

Giorgio Bacci

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Personal Informations

name Giorgio Bacci
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nationality Italian
gender Male

Education

- 2009–2013 **Ph.D. in Computer Science**, *University of Udine*, (thesis defended 27th May 2013).
Research Topics: Formal methods and semantic models for concurrency theory, with applications in the field of Systems Biology. Coalgebraic methods for Probabilistic Systems.
- 2005–2008 **Master Degree in Computer Science**, *University of Udine*, *110/110 cum laude*.
Covered Topics: Applications in different fields of computer science: advanced theoretical methodologies for semantical program analysis; advanced algorithm design methodologies and complexity analysis.
- 2002–2004 **Beachelor's Degree in Computer Science**, *University of Udine*, *110/110 cum laude*.
Covered Topics: Basic methodological knowledges of computer science: theoretical algorithm analysis, management and maintenance of software and computer systems, formal methods for semantical analysis.
- 1997–2002 **Scientific Lyceum (High School)**, *Liceo Scientifico Michelangelo Grigoletti*, via Interna 12 Pordenone, 33170 Italy, *Grade: 80/100*.
Covered Topics: Humanistic and scientific background. Foreign language: English.

Doctoral Courses

- May 2009 **Data Mining and Mathematical Programming**, Udine, Italy.
held by Paolo Serafini
- June 2009 **School on Formal Methods 09: Web Services**, Bertinoro, Italy.
- July 2009 **FIT Summer School**, Novi Sad, Serbia.
- September **Systems Biology**, Udine, Italy.
2009 held by Marino Miculan and Alberto Policriti
- Oct–Dec **Description & Verification of Concurrent Systems**, UPV Valencia, Spain.
2009 held by Javier Oliver and Marisa Llorens
- Oct–Dec **Concepts & Methods for Parallel Computation**, UPV Valencia, Spain.
2009 held by Antonio M. Vidal

- April 2010 **Computational Complexity**, Udine, Italy.
held by Romeo Rizzi
- May 2010 **Introduction to Software Configuration Management**, Udine, Italy.
held by Lars Bendix
- Oct 2010 **Ehrenfeucht-Fraïssé Games: Applications and Complexity**, Udine, Italy.
held by Angelo Montanari and Nicola Vitacolonna
- Sept-Oct 2011 **Logic Programming, Knowledge Representation, and Non Monotonic Reasoning**, Udine, Italy.
held by Agostino Dovier and Angelo Montanari
- Nov-Dec 2011 **Hybrid Automata**, Udine, Italy.
held by Carla Piazza
- Oct 2013 **Introduction to Logic and Model Theory**, Aalborg, Denmark.
held by Radu Mardare
- Oct 2013 **Differential Geometry**, Aalborg, Denmark.
held by Lisbeth Fajstrup, Martin Raussen, Rafael Wisniewski

Honours and Awards

Nominee for best paper award at ETAPS 2013

Experience

- Oct-Dec 2009 **Visiting the Technical University of Valencia**, UPV, Spain.
Activities: attendance of some Ph.D. courses.
- Mar-May 2011 **Visiting the University of Edinburgh**, School of Informatics, UK.
Activities: Research collaboration with prof. Vincent Danos.
- May-June 2012 **Visiting the University of Aalborg**, *Department of Computer Science*, Distributed and Embedded Systems Unit, Denmark.
Activities: Research collaboration with Radu Mardare and prof. Kim G. Larsen.

Program Committee Memberships

- 2015 **ICE 2015**, *8th Interaction and Concurrency Experience*, PC Member.

Organized Events

- 2014-now **Breakfast Talks**, *Informal series of talks at DES unit*, Aalborg University, Chair.
- 2015-now **DES Seminars**, *Formal series of seminars at DES unit*, Aalborg University, Chair.

Research Project

- 2009–2012 **SisteR**, *Sistemi di Riduzione: sintesi, raffinamento e verifica di modelli comportamentali*, Italian Project, MiUR PRIN 20088HXMYN.
- 2012–2013 **MT-LAB**, *Modeling of information Technology*, VKR Centre of Excellence, Supported by Villum Foundation and Velux Foundation.
- 2012–2017 **IDEA4CPS**, *Foundations for Cyber-Physical Systems*, the Danish National Research Foundation and the National Science Foundation China.
- 2013–2016 **SENSATION**, *Self Energy-Supporting Autonomous Computation*, Supported by the European Union 7th Framework Programme (FP7/2007-2013).

Attended Conferences and Workshops

- July 2007 **Workshop on Developments in Computational Models, DCM 2007**, Wroclaw, Poland, (speaker).
- September 2009 **Workshop on Membrane Computing and Biologically Inspired Process Calculi, MeCBIC 2009**, Bologna, Italy, (speaker).
- September 2009 **Conference on Algebra and Coalgebra in Computer Science, CALCO 2009**, Udine, Italy, (helped in the organization).
- August 2010 **Workshop on Membrane Computing and Biologically Inspired Process Calculi, MeCBIC 2010**, Jena, Germany, (speaker).
- October 2010 **International Workshop on Graph Computation Models, GCM 2010**, Enschede, The Netherlands, (speaker).
- April 2012 **Workshop on Coalgebraic Methods in Computer Science, CMCS 2012**, Tallinn, Estonia, (speaker).
- August 2013 **International Conference on Quantitative Evaluation of Systems, QEST 2013**, Buenos Aires, Argentina, (speaker).
- Jan 2014 **Quantitative Models: Expressiveness, Analysis, and New Applications, Dagstuhl Seminar 14041**, Dagstuhl, Germany, (speaker).
- March 2014 **Workshop on Duality and Probabilistic Systems, Bellairs Workshop 2014**, McGill Bellairs Reserch Center, Barbados, (speaker).
- March 2014 **Research Seminar in Open Problems in Concurrency Theory, OPCT 2014**, Bertinoro, Italy, (invited attendee).
- Sept 2014 **IDEA4CPS workshop Project meeting, IDEA4CPS 2014**, Aalborg, Denmark, (speaker).
- April 2015 **European Joint Conferences on Theory and Practice of Software, ETAPS 2015**, London, UK, (speaker).
- Oct 2015 **International Colloquium of Theoretical Aspects of Computing, ICTAC 2015**, Cali, Colombia, (speaker).
- Apr 2016 **International Workshop on Weighted Automata: Theory and Applications, WATA 2016**, Aalborg, Denmark, (speaker).
- Aug 2016 **International Conference on Concurrency Theory, CONCUR 2016**, Québec City, Canada, (speaker).

Teaching

- 2010–2011 **Architettura degli Elaboratori e Laboratorio**, *LT Informatica*, University of Udine, principal holder: prof. Pietro di Gianantonio.
16 hours
- 2011–2012 **Architettura degli Elaboratori e Laboratorio**, *LT Informatica*, University of Udine, principal holder: prof. Pietro di Gianantonio.
16 hours
- 2014–2015 **Semantics and Verification**, Aalborg University, principal holders: prof. Kim G. Larsen and Jiří Srba.
45 hours
- 2016–2017 **Computability and Complexity**, Aalborg University, principal holder: prof. Radu Mardare.
45 hours

Problem Based Learning (PBL)

- Spring 2014 **Project Supervision**, *DAT4, Design and Implementation of a Compiler*, Aalborg University, semester coordinator: prof. Alexandre David.
100 hours (one group of 7 people)
- Spring 2015 **Project Supervision**, *DAT4, Design and Implementation of a Compiler*, Aalborg University, semester coordinator: prof. Hans Hüttel.
60 hours (one group of 4 people)
- Spring 2015 **Project Supervision**, *SW4, Design and Implementation of a Compiler*, Aalborg University, semester coordinator: prof. Lone Leth Thomsen.
75 hours (one group of 5 people)
- Spring 2016 **Project Supervision**, *SW2, Programming and Problem Solving*, Aalborg University, semester coordinator: prof. Kurt Nørmark.
100 hours (one group of 7 people)

Attended Courses in Pedagogy

- Nov 2013 **Basic Course in Pedagogy for University Teachers**, Aalborg, Denmark.
held by Dorina Gnaur and Annie Aarup Jensen (30 working hours - 2 ECTS)
- Sept, Oct 2014 **Basic course with focus on PBL, AAU-model**, Aalborg, Denmark.
held by Dorina Gnaur and Annie Aarup Jensen (30 working hours - 2 ECTS)
- May 2014 **Project Examination at Aalborg University**, Aalborg, Denmark.
held by Hans Hüttel

Languages

- italian Mother tongue
english B2 (scholarly)

Journal Publications

- [1] **Giorgio Bacci**, Marino Miculan, *Structural Operational Semantics for Continuous State Stochastic Transition Systems*, in Dirk Pattinson and Lutz Schröder, editors, 11th International Workshop on Coalgebraic Methods in Computer Science, CMCS 2012 (Selected Papers), Journal of Computer and System Sciences, Volume 81, Issue 5, pp. 834–858, 2015, (doi: 10.1016/j.jcss.2014.12.003).
- [2] **Giorgio Bacci**, Marino Miculan, *Measurable Stochastic for Brane Calculus*, in G. Ciobanu and M. Koutny, editors, Modelling and Analysis of Biological Systems, Theoretical Computer Science, Volume 431, pp. 117–136, 2012, (doi: 10.1016/j.tcs.2011.12.055).

Invited Publications

- [3] **Giorgio Bacci**, Vincent Danos, Ohad Kammar, *On the statistical thermodynamics of communicating processes*, in A. Corradini, B. Klin, and C. Cirstea, editors, Proceedings of the 4th International Conference on Algebra and Coalgebra in Computer Science (CALCO 2011). Lecture Notes in Computer Science Volume 6859, pp. 1–18, 2011 (doi: 10.1007/978-3-642-22944-2_1).

- [4] **Giorgio Bacci**, Giovanni Bacci, Kim G. Larsen, Radu Mardare, *The Behavior of Probabilistic Systems: From Equivalences to Behavioral Distances*, in M. Abadi, P. Gardner, A. D. Gordon, R. Mardare editors, Essays for the Luca Cardelli Fest, Microsoft Research Technical Reports, MSR-TR-2014-104, pp. 15–26, 2014.

Peer Reviewed Publications

- [5] **Giorgio Bacci**, Giovanni Bacci, Kim G. Larsen, Radu Mardare, *Complete Axiomatization for the Bisimilarity Distance on Markov Chains*, in J. Desharnais and R. Jagadeesan editors, Proceedings of the 27th International Conference on Concurrency Theory (CONCUR 2016). Leibniz International Proceedings in Informatics, Article No. 21, 2016 (doi: 10.4230/LIPIcs.CONCUR.2016.21).
- [6] **Giorgio Bacci**, Giovanni Bacci, Kim G. Larsen, Radu Mardare, *Converging from Branching to Linear Metrics on Markov Chains*, in M. Leucker, C. Rueda, F. D. Valencia editors, Proceedings of the 12th International Colloquium of Theoretical Aspects of Computing (ICTAC 2015). Lecture Notes in Computer Science Volume 9399, pp. 1-19, 2015 (doi: 10.1007/978-3-319-25150-9_21).
- [7] **Giorgio Bacci**, Giovanni Bacci, Kim G. Larsen, Radu Mardare, *On the Total Variation Distance of Semi-Markov Chains*, in A. Pitts editor, Proceedings of the 18th International Conference on Foundations of Software Science and Computation Structures (FoSSaCS 2015). Lecture Notes in Computer Science, Volume 9034, pp. 185-199, 2015 (doi: 10.1007/978-3-662-46678-0_12).
- [8] **Giorgio Bacci**, Marino Miculan, Romeo Rizzi, *Finding a Forest in a Tree (the matching problem for wide reactive systems)*, in M. Maffei, E. Tuosto editors, Proceedings of the 9th International Symposium on Trustworthy Global Computing (TGC 2014). Lecture Notes in Computer Science, Volume 8902, pp. 17-33, 2014 (doi: 10.1007/978-3-662-45917-1_2).
- [9] **Giorgio Bacci**, Giovanni Bacci, Kim G. Larsen, Radu Mardare, *Bisimulation on Markov Processes over Arbitrary Measurable Spaces*, in F. van Breugel, E. Kashefi, C. Palamidessi, J. Rutten editors, Horizons of the Mind. A Tribute to Prakash Panangaden, Lecture Notes in Computer Science Volume 8464, pp. 76–95, 2014 (doi: 10.1007/978-3-319-06880-0_4).
- [10] **Giorgio Bacci**, Giovanni Bacci, Kim G. Larsen, Radu Mardare, *Computing Behavioral Distances, Compositionally*, in K. Chatterjee, J. Sgall, editors, Proceedings of the 38th International Symposium on Mathematical Foundations of Computer Science (MFCS 2013). Lecture Notes in Computer Science Volume 8087, pp. 74–85, 2013 (doi: 10.1007/978-3-642-40313-2_9).
- [11] **Giorgio Bacci**, Giovanni Bacci, Kim G. Larsen, Radu Mardare, *The BisimDist Library: Efficient Computation of Bisimilarity Distances for Markovian Models*, in K. Joshi, M. Siegle, M. Stoelinga, P. R. D’Argenio, editors, Proceedings of the 10th International Conference on Quantitative Evaluation of SysTems (QEST 2013). Lecture Notes in Computer Science Volume 8054, pp. 257–260, 2013 (doi: 10.1007/978-3-642-40196-1_23).
- [12] **Giorgio Bacci**, Giovanni Bacci, Kim G. Larsen, Radu Mardare, *On-the-Fly Exact Computation of Bisimilarity Distances*, in N. Piterman, S. A. Smolka, editors, Proceedings of the 19th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2013). Lecture Notes in Computer Science Volume 7795, pp. 1–15, 2013 (doi: 10.1007/978-3-642-36742-7_1).

- [13] **Giorgio Bacci**, Marino Miculan, *Structural Operational Semantics for Continuous State Probabilistic Processes*, in D. Pattinson, L. Schröder, editors, Proceedings of the 11th International Workshop on Coalgebraic Methods in Computer Science (CMCS 2012), Lecture Notes in Computer Science Volume 7399, pp. 71–89, 2012 (doi: 10.1007/978-3-642-32784-1_5).
- [14] **Giorgio Bacci**, Davide Grohmann, *On Decidability of Bigraphical Sortings*, in Preliminary proceedings of the Third International Workshop on Graph Computation Models (GCM 2010).
- [15] **Giorgio Bacci**, Marino Miculan, *Measurable Stochastic for Brane Calculus*, in G. Ciobanu, M. Koutny, editors, Proceedings of the Fourth International Workshop on Membrane Computing and Biologically Inspired Process Calculi (MeCBIC 2010), EPTCS 40, pp. 6–22, 2010. Printed version: ISBN 978-3-86805-767-6 (doi: 10.4204/EPTCS.40.2).
- [16] **Giorgio Bacci**, Davide Grohmann, Marino Miculan, *A framework for protein and membrane interactions*, in G. Ciobanu, editor, Proceedings of the Third International Workshop on Membrane Computing and Biologically Inspired Process Calculi (MeCBIC 2009). EPTCS 11, pp. 19–13, 2009 (doi: 10.4204/EPTCS.11.2).
- [17] **Giorgio Bacci**, Davide Grohmann, Marino Miculan, *Bigraphical models for protein and membrane interactions*, in G. Ciobanu, editor, Proceedings of the Third International Workshop on Membrane Computing and Biologically Inspired Process Calculi (MeCBIC 2009). EPTCS 11, pp. 3–18, 2009 (doi: 10.4204/EPTCS.11.1).
- [18] **Giorgio Bacci**, Davide Grohmann, Marino Miculan, *DBtk: a Toolkit for Directed Bigraphs*, in A. Kurz, M. Lenisa, and A. Tarlecki, editors, in Proceedings of a Satellite Workshop of the Third Conference on Algebra and Coalgebra in Computer Science (CALCO-tools 2009). Lecture Notes in Computer Science Volume 5728, pp. 413–422, 2009 (doi: 10.1007/978-3-642-03741-2_28).
- [19] **Giorgio Bacci**, Marino Miculan, *Undecidability of Model checking in Brane Logic*, in Dezani and Danos, editors, Proceedings of the Third International Workshop on Developments in Computational Models (DCM 2007). Electronic Notes in Theoretical Computer Science Volume 192, Issue 3, pp. 23–37. (doi: 10.1016/j.entcs.2008.10.025).
- [20] Marino Miculan, **Giorgio Bacci**, *Modal Logics for Brane Calculus*, in C. Priami, editor, Proceedings of the Fourth Conference on Computational Methods in Systems Biology (CMSB’06). Lecture Notes in Computer Science, Volume 42, pp 1–16, 2006. (doi: 10.1007/11885191).

Short Contributions and Technical Reports

- [21] **Giorgio Bacci**, *Final Coalgebras in Categories with Factorization Systems*, Short contribution presented at the 11th International Workshop on Coalgebraic Methods in Computer Science (CMCS 2012).

Ph.D. thesis

title *Generalized Labelled Markov Processes, Coalgebraically*
 supervisor prof. Miculan Marino

abstract Coalgebras of measurable spaces are of interest in probability theory as a formalism for representing Labelled Markov Processes (LMPs). The thesis discusses some general facts related to the notions of bisimulation and cocongruence on these systems, and provides a faithful characterization of bisimulation on LMPs on generic measurable spaces. This has been used to prove that bisimilarity on single LMPs is an equivalence without assuming the state space to be analytic. As the second main contribution, it has been introduced the first specification rule format to define well-behaved composition operators for LMPs. This allows one to define process description languages on LMPs which are always guaranteed to have a fully-abstract semantics and with operators that are congruential w.r.t. behavioral equivalence.

key words Markov Processes; Bisimulation; Coalgebras; Structural operational semantics; Behavioral distances