Renato Neves

University of Minho,
Informatics department,
4710-057 Braga

Phone: (+351) 919 660 780
Email: nevrenato@gmail.com

Personal information

Nationality: Portuguese

Birth year: 1988

Position

I am an Auxiliar Professor at University of Minho and a Senior Researcher at INESC-TEC. Previously I was a Postdoctoral Researcher at University College London and INESC-TEC.

Research Interests: Cyber-Physical and Quantum

Cyber-Physical: I am currently working on the development of cyber-physical programming languages, their calculi and semantics. In this mission, and with several collaborators, I contributed to different topics that intersect computer science, analysis, and control theory.

Quantum: Current quantum programming languages with a formal semantics assume perfectly well-behaved operations – often a too strong assumption. My collaborators and I are on working on formal foundations for quantum languages that drop this assumption. We are doing this by natively incorporating notions of noise and approximate behaviour in quantum programming; which actually smoothly connects with my research of the cyber-physical domain: in both cases we need to take into account some form of timing constraint, noise, and approximate behaviour.

Education

PhD in Computer Science, Minho, Aveiro, and Porto Universities (MAP-i), June 2018.
MSc in Informatics Engineering, University of Minho, September 2013, final grade 18 (0-20).

Publications

[1] Luís Soares Barbosa, Manuel A. Martins, Alexandre Madeira, and Renato Neves. Reuse and integration of specification logics: The hybridisation perspective. In Thouraya Bouabana-Tebibel and Stuart H. Rubin, editors, *Theoretical Information Reuse and Integration*, volume 446 of *Advances in Intelligent Systems and Computing*, pages 1–30. Springer, 2016.

[2] Fredrik Dahlqvist and Renato Neves. Compositional semantics for new paradigms: probabilistic, hybrid and beyond. *CoRR*, abs/1804.04145, 2018.

[3] Fredrik Dahlqvist and Renato Neves. An internal language for categories enriched over generalised metric spaces. In Florin Manea and Alex Simpson, editors, *30th EACSL Annual Conference on Computer Science Logic, CSL 2022, February 14-19, 2022, Göttingen, Germany (Virtual Conference)*, volume 216 of *LIPIcs*, pages 16:1–16:18. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2022.

[4] Sergey Goncharov, Julian Jakob, and Renato Neves. A semantics for hybrid iteration. In Sven Schewe and Lijun Zhang, editors, *29th International Conference on Concurrency Theory, CONCUR 2018, September 4-7, 2018, Beijing, China*, volume 118 of *LIPIcs*, pages 22:1–22:17. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2018.

[5] Sergey Goncharov and Renato Neves. An adequate while-language for hybrid computation. In Ekaterina Komendantskaya, editor, *Proceedings of the 21st International Symposium on Principles and Practice of Programming Languages, PPDP 2019, Porto, Portugal, October 7-9, 2019*, pages 11:1–11:15. ACM, 2019.

[6] Sergey Goncharov, Renato Neves, and José Proença. Implementing hybrid semantics: From functional to imperative. In Violet Ka I Pun, Volker Stolz, and Adenilso Simão, editors, *Theoretical Aspects of Computing - ICTAC 2020 - 17th International Colloquium, Macau, China, November 30 - December 4, 2020, Proceedings*, volume 12545 of *Lecture Notes in Computer Science*, pages 262–282. Springer, 2020.

[7] Dirk Hofmann, Renato Neves, and Pedro Nora. Generating the algebraic theory of c(x): the case of partially ordered compact spaces. *Theory and Applications of Categories*, 33(12):276–295, 2018.

[8] Dirk Hofmann, Renato Neves, and Pedro Nora. Limits in categories of vietoris coalgebras. *Math. Struct. Comput. Sci.*, 29(4):552–587, 2019.

[9] Alexandre Madeira, Renato Neves, Luís Soares Barbosa, and Manuel A. Martins. A method for rigorous design of reconfigurable systems. *Sci. Comput. Program.*, 132:50–76, 2016.

[10] Alexandre Madeira, Renato Neves, and Manuel A. Martins. An exercise on the generation of many-valued dynamic logics. *J. Log. Algebraic Methods Program.*, 85(5):1011–1037, 2016.

[11] Alexandre Madeira, Renato Neves, Manuel A. Martins, and Luís Soares Barbosa. When even the interface evolves.. In *Seventh International Symposium on Theoretical Aspects of Software Engineering, TASE 2013, 1-3 July 2013, Birmingham, UK*, pages 79–82. IEEE Computer Society, 2013.

[12] Alexandre Madeira, Renato Neves, Manuel A. Martins, and Luís Soares Barbosa. A dynamic logic for every season. In Christiano Braga and Narciso Martí-Oliet, editors, *Formal Methods: Foundations and Applications - 17th Brazilian Symposium, SBMF 2014, Maceió, AL, Brazil, September 29-October 1, 2014. Proceedings*, volume 8941 of *Lecture Notes in Computer Science*, pages 130–145. Springer, 2014.

[13] Alexandre Madeira, Renato Neves, Manuel A. Martins, and Luís Soares Barbosa. Hierarchical hybrid logic. In Sandra Alves and Renata Wasserman, editors, *12th Workshop on Logical and Semantic Frameworks, with Applications, LSFA 2017, Brasília, Brazil, September 23-24, 2017*, volume 338 of *Electronic Notes in Theoretical Computer Science*, pages 167–184. Elsevier, 2017.

[14] Manuel A. Martins, Alexandre Madeira, Luís Soares Barbosa, and Renato Neves. Paradigm integration in a specification course. In James Joshi, Elisa Bertino, Bhavani Thuraisingham, and Ling Liu, editors, *Proceedings of the 15th IEEE International Conference on Information Reuse and Integration, IRI 2014, Redwood City, CA, USA, August 13-15, 2014*, pages 492–499. IEEE Computer Society, 2014.

[15] Renato Neves and Luís Soares Barbosa. Hybrid automata as coalgebras. In Augusto Sampaio and Farn Wang, editors, *Theoretical Aspects of Computing - ICTAC 2016 - 13th International Colloquium, Taipei, Taiwan, ROC, October 24-31, 2016, Proceedings*, volume 9965 of *Lecture Notes in Computer Science*, pages 385–402, 2016.

[16] Renato Neves and Luís Soares Barbosa. Languages and models for hybrid automata: A coalgebraic perspective. *Theor. Comput. Sci.*, 744:113–142, 2018.

[17] Renato Neves, Luís Soares Barbosa, Dirk Hofmann, and Manuel A. Martins. Continuity as a computational effect. *J. Log. Algebraic Methods Program.*, 85(5):1057–1085, 2016.

[18] Renato Neves, Alexandre Madeira, Luís Soares Barbosa, and Manuel A. Martins. Asymmetric combination of logics is functorial: A survey. In Phillip James and Markus Roggenbach, editors, *Recent Trends in Algebraic Development Techniques - 23rd IFIP WG 1.3 International Workshop, WADT 2016, Gregynog, UK, September 21-24, 2016, Revised Selected Papers*, volume 10644 of *Lecture Notes in Computer Science*, pages 39–55. Springer, 2016.

[19] Renato Neves, Alexandre Madeira, Manuel A. Martins, and Luís Soares Barbosa. Giving alloy a family. In *IEEE 14th International Conference on Information Reuse & Integration, IRI 2013, San Francisco, CA, USA, August 14-16, 2013*, pages 512–519. IEEE Computer Society, 2013.

[20] Renato Neves, Alexandre Madeira, Manuel A. Martins, and Luís Soares Barbosa. Hybridisation at work. In Reiko Heckel and Stefan Milius, editors, *Algebra and Coalgebra in Computer Science - 5th International Conference, CALCO 2013, Warsaw, Poland, September 3-6, 2013. Proceedings*, volume 8089 of *Lecture Notes in Computer Science*, pages 340–345. Springer, 2013.

[21] Renato Neves, Alexandre Madeira, Manuel A. Martins, and Luís Soares Barbosa. An institution for alloy and its translation to second-order logic. In Thouraya Bouabana-Tebibel and Stuart H. Rubin, editors, *Integration of Reusable Systems [extended versions of the best papers which were presented at IEEE International Conference on Information Reuse and Integration and IEEE International Workshop on Formal Methods Integration, San Francisco, CA, USA, August 2013]*, volume 263 of *Advances in Intelligent Systems and Computing*, pages 45–75. Springer, 2013.

[22] Renato Neves, Alexandre Madeira, Manuel A. Martins, and Luís Soares Barbosa. Proof theory for hybrid(ised) logics. *Sci. Comput. Program.*, 126:73–93, 2016.

[23] Renato Neves, Manuel A. Martins, and Luís Soares Barbosa. Completeness and decidability results for hybrid(ised) logics. In Christiano Braga and Narciso Martí-Oliet, editors, *Formal Methods: Foundations and Applications - 17th Brazilian Symposium, SBMF 2014, Maceió, AL, Brazil, September 29-October 1, 2014. Proceedings*, volume 8941 of *Lecture Notes in Computer Science*, pages 146–161. Springer, 2014.

Software packages

Lince - Simulation of hybrid programs. Link: `http://arcatools.org/assets/lince.html#fulllince`.

Hybrid Hets - A software package that extends logics in `Hets` into so-called hybridised logics. This package was later integrated into the main tool `Hets`, which is quite well-known in the system modelling/theorem proving community.

Research Projects

I am a coauthor of the following research project proposals.

Ibex - Quantitative methods for cyber-physical programming (PI), 2021. Accepted for funding (249k euros) by the Portuguese Foundation of Science and Technology (FCT).

Quantitative Algebraic Reasoning of Hybrid Programs (co-I), 2020. Accepted for funding (77542 GBP) by the Research Institute in Verified Trustworthy Software Systems (VeTSS), hosted at Imperial College.

Klee - Coalgebraic Modeling and Analysis for Computational Synthetic Biology (co-I), 2018. Accepted for funding (238171 euros) by the Portuguese Foundation of Science and Technology (FCT).

I am/was a member of the research projects listed in the table below.

Denomination	**Host Institution**	**Year**
CTRL-F - Computational effects and high-level control (co-PI)	Reykjavik University	2022-25
Ibex - Quantitative methods for cyber-physical programming (PI)	INESC-TEC	2022-24
Quantitative Algebraic Reasoning of Hybrid Programs (co-I)	Univ. College London	2020-21
Klee - Coalgebras for Computational Synthetic Biology (co-I)	INESC-TEC	2018-21
DaVinci - Variability and Interaction for Cyber-Physical Syst.	INESC-TEC	2018-21
Dalí - Dynamic logics for cyber-physical systems	INESC-TEC	2016-20
Trust - Trustworthy Software Design with Alloy	INESC-TEC	2016-20
PT-FLAD Chair in Smart Cities & Smart Governance	University of Minho	2016-18
Nasoni - Heterogeneous software coordination	INESC-TEC	2013-16
Mondrian - Foundations for architectural design	INESC-TEC	2013-16

Individual Grants Awarded

Type	**Project/Institution**	**Year**	**Topic**
Research grant	PL-FLAD Chair	2018	Hybrid Programs
Accomodation grant	Topdrim School on Topology	2015	-
PhD grant	Portuguese Science and Tech. Foundation (FCT)	2014	Hybrid programs
Research grant	Nasoni - Heterogeneous software coordination	2013	Hybrid logics
Research grant	Mondrian - Foundations for architectural design	2013	Hybrid logics
Research grant	Mondrian - Foundations for architectural design	2012	Hybrid logics

Academic Service

I reviewed submissions to the following conferences and journals: ICTAC 2022, JLAMP 2022, FACS 2021, FM 2021, ICTAC 2021, TASE 2021, FORTE 2021, FoSSacS 2020, Formalise 2020, JLAMP 2020, CONCUR 2020, TOCL 2020, FoSSacS 2019, FSCD 2019, MFCS 2019, iFM'19, SEFM 2018, AiML 2018, JLAMP 2018, TASE 2017, SETTA 2015, SBLP 2014, SBLP 2013. I am currently a guest editor in JLAMP. Additionally I was a PC member of the conferences/workshops listed on the table below.

Conference/Workshop Name	**Year**
38th Conference on the Mathematical Foundations of Programming Semantics (MFPS)	2022
26th International Workshop on Algebraic Development Techniques (WADT), Track chair	2022
8th International Conference on eDemocracy & eGovernment (ICEDEG)	2021
3rd IFIP International Conference on Topics in Theoretical Computer Science (TTCS)	2020
3rd DaLí Workshop - Dynamic Logic: new trends and applications	2020
9th Intern. Workshop on Open Community approaches to Education, Research and Technology	2019
EAI International Conference on Smart Governance for Sustainable Smart Cities (SmartGov)	2019
7th International Conference on eDemocracy & eGovernment (ICEDEG)	2019
2nd DaLí Workshop - Dynamic Logic: new trends and applications	2019
International Symposium on Molecular Logic and Computational Synthetic Biology	2018

In 2022 I coorganised a 4-hour seminar on quantum programming for our research group. The lecturer was Peter Selinger, one of the pioneers on the topic.

In 2020 I was member of the organisation committee of a workshop in the UNESCO World Logic Day, which happened in 2021.

In 2019 I was a publicist for the 3rd World Congress on Formal Methods (around 600 participants). In 2019 I also coorganised a 4-hour seminar on quantum λ-calculus. The lecturer was Benoît Valiron, one of the main contributors on the topic.

In 2017 I coorganised an international school on Probabilistic programming (around 90 participants).

In 2014 I coorganised a 'MAP-i Spring School on Logic of Dynamical Systems'. The lectures were given by a team from Carnegie Mellon University.

Invited Talks

I will give/gave invited talks at the following venues/research groups.

Conference/Workshop/Research group	**Year**
18th International Conference on Formal Aspects of Component Software (FACS'22)	2022
16th IFIP WG 1.3 Intern. Workshop on Coalgebraic Methods in Computer Science (CMCS'22)	2022
Computer Science Theory Seminar @ TTU	2022
Open Problems in Concurrency Theory, Int. Research Seminar	2019
Portuguese Seminar on Topology	2018
Chair of Computer Science @ Friedrich-Alexander University	2018
Peking University	2018
Coalgebra in the Netherlands Seminar (COIN)	2015
Mathematical and Metamathematical Modeling @ Tokyo University	2015

Schools and Professional Valorisation

School/Course	**Year**
IBM-QuantaLab Quantum Computing	2018
Summer school on Topology driven methods for complex systems	2015
Winter school on Logics for Dynamical Systems	2014
Summer school on Cyber-Physical Systems (CPS)	2013
Midlands graduate school (Mathematical Foundations of Computing Science)	2013
Course on Lecturing @ Bee consulting, maximum grade	2010

Selection of collaborations

Name	**Topic**
Benoît Valiron (Université Paris-Saclay)	Timing constraints in quantum programming
Dirk Hofmann (University of Aveiro)	Coalgebra in the topological setting
Sergey Goncharov (Friedrich-Alexander University)	Hybrid semantics
Fredrik Dahlqvist (University College London)	Quantitative semantics and calculi
Tarmo Uustalu (University of Reykjavik)	Typing systems for hybrid programming

Teaching Activities

Courses taught

The following table lists all courses that I taught. Years marked with * denote that I was the coordinator of the respective course edition.

Title	**Institute/Programme**	**Level**	**Year**
Quantum Computing	MAP-i programme	PhD	2020-21⋆
Cyber-Physical Computation	MAP-i programme	PhD	2019-20⋆
Quantum Computing	University of Minho	MSc	2021-22, 2022-23⋆
Cyber-Physical Programming	University of Minho	MSc	2021-22, 2022-23⋆
Cyber-Physical Computation	University of Minho	MSc	2021-22, 2022-23⋆
Architecture and Calculi	University of Minho	MSc	2019-20⋆, 2020-21⋆
Quantum Logic	University of Minho	MSc	2019-20, 2020-21
Functional Programming	University of Minho	BSc	2021-22
Program Calculus	University of Minho	BSc	2014-15, 2016-17, 2018-19, 2019-20, 2021-22
Informatics Labs	University of Minho	BSc	2014-15, 2019-20
Hybridse to specify (4 hours)	University of Minho	MSc	2013
Introduction to Programming	Singesco Center	High School	2010-11
Introduction to Databases	Singesco Center	High School	2010-11

Course proposals and restructuring of master degrees

In 2020 I proposed a course on 'Quantum Computing' in the context of the MAP-i doctoral programme with a team comprised of specialists on quantum-error correction codes, quantum λ-calculus, computability, and logic. The team included members of University of Minho and University of Aveiro (the MAP-i doctoral programme expects the lecturing team to be inter-universitary). The proposal was accepted for the academic year of 2020-21.

In 2019 I designed and proposed a course on 'Cyber-Physical Computation' in the context of the MAP-i doctoral programme with a teaching team that includes members of the University of Minho and University of Aveiro. The proposal was accepted for that academic year and was attended by students with different backgrounds (Physics and Informatics).

In 2019 I was invited by the pedagogical committee to participate in the restructuring of the degree "Mestrado Integrado em Engenharia Física" (Masters in Physics Engineering) at the University of Minho. Specifically, I participated in the coordination of the courses in the degree that intersect programming languages, quantum, and cyber-physical computation. On top of that, I designed a new course ('Cyber-physical Computation') for the degree.

(Co)supervisions

Name	**Level**	**Year**	**Topic**
Pedro Nora	PostDoc	2019	Quantitative semantics and its relation to Coalgebra
Juliana Souza	PhD	–	Quantitative semantics of hybrid programming
Vítor Fernandes	PhD	–	Timing constraints in Quantum (collab. with B. Valiron)
Liu Ai	PhD	2020	Quantum transition systems & component-based progr.
Eduardo Barbosa	MSc	–	Component-based programming and Agda
Tomás Carneiro	MSc	–	Verification of quantum programs
Paulo Ribeiro	MSc	2021	Regular expressions for timed automata
Tiago Loureiro	MSc	2017	Design and simulation of hybrid systems
Liu Ai	Visiting scholar	2018	Quantum automata and coalgebras for quantum systems
Rita Vale	BSc	2018	Implementation of a basic hybrid programming language

Juries

Name	**Level**	**Year**	**Topic**
Leandro Gomes	PhD	2022	Weighted computation
André Sequeira	PhD (pre-thesis)	2022	Quantum reinforcement learning
Diogo Rosa	MSc	2021	Fault tree analysis

Last time updated : September 2, 2022