



# Ludovico Battista

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## Contact Information

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## Positions

- '23 - current **Post-doc**, *FBK - Fondazione Bruno Kessler, FM - Formal Methods, Trento*.  
'22 - '23 **Post-doc**, *Alma Mater Studiorum - University of Bologna, Department of Mathematics, Bologna*.

## Education

- '18-'22 **Ph.D. in Pure Mathematics**, *Università di Pisa, Pisa, 08/04/2022, cum laude.*  
**PhD Thesis:** “Hyperbolic 4-manifolds, perfect circle-valued Morse functions and infinitesimal rigidity”  
**Supervisor:** Prof. Bruno Martelli.
- '16-'18 **Graduate Student in Pure Mathematics**, *Università di Pisa, Pisa, Master Degree in Mathematics, 110/110 cum laude, 26/10/2018.*  
**Master Thesis:** “Principal congruence Link complements”  
**Advisor:** Prof. Bruno Martelli.  
**Reward:** the thesis was awarded a prize by *Istituto Nazionale di Alta Matematica*.
- '13-'16 **Bachelor Student in Pure Mathematics**, *Università di Pisa, Pisa, Bachelor Degree in Mathematics, 110/110 cum laude, 13/05/2016.*  
**Bachelor Dissertation:** “Crescita di gruppi: un gruppo con crescita intermedia” (Group growth: a group with intermediate growth).  
**Advisor:** Prof. Roberto Frigerio.

## Publications

- 1 **Hyperbolic 4-manifolds with perfect circle-valued Morse functions**, *j.w. with Martelli, B., Transactions of the American Mathematical Society 375.04: 2597-2625, 2022.*  
arXiv Journal

- 2 **Infinitesimal Rigidity for Cubulated Manifolds**, Geom Dedicata 217, 33, 2023.  
arXiv Journal
- 3 **Dodecahedral  $L$ -spaces and hyperbolic 4-manifolds**, j.w. with Leonardo Ferrari and Diego Santoro, Accepted in Communications in Analysis and Geometry, 2022.  
arXiv Journal
- 4 **Bounded Cohomology Classes of Exact Forms**, j.w. with S. Francaviglia, M. Moraschini, F. Sarti, A. Savini, Proceedings of the American Mathematical Society, 2022.  
arXiv Journal
- 5 **SMT-Based Stability Verification of an Industrial Switched PI Control Systems**, j.w. with S. Basagiannis, A. Becchi, A. Cimatti, G. Giantamidis, S. Mover, A. Tacchella, S. Tonetta, V. A. Tsachouridis, 53rd Annual IEEE/IFIP International Conference on Dependable Systems and Networks, DSN Workshop VERDI, 2023.  
Journal
- 6 **Stability Verification of an Industrial Switched PI Control Systems**, j.w. with S. Basagiannis, A. Becchi, A. Cimatti, G. Giantamidis, S. Mover, A. Tacchella, S. Tonetta, V. A. Tsachouridis, Proceedings of the 11th Int. Workshop on Applied Verification for Continuous and Hybrid Systems, 2024.  
EasyChair
- 7 **Formal Verification of Stability for Parametric affine Switched Systems**, j.w. with S. Tonetta, 8th IFAC Conference on Analysis and Design of Hybrid Systems ADHS 2024, 2024.  
ScienceDirect
- 8 **Deriving Liveness Properties of Hybrid Systems from Reachable Sets and Lyapunov-like Certificates**, j.w. with S. Tonetta, To be presented at ATVA25, 2025.  
ATVA25 Extended version

## Talks

- Sep '20 **Seminar of Geometry group, Pisa**, *A Hyperbolic 4-manifold with a perfect circle valued Morse function.*
- Apr '22 **Seminario di Algebra e Geometria, Bologna**, *Hyperbolic 4-manifolds, perfect circle valued Morse functions and infinitesimal rigidity.*
- Oct '22 **Geometry seminars, Neuchâtel**, *Dodecahedral  $L$ -spaces and Hyperbolic 4-manifolds.*
- Nov '22 **Geometry seminars, Luxembourg**, *Hyperbolic 4-manifolds, perfect circle-valued Morse functions and infinitesimal rigidity.*
- Jul '24 **Analysis and Design of Hybrid Systems, Boulder, Colorado, Stati Uniti**, *Formal Verification of Stability for Parametric affine Switched Systems.*
- (planned) Oct '25 **Automated Technology for Verification and Analysis, Bangalore, India**, *Deriving Liveness Properties of Hybrid Systems from Reachable Sets and Lyapunov-like Certificates.*

**More**, I have took part in many informal seminars both online (especially during COVID pandemic, GT GAPS, Exotic LS) and offline (Pisa, Bologna, Nice, Ventotene).

## Organized activities

- Mar '23 **Non-positive curvature in manifolds and groups**, *Math Day funded by INdAM.*  
[Link](#)
- Mar '23 **Manifolds and groups in Bologna**, *Workshop funded by GNSAGA (INdAM).*  
[Link](#)
- '22 **TGV: Seminari di Topologia e Geometria delle Varietà**, *Department of Mathematics, Bologna*, with Stefano Francaviglia, Marco Moraschini e Stefano Riolo,  
We organized a weekly meeting with master students to introduce them to some research topics in differential topology.
- '18-'21 **BabyGeometri**, *Department of Mathematics, Pisa*, Weekly mettings for early-career geometers in Pisa.  
[Link](#)

## Referee activity

**Reviewer**, I have served as (sub)reviewer for several international conferences as FM, TACAS, SAFECOMP.

## Scholarships

- '16-'18 **Scolarship for Mathematics Master students**, *Istituto Nazionale di Alta Matematica.*  
I ranked first in the national test for this scolarship. It consisted in a written exam with several problems about Analysis, Probability, Geometry and Algebra.
- '13-'16 **Scolarship for Mathematics students**, *Istituto Nazionale di Alta Matematica.*  
I won this scolarship for academic achievement, and I succeeded in renewing it for the whole duration of my Bachelor's Degree.

## Visiting

- Nov '22 **Research visit**, *University of Luxembourg.*  
During my visit a gave a talk in the framework of the research seminars of the geometry group, and I collaborated with prof. Jean-Marc Schlenker and his research team.
- Oct '22 **Research visit**, *University of Neuchâtel.*  
During my visit a gave a talk in the framework of the research seminars of the geometry group, and I collaborated with prof. Aleksandr Kolpakov and his research team.

## Teaching experience

- '21 - '22 **Support to teaching for the course *Differential Geometry* - Department of Physics, Pisa.**
- '21 - '22 **Support to teaching for the course *Geometria e algebra lineare -modulo Geometria* - Department of Civil and Industrial Engineering, Pisa.**

- '19 **Support to teaching for the course *Principles of Geometry*** - Department of Mathematics, Pisa.
- '18 **Semestral course in Arithmetic to reduce early university leaving** - Department of Mathematics, Pisa.
- '17 - '18 **Part-time Counseling (Counseling)** - Department of Mathematics, Pisa.
- '16 - '17 **Part-time Tutoring (Tutorato alla Pari)** - Department of Mathematics, Pisa.

## Schools and Conferences

- (planned) **Conference**, *International Symposium on Automated Technology for Verification and Analysis*, Bangalore, India, Paper published.
- Sep '25 **Conference**, *Higher Dimensional Hyperbolic Geometry*, Ventotene, Italy.
- Jul '24 **Conference**, *The 8th IFAC Conference on Analysis and Design of Hybrid Systems*, Boulder, Colorado, Paper published.
- Sep '23 **Conference**, *GRAZP: Groups and Rigidity Around the Zimmer Program*, Ventotene, Italy.
- Jul '23 **Conference**, *VERDI workshop*, Porto, Portugal.
- Sep '22 **Conference**, *Recent Advances in Bounded Cohomology*, Regensburg.
- Sep '22 **Conference**, *4-Manifolds: From Above and Below*, Marseille, Flash talk given.
- July '22 **Conference**, *Geometry and Dynamics of Moduli Spaces*, Bologna.
- May '22 **Conference**, *Arithmetic Groups and 3-Manifolds*, Bonn.
- Dec '21 **Conference**, *Winter Braids XI*, Dijon, Flash talk given, poster presented.
- Sep '21 **Conference**, *Counting problems*, Ventotene, Flash talk given.
- Jul '21 **Conference**, *Swiss Knots 2021*, Fribourg.
- June '21 **Conference**, *Trisections and the Thom conjecture*, Matemale.
- Feb '20 **Conference**, *Winter Braids X*, Pisa.
- Sep '19 **Conference**, *Of coarse! Quasi-isometries and groups: rigidity and classification*, Ventotene.
- Jun '19 **School**, *Géométrie, topologie et arithmétique de façon hyperbolique*, Les Diablerets.
- Jun '19 **Conference**, *Knot concordance and low-dimensional manifolds*, Le Croisic.
- May '19 **School**, *Trisections of smooth 4-manifolds*, Matemale.
- Feb '19 **School**, *Geometry, Algebra and Combinatorics of Moduli Spaces and Configurations III*, Dobbiaco.
- Jan '19 **Conference**, *Conference on Geometric Structures in Nice*, Nice.
- Jan '19 **School**, *Winter School on Geometric Structures in Nice*, Nice.
- Nov '18 **Workshop**, *Workshop on Topology and Neuroscience*, Lausanne.
- Jun '18 **Research school**, *3-Manifolds and Geometric Group Theory*, Marseille.

## Skills

### Language skills

Italian	Mother tongue
English	Advanced, C1
French	Basic, A1

### Programming skills

Python	Advanced
MATLAB	Advanced
L <small>A</small> T <small>E</small> X	Advanced
Sage	Intermediate
C Language	Basic

### Code samples

- Paper 2 The results presented in Paper 2 were obtained using some code provided alongside the publication. This consists mainly of Sage and MATLAB scripts.
- Paper 3 The results presented in Paper 3 were obtained using some code provided alongside the publication. This consists mainly of Sage scripts. Written in collaboration with Leonardo Ferrari.
- Paper 7 Paper 7 underwent an experimental evaluation conducted with the code provided alongside the publication. This consists mainly of Python scripts. A repeatability evaluation was available, and the paper obtained the corresponding badge.
- Paper 8 Paper 8 underwent an experimental evaluation conducted with the code provided alongside the publication. This consists of a large software written in Python and MATLAB, which makes use of several software and packages like PySMT, z3, cvc5, CORA, and nuXmv. A repeatability evaluation was available, and the paper obtained the Available and Functional badges.