Ludovico Battista

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Contact Information

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Birth 10/04/1994, in Campobasso (CB), Italy

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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*, ATVA25, 2025.
Springer 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*.

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

Oct '25 **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*.

Jul '23 **Workshop**, *VERDI*, Porto, Portugal.

'19-'22 **More**, *I have taken part in more than 20 international conferences on Geometry and Topology*.

Skills

Language skills

Italian Mother tongue

English Advanced, C1 (Cambridge certification 2024)

French Basic, A1

Programming skills

Python Advanced

MATLAB Advanced

LaTeX Advanced

Sage Intermediate

C Language Basic

Code samples

VeriLHyS **Tool**, I am the main contributor of the tool VeriLHyS that can be used to verify LTL properties on Hybrid Systems. Mainly written in Python and MATLAB. Available at https://es-static.fbk.eu/tools/verilhys/, This tool make use of several external packages and softwares (SMT solvers like cvc5 and z3, Reachable Set Computation by CORA in a MATLAB environment, Numerical Optimization by Mosek, Model Checking by nuXmv); I consider this to be an important ability to work in the area of computational mathematics..

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.