

Nikolas TAPIA

Curriculum Vitae

Hochstraße 11A

13357 Berlin

 tapia@wias-berlin.de

<https://wias-berlin.de/people/tapia>

Experience

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Postdoc, WIAS, Germany

Postdoc position at WIAS , as part of the BMS MATH⁺ AA4-2 project “Optimal Control in Energy Markets Using Rough Analysis and Deep Networks”.

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Postdoc, WIAS & TU Berlin, Germany

Joint postdoc position at WIAS (50%) and TU Berlin (50%), as part of the BMS MATH⁺ EF1-13 project “Stochastic and Rough Aspects in Deep Neural Networks”.

 20

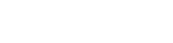
Postdoc, WIAS & TU Berlin, Germany

Joint postdoc position at WIAS (50%) and TU Berlin (50%), as part of the BMS MATH⁺ EF1-5 project “On robustness of deep neural networks”.

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Postdoc, NTNU Trondheim, Norway, (6 months)

ERCIM postdoc position at the Norwegian University of Science and Technology, hosted by K. Ebrahimi-Fard.

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Postdoc, NTNU Trondheim, Norway, (6 months)

ERCIM postdoc position at the Norwegian University of Science and Technology, hosted by K. Ebrahimi-Fard.

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Academic Formation

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PhD in Mathematics, U. de Chile and Sorbonne Université, Chile and France

Joint diploma under the direction of D. Remenik (UCh) and L. Zambotti (SU).

Thesis: *Directed Polymers and Rough Paths*.

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MSc. Mathematical Engineering, U. de Chile, Chile

Thesis: *Exponential ergodicity for AIMD Markov processes*

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Teaching Experience

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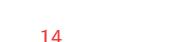
Lecturer, Technische Universität Berlin, Germany, taught in German

Stochastik für Informatik(er).

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Lecturer, Universidad de Chile, Chile

Multivariate Calculus.

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Lecturer, Universidad de Los Andes, Chile

Advanced calculus.

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Languages

Spanish Native

English Advanced

French B2+

German B1+

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Computer skills

Python Advanced

C++ Intermediate

\LaTeX Advanced

Julia, Rust Intermediate

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Research keywords

Residual Neural Networks, Rough Paths, Signatures, Numerical Analysis, Hopf algebras.

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Main collaborators

Christian Bayer, Carlo Bellingeri, Joscha Diehl, Ana Djurdjevac, Kurusch Ebrahimi-Fard, Peter K. Friz, Emilio Ferrucci, Christopher Salvi, Alexander Schmeding.

Publications and preprints

- [1] C. Bayer, P. K. Friz, and N. Tapia, *Stability of deep neural networks via discrete rough paths*, *SIAM J. Math. Data Sci.* **5** (2023), no. 1, 50–76.
- [2] C. Bellingeri, A. Djurdjevac, P. K. Friz, and N. Tapia, *Transport and continuity equations with (very) rough noise*, *Partial Differ. Equ. Appl.* **2** (2021), no. 4, Paper No. 49, 26.
- [3] C. Bellingeri, E. Ferrucci, and N. Tapia, *Branched Itô formula and natural Itô-Stratonovich isomorphism*, 2023, [arXiv:2312.04523 \[math.PR\]](https://arxiv.org/abs/2312.04523).
- [4] E. Celledoni, P. I. E. Lystad, and N. Tapia, *Signatures in shape analysis: an efficient approach to motion identification*, Geometric science of information, Lecture Notes in Comput. Sci., vol. 11712, Springer, Cham, 2019, pp. 21–30.
- [5] I. Chevyrev, J. Diehl, K. Ebrahimi-Fard, and N. Tapia, *A multiplicative surface signature through its magnus expansion*, 2024, [arXiv:2406.16856 \[math.RA\]](https://arxiv.org/abs/2406.16856).
- [6] J. Diehl, K. Ebrahimi-Fard, and N. Tapia, *Iterated-sums signature, quasisymmetric functions and time series analysis*, *Sém. Lothar. Combin.* **84B** (2020), Art. 86, 12.
- [7] ———, *Time-warping invariants of multidimensional time series*, *Acta Appl. Math.* **170** (2020), 265–290.
- [8] ———, *Tropical time series, iterated-sums signatures, and quasisymmetric functions*, *SIAM J. Appl. Algebra Geom.* **6** (2022), no. 4, 563–599.
- [9] ———, *Generalized iterated-sums signatures*, *J. Algebra* **632** (2023), 801–824.
- [10] J. Diehl, R. Preiß, M. Ruddy, and N. Tapia, *The moving-frame method for the iterated-integrals signature: Orthogonal invariants*, *Foundations of Computational Mathematics* **23** (2023), no. 4, 1273–1333.
- [11] K. Ebrahimi-Fard, F. Patras, N. Tapia, and L. Zambotti, *Hopf-algebraic deformations of products and Wick polynomials*, *Int. Math. Res. Not. IMRN* (2020), no. 24, 10064–10099.
- [12] ———, *Wick polynomials in noncommutative probability: a group-theoretical approach*, *Canad. J. Math.* **74** (2022), no. 6, 1673–1699.
- [13] ———, *Shifted substitution in non-commutative multivariate power series with a view toward free probability*, *SIGMA Symmetry Integrability Geom. Methods Appl.* **19** (2023), Paper No. 038, 17.
- [14] P. K. Friz, P. P. Hager, and N. Tapia, *Unified signature cumulants and generalized Magnus expansions*, *Forum Math. Sigma* **10** (2022), Paper No. e42, 60.
- [15] L. Schmitz and N. Tapia, *Free generators and hoffman's isomorphism for the two-parameter shuffle algebra*, 2024, [arXiv:2401.06691 \[math.RA\]](https://arxiv.org/abs/2401.06691).
- [16] N. Tapia and L. Zambotti, *The geometry of the space of branched rough paths*, *Proc. Lond. Math. Soc. (3)* **121** (2020), no. 2, 220–251.
- [17] M. G. Varzaneh, S. Riedel, A. Schmeding, and N. Tapia, *The geometry of controlled rough paths*, 2022, [arXiv:2203.05946 \[math.PR\]](https://arxiv.org/abs/2203.05946).

Scholarships and Grants

October 2018–April 2019, European Research Consortium for Informatics and Mathematics (ERCIM)

Alain Bensoussan postdoctoral fellowship

March 2014–September 2018, Chilean National Council for Research and Development

Doctoral scholarship

Seminars and Workshops

Top 10 talks

November 7, 2023, Imperial College London

Branched Itô formula and natural Itô-Stratonovich isomorphism

July 25, 2022, SciCADE 2022

Signatures in numerical analysis

October 28, 2021, Funktionalanalysis Oberseminar, Universität des Saarlandes, Saarbrücken, Germany

Robustness of Residual Neural Networks

August 23, 2021, *LMMS Summer School: Mathematical Methods in Machine Learning*, Schloss Dagstuhl, Germany

Iterated sums for time series classification

July 20, 2021, *10th World Congress in Probability and Statistics*

Transport and continuity equations with (very) rough noise

March 31, 2021, *Seminario Chileno de Probabilidades*

Iterated sums for time series classification

December 7, 2020, *MFO Meeting “New directions in rough paths theory”*

Signature cumulants and generalized Magnus expansions

August 24, 2020, *Bernoulli–IMS One World Symposium*

Time-warping invariants of multidimensional time series

August 27, 2019, *Geometric Science of Information 2019*

Signatures in Shape Analysis

July 23, 2019, *SciCADE 2019*

Algebraic aspects of signatures

Organization

- Workshop **April 27–29, 2023**, *Berlin, Germany*
17th Annual Berlin-Oxford Young Researchers Meeting on Applied Stochastic Analysis
- Workshop **September 20–25, 2021**, *Greifswald, Germany*
Noncommutative algebra, probability and analysis in action
- Workshop **June 15–19, 2021**, *Online*
Summer school for researchers between geometry and stochastic analysis
- Workshop **May 31–June 2, 2021**, *Online*
SPDEs & their Friends
- Workshop **February 25–26, 2021**, *Online*
Cumulants in Stochastic Analysis
- Seminar **March 2020 – Ongoing**, *Online*
Algebraic and Combinatorial Perspectives in the Mathematical Sciences
- Workshop **November 14–15, 2019**, *Oslo, Norway*
Algebraic and Analytic Perspectives in the theory of Rough Paths and Signatures
- Seminar **October 2018–May 2019**, *NTNU Trondheim, Norway*
Mathematical Perspectives in Machine Learning
- Workshop **May 8–11, 2019**, *Trondheim, Norway*
Non-commutative Stochastic Calculus