero scalar curvature have only been discovered recently[8]. Currently I am interested in the study of the structure of indefinite Einstein solvmanifolds (joint work with Federico A. Rossi) and nilmanifolds with ad-invariant metrics (joint work with Federico A. Rossi and Viviana del Barco).

In my research work, I employ systematically techniques of symbolic computation. I have developed a C++library to this end, extending the symbolic computation library GiNaC, and I am developing a program to parallelize computations in Magma.

Talks

- 11/1/2005: "Structures on 5-manifolds and SU(3) holonomy"; Humboldt Universität, Berlin.

[1]Diego Conti, Simon Salamon. Generalized Killing spinors in dimension 5, *Transactions of the American Mathematical Society* (2007), 359(11):5319–5343.

[2]Diego Conti. Half-flat nilmanifolds, *Mathematische Annalen* (2011) 350(1):155–168.

[3]Diego Conti. SU(3)-holonomy metrics from nilpotent Lie groups, *Asian Journal of Mathematics* (2014) 18(2):281–320.

[4]Diego Conti, Thomas Madsen, Simon Salamon. Quaternionic geometry in dimension 8. In "Geometry and Physics. A Festschrift in honour of Nigel Hitchin", Oxford University Press 2018.

[5]Diego Conti, Marisa Fernàndez, Josè A. Santisteban. On seven-dimensional quaternionic contact solvable Lie groups, *Forum Mathematicum* (2014) 26(2):547–576.

[6]Diego Conti. Intrinsic torsion in quaternionic contact geometry. *Annali della Scuola Normale Superiore di Pisa — Classe di Scienze* 16 (2016) 2:625-674.

[7]Diego Conti, Viviana del Barco, Federico A. Rossi. Diagram involutions and homogeneous Ricci-flat metrics. *Manuscripta Mathematica*, (2020)

[8]Diego Conti, Federico A. Rossi. Einstein nilpotent Lie groups, *Journal of Pure and Applied Algebra*, (2018) 223(3):976–997

- 27/7/2005: "Hypersurfaces in Ricci-flat manifolds"; ITC-IRST, Povo (Trento).
- 10/3/2006: "Stable forms and Killing spinors", at conference "Recenti sviluppi della geometria complessa, differenziale, simplettica". Centro di Ricerca Matematica E. de Giorgi, Pisa.
- 16/6/2006: "Cohomogeneity one Einstein-Sasaki 5-manifolds", at conference "Giornata di geometria differenziale pescarese", Università di Chieti e Pescara.
- 23/10/2006: "Cohomogeneity one Einstein-Sasaki 5-manifolds", at conference "Recent Advances in Complex and Real Geometry", Levico Terme (Trento).
- 7/2/2007: "Forme invarianti, fibrati associati e geometrie speciali", at conference "Geometria tra Torino e Alessandria", Torino.
- 26/3/2008: "Invariant Einstein-Sasaki metrics and the compactification problem", at conference "Extremal Kähler Metrics and Kähler-Ricci Flow". Centro di Ricerca Matematica E. de Giorgi, Pisa.
- 22/1/2009: "Immergere in varietà con torsione", at conference "Recenti Sviluppi in Geometria Complessa e Simplettica". Centro di Ricerca Matematica E. de Giorgi, Pisa.
- 8/6/2009: "Special geometries and isometric embeddings". Universidad del Pais Vasco, Bilbao.
- 8/10/2009: "Half-flat structures on nilmanifolds". Università di Torino.
- 8/11/2010: "Evolving hypo structures on nilmanifolds: a DGA flow". University of Hamburg.
- 12/11/2010: "Special geometries on Lie algebras", at conference "2nd Northern German Differential Geometry Day", Leibniz Universität Hannover.
- 8/11/2011: "Metriche di coomogeneità uno con olonomia SU(3)", at conference "New trends in Differential Geometry", L'Aquila.
- 28/10/2011: "SU(3)-holonomy metrics from nilpotent Lie groups", Aarhus University.
- 23/10/2013: "Varietà quaternionic contact e torsione intrinseca", meeting of project FIRB 2012 "Geometria Differenziale e Teoria Geometrica delle Funzioni", Firenze.
- 16/7/2014: "G_2 metrics from SO(3) structures", at conference "G_2 days 2014", UCL, London.

- 19/9/2014: "Almost quaternion-Kähler manifolds", Joint meeting DMV–PTM, special session "Quaternion-Kähler manifolds and related structures in Riemannian and algebraic geometry", Poznań.
- 25/2/2015: "Invariant G_2 metrics from polynomials", at conference "Workshop in memory of Sergio Console", Torino.
- 22/1/2016: "Rigidità e deformazioni in geometria quaternionica", at conference "Workshop su varietà reali e complesse: geometria, topologia e analisi armonica", Pisa.
- 29/9/2017: "Indefinite Einstein metrics on nilpotent Lie groups", Universidad del Paìs Vasco, Bilbao.
- 30/6/2018: "Indefinite homogeneous Einstein metrics", UCL London (KCL/UCL Geometry Seminar).
- 4/7/2018: "Einstein nilmanifolds and the moment map", Glances@Manifolds 2018, Krakow.
- 5/12/2019: "Invariant metrics with special holonomy", University of Surrey.
- 10/9/2020: "Quaternion-Kähler 8-manifolds and their deformations" at online conference "Recent progress in HyperComplex analysis and geometry." `http://www.hypercomplex.it/2020`.

Participation to summer schools and workshops

- 6–9 January 2004: UK-Japan Winter School on "Geometry and Analysis Towards Quantum Theory", University of Durham (UK).
- 6 September - 12 November 2004: "Differential Geometry and Topology", Centro di Ricerche Matematiche E. De Giorgi, Pisa.
- 14–17 September 2005: "Symmetry in Geometry and Physics", Università di Roma "La Sapienza".
- 17–29 July 2005: Summer school on "Real PDE's for Complex and CR-geometry", ITC-IRST, Povo (Trento).
- 4–8 September 2006, "Geometry Conference in honour of Nigel Hitchin", CSIC, Madrid.
- 13–16 July 2007, "Recent Advances in Differential Geometry", Università di Lecce.
- 13–18 December 2007 Workshop on deformation theory in algebraic and differential geometry, Humboldt Universität, Berlino.

- 8–10 September 2008 GLAM "Global Analysis On Manifolds", Università di Roma "La Sapienza".
- 17–18 October 2008 Incontro PRIN "Metriche Riemanniane e Varietà Differenziabili", Politecnico di Torino.
- 5 June 2009 Giornata INDAM 2009, Università di Torino.
- 16–19 June 2009 Kahlerian and Sasakian geometry, Roma.
- 17 July 2009 Turin Differential Geometry Day, Torino.
- 31 August 2009 - 5 Settembre School (and workshop) on Hodge theory and algebraic geometry, Trento.
- 14–18 June 2010, "Symmetric spaces and their generalizations", Levico Terme, Trento.
- 10–11 June 2012, "G_2 days", London.
- 28 February – 3 March 2013 "Varietà reali e complesse: geometria, topologia e analisi armonica", Pisa.
- 7 June 2013 "Giornata di Geometria Milano Torino", Torino.
- 20–22 February 2014 "Secondo workshop su varietà reali e complesse: geometria, topologia e analisi armonica", Pisa.
- 16–20 June 2014, Workshop "Complex Geometry and Lie Groups", Torino.
- 23–27 June 2014, "Asymptotic aspects of complex and algebraic geometry", Milano Bicocca.
- 3–4 February 2016, "Workshop - Complex geometry and Hamiltonian actions", Parma.
- 20–22 April 2016, "Special Hermitian metrics on non-Kähler manifolds", Firenze.
- 11–15 July 2016, "Differential geometry in the large", Firenze.
- 5–16 September 2016, "Hitchin70: differential geometry and quantization", Aarhus.
- 26–28 January 2017, "Perspectives in geometry. A conference in memory of Paolo de Bartolomeis", Firenze.
- 5–9 Giugno 2017, "Constructions of Compact Exceptional Holonomy Spaces: Past, Present and Future", Imperial College, London.
- 1–3 February 2018, "Workshop 2018 su varietà reali e complesse: geometria, topologia e analisi armonica", Pisa.

- 11–15 June 2018, "5th Workshop Complex Geometry and Lie Groups", Firenze.
- 7–11 January 2019, "Special Holonomy and Algebraic Geometry", Imperial College, London.
- 21–23 February 2019, "Workshop 2019. Varietà reali e complesse: geometria, topologia e analisi armonica", Pisa.

Publications

1. Diego Conti, Simon Salamon. Generalized Killing spinors in dimension 5, *Transactions of the American Mathematical Society* (2007), 359(11):5319–5343.
   ISSN: 0002-9947, doi: 10.1090/S0002-9947-07-04307-3
2. Diego Conti, Simon Salamon. Reduced holonomy, hypersurfaces and extensions, *International Journal of Geometric Methods in Modern Physics* (2006) 3(5–6): 899–912.
   ISSN: 0219-8878, doi: 10.1142/S021988780600148X
3. Diego Conti, Adriano Tomassini. Special symplectic six-manifolds, *The Quarterly Journal of Mathematics* (2007) 58(3):297–311.
   ISSN: 0033-5606, doi: 10.1093/qmath/ham013
4. Diego Conti. Cohomogeneity one Einstein-Sasaki 5-manifolds, *Communications in Mathematical Physics* (2007), 274(3):751–774.
   ISSN: 0010-3616, doi: 10.1007/s00220-007-0286-3
5. Diego Conti. Invariant forms, associated bundles and Calabi-Yau metrics, *Journal of Geometry and Physics* (2007), 57(12):2483–2508.
   ISSN: 0393-0440, doi: 10.1016/j.geomphys.2007.08.010
6. Diego Conti, Anna Fino. Calabi-Yau cones from contact reduction, *Annals of Global Analysis and Geometry* (2010) 38(1):93–118.
   ISSN: 0232-704X, doi: 10.1007/s10455-010-9202-8
7. Diego Conti. Embedding into manifolds with torsion, *Mathematische Zeitschrift* (2011) 268(3–4):725–751.
   ISSN: 0025-5874, doi: 10.1007/s00209-010-0692-7
8. Diego Conti. Half-flat nilmanifolds, *Mathematische Annalen* (2011) 350(1):155–168.
   ISSN: 0025-5831, doi: 10.1007/s00208-010-0535-1
9. Diego Conti, Marisa Fernàndez, Josè A. Santisteban. Solvable Lie algebras are not that hypo, *Transformation Groups* (2011) 16(1):51–69.
   ISSN: 1083-4362, doi: 10.1007/s00031-011-9127-8

10. Diego Conti, Marisa Fernàndez. Nilmanifolds with a calibrated G_2-structure. *Differential Geometry and its Applications* (2011) 29(4):493–506.
ISSN: 0926-2245, doi: 10.1016/j.difgeo.2011.04.030

11. Diego Conti, Marisa Fernàndez, Josè A. Santisteban. On seven-dimensional quaternionic contact solvable Lie groups, *Forum Mathematicum* (2014) 26(2):547–576.
ISSN: 0933-7741, doi: 10.1515/forum-2011-0128

12. Diego Conti. SU(3)-holonomy metrics from nilpotent Lie groups, *Asian Journal of Mathematics* (2014) 18(2):281–320.
ISSN: 1093-6106, doi: 10.4310/AJM.2014.v18.n2.a6.

13. Diego Conti, Thomas Madsen. The odd side of torsion geometry, *Annali di Matematica Pura e Applicata* (2014) 193(4): 1041–1067.
ISSN: 0373-3114, doi: 10.1007/s10231-012-0314-6

14. Diego Conti, Thomas Madsen. Harmonic structures and intrinsic torsion. *Transformation Groups* (2015) 20(3): 699–723.
ISSN: 1083-4362, doi: 10.1007/s00031-015-9325-x

15. Diego Conti, Thomas Madsen. Invariant torsion and G_2 metrics. *Complex Manifolds* (2015) 2:140–167.
ISSN: 2300-7443, doi: 10.1515/coma-2015-0011

16. Diego Conti. Intrinsic torsion in quaternionic contact geometry. *Annali della Scuola Normale Superiore di Pisa — Classe di Scienze* 16 (2016), 2:625-674.
ISSN: 0391-173X, doi: 10.2422/2036-2145.201407_004

17. Diego Conti, Marisa Fernàndez. Einstein almost cokähler manifolds, *Mathematische Nachrichten* (2016) 289(11–12):1396–1407.
ISSN: 0025-584X, doi: 10.1002/mana.201400412

18. Diego Conti, Federico A. Rossi. The Ricci tensor of almost parahermitian manifold, *Ann Glob Anal Geom* (2018) 53: 467.
ISSN: 0232-704X, doi: 10.1007/s10455-017-9584-y

19. Diego Conti, Federico A. Rossi. Einstein nilpotent Lie groups, *Journal of Pure and Applied Algebra*, (2018) 223(3):976–997.
ISSN: 0022-4049, doi: 10.1016/j.jpaa.2018.05.010

20. Diego Conti, Thomas Madsen, Simon Salamon. Quaternionic geometry in dimension 8. In "Geometry and Physics. A Festschrift in honour of Nigel Hitchin", Oxford University Press 2018.
ISBN: 9780198802006. doi: 10.1093/oso/9780198802013.001.0001

21. Diego Conti, Federico Rossi. Construction of nice nilpotent Lie groups. *Journal of Algebra*, (2019) 525:311-340.
ISSN: 0021-8693. doi: 10.1016/j.jalgebra.2019.01.020

22. Diego Conti, Federico Rossi. Ricci-flat and Einstein pseudoriemannian nilmanifolds. *Complex Manifolds*, (2019) 6:170–193.
ISSN: 2300-7443. doi: 10.1515/coma-2019-0010

23. Diego Conti, Viviana del Barco, Federico A. Rossi. Diagram involutions and homogeneous Ricci-flat metrics. *Manuscripta Mathematica*, (2020).
eISSN: 1432-1785, ISSN: 0025-2611. doi: 10.1007/s00229-020-01225-y

24. Diego Conti, Federico A. Rossi. Indefinite Einstein metrics on nice Lie groups. *Forum mathematicum*, (2020).
eISSN: 1435-5337, ISSN: 0933-7741. doi: 10.1515/forum-2020-0049

Research projects

- Principal investigator for project "Homogeneous Einstein metrics of indefinite signature", financed for 20.000€ by Università di Milano Bicocca (Fondo di Ateneo Quota Competitiva). Effective: 2020–2021.

- Participation in financed project PRIN 2007 "Varietà Kähleriane, Gruppi di Olonomia e Sottovarietà. Le loro Interazioni." Principal investigator: Simon Salamon. Effective: 22/9/2008 – 22/9/2010.

- Participation in financed project PRIN 2010 "Varietà reali e complesse: geometria, topologia e analisi armonica". Principal investigator: Fulvio Ricci. Effective: 1/2/2013 – 1/2/2016.

- Participation in financed project FIRB 2012 "Differential Geometry and Geometric Function Theory". Principal investigator: Caterina Stoppato. Effective: 23/3/13 – 23/3/2017.

- Member of group INdAM GNSAGA, 2006–2020

I applied as Principal Investigator for a project PRIN 2017, line B, entitled "Homogeneous Einstein metrics of indefinite signature", obtaining a score of 95/100.

Organization

Organization of workshop "Geometria in Bicocca 2010", held in Milan 6-7 May 2010. Organizers: Diego Conti, Alessandro Ghigi, Gianni Manno, Roberto Paoletti.

Organization of workshop "Geometria in Bicocca 2011", held in Milan 12-13 May 2011. Organizers: Gennaro Amendola, Diego Conti, Alessandro Ghigi, Gianni Manno, Roberto Paoletti, Jasmin Raissy.

Organization of workshop "Geometria in Bicocca 2012", held in Milano 10-11 May 2012. Organizers: Gennaro Amendola, Francesco Bastianelli, Diego Conti, Gianni Manno, Jasmin Raissy, Federico Rossi.

Organization of special session “Symplectic geometry and special metrics” al meeting First Joint International Meeting RSME-SCM-SEMA-SIMAI-UMI Bilbao, June 30 - July 4, 2014. Organizers: Diego Conti, Marisa Fernàndez, Anna Fino, Luis Ugarte.

Organization of INdAM meeting “New perspectives in differential geometry: special metrics and quaternionic geometry”, Roma, November 16 – 20, 2015. Organizers: Simon Chiossi, Diego Conti, Caterina Stoppato, Luigi Vezzoni. Scientific committee: Anna Fino, Graziano Gentili, Emilio Musso, Andrew Swann.

Organization of workshop “Geometria in Bicocca 2018”, Milano, 31 May – 1 June 2018. Organizers: Sonia Brivio, Diego Conti, Alberto Della Vedova, Filippo Favale, Roberto Paoletti, Federico A. Rossi.

Teaching

For the bachelor degree in Mathematics at Università di Milano Bicocca:

- 2006–07, 2007–08, 2008–09: exercises of Geometria Differenziale;
- 2008–09, 2009–10, 2010–11, 2011–12: exercises of Geometria I;
- 2009–10, 2010–11, 2011–12: lessons and exercises of Istituzioni di Geometria II modulo;
- 2012–13: lessons and exercises of Istituzioni di Geometria I modulo;
- 2012–13, 2013–14: exercises of Algebra Lineare e Geometria;
- 2014–15, 2017–18, 2018–19, 2019–20: lessons of Algebra Lineare e Geometria;
- 2013–14, 2018–19: lessons and exercises of Geometria III.

For the master degree in Mathematics at Università di Milano Bicocca:

- 2015–16, 2017–18, 2019–20: lessons of Complex Geometry;
- 2016–17, 2018–19: lessons of Differential Geometry.

For the bachelor degree in Computer science at Università di Milano Bicocca:

- 2014–15, 2015–16, 2016–17: lessons of Analisi Matematica.

Theses

- Advisor to Federico Pianoforte, bachelor degree in Mathematics, Università di Milano Bicocca. Title of the thesis: Il teorema di Gauss-Bonnet e il teorema dell’indice di Hopf. Defended on 26/02/2015.

- Advisor to Giovanni Tirone, bachelor degree in Mathematics, Università di Milano Bicocca. Defended on 25/02/2016.
- Advisor to Davide Perolini, master degree in Mathematics, Università di Milano Bicocca. Title of the thesis: Spin(7)-strutture e deformazioni lineari. Defended on 27/9/2018.
- Advisor to Mauro Mantegazza, joint PHD programme in Mathematics INdAM – Milano Bicocca – Pavia. Title of the thesis: An intrinsic approach to the c-map. Defended on 13/12/2019.
- I am the advisor to Romeo Segnan Dalmasso, joint PHD programme in Mathematics Milano Bicocca – University of Surrey, and Daniel Perolini, joint PHD programme in Mathematics INdAM – Milano Bicocca – Pavia.

Other scientific activity

- 2007–2020: development of Wedge, a library for symbolic computations in differential geometry, `https://github.com/diego-conti/wedge` ($\approx$ 10000 lines of C++ source code)
- 2018–2020: development of DEMONbLAST, a program to classify nice nilpotent Lie algebras and Einstein or nilsoliton metrics on them, `https://github.com/diego-conti/DEMONbLAST` ($\approx$ 4000 lines of C++ source code)