Curriculum Vitae

up to January 24, 2019

Alessandro De Luca

DIETI, University of Naples Federico II
via Claudio, 21 — 80125 Napoli, Italy
alessandro.deluca@unina.it

Personal

Born: 1981 in Heerlen, Netherlands. Nationality: Italian.

Current position

Member of the Department of Electrical Engineering and Information Technologies (DIETI) since its activation at the University of Naples Federico II on January 1, 2013. Aassistant professor (*Ricercatore*) of Computer Science at the same university since December 28, 2010.

Past Employment and Education

- Post-doc researcher at the Department of Mathematics of the University of Turku (Finland), within the "Words, Numbers and Tilings with Applications" project, headed by Luca Q. Zamboni and sponsored by the Finnish Academy via a FiDiPro grant, from October 1, 2010 to February 29, 2012 (part-time after December 28, 2010).
- Post-doc researcher at the Laboratoire de Combinatoire et d'Informatique Mathématique (LaCIM) of Université du Québec à Montréal (UQAM) under the supervision of Christophe Reutenauer and Srečko Brlek, from September 21, 2009 to September 20, 2010.
- Post-doc researcher in Computer Science at the Department of Mathematics and Applications of University of Naples Federico II, from June 1, 2008 to May 31, 2009.

- Ph.D. awarded on March 3, 2008 by the Graduate School in Mathematical and Computing Sciences of the University of Naples Federico II. Thesis: Combinatorial aspects of Sturmian sequences and their generalizations. Advisor: Aldo de Luca.
- MSc ("Laurea") *cum laude* in Mathematics at the University of Naples Federico II, October 22, 2003.
- Attendance of the Algebraic Geometry and Algebraic Topology classes of the Scuola Matematica Interuniversitaria (SMI), at the University of Perugia (Italy), August 2003.
- Native Italian speaker; fluent English speaker and good French speaker.

Teaching Experience

- Since academic year 2012–13, adjunct professor of Information Theory, a graduate Computer Science class at the University of Naples Federico II. From 2005–06 till 2007–08, teaching assistance for the same class, then held by Aldo de Luca.
- Since academic year 2011–12, adjunct professor of Databases and Information Systems lab, an undergraduate Computer Science class at the University of Naples Federico II.
- Teaching assistance for the Mathematics for Computer Science class held by Anne Bergeron at UQAM in 2010.
- Teaching assistance for the Matrix Algebra class held by Srečko Brlek at UQAM in 2010.

Scientific Research

The main areas of my research are theoretical computer science and discrete mathematics. In particular, I am interested in *combinatorics on words*, the study of structural and algebraic properties of finite and infinite strings of symbols. This field has deep connections with number theory, physics, biology, and other areas of computer science.

Sturmian words and generalizations have been the main focus of my investigation. Recently, I mostly concentrated on Christoffel words [1, 4, 7, 11] with their connection to number theory, and on open vs. closed (aka *periodic-like*) prefixes of words, especially in the Sturmian and trapezoidal cases [2, 6, 8]. We also found that Sturmian and Arnoux-Rauzy words have *well distributed occurrences* [3, 5], showing how this yields statistically valid pseudorandom number generation. In a different line of research, we characterized infinite Sturmian words in terms of the lexicographic order [9].

Previously, I had also focused on rich words, a broad family containing (epi-)Sturmian words and their factors, from the point of view of periodicity [17] and complexity [14,

15]. Inspired by bioinformatics (Watson-Crick involution), we also introduced and studied some different generalizations of episturmian words, all based on *special factors* and *involutory antimorphisms* of the free monoid [13, 16, 18–23, 25]. In other papers related to episturmian words, we used and expanded the important tool known as (iterated) palindromic closure or *palindromization* [10, 12, 25].

My first efforts were devoted to finite factors of Sturmian words, finding new characterizations (implemented as linear-time algorithms) and studying the structure and enumeration of palindromic factors [24, 26, 27].

Research Projects and Collaborations

- Ongoing collaboration with Gabriele Fici (University of Palermo) and Golnaz Badkobeh (Goldsmiths University of London), among others.
- Member of the Centre for Combinatorics on Words and Applications (CCWA) at Murdoch University, Perth (Australia) since late 2014.
- Member of the Group for Algebraic and Geometric Structures and Their Applications (GNSAGA) of the Italian Institute for Higher Mathematics (INdAM) since 2005.
- In 2010–2012, active participation in the aforementioned FiDiPro project at the University of Turku, sponsored by the Finnish Academy.
- Participating in the project PRIN 2010–11 "Automi e Linguaggi Formali: Aspetti Matematici e Applicativi" (Automata and formal languages: mathematical and applicative aspects) funded by the Italian Ministry of Education (MIUR). Previously member of similar projects PRIN 2007 and PRIN 2005.
- Visiting University of North Texas (Denton, USA) in 2007, from November 6 to December 18, invited by Prof. Luca Q. Zamboni.
- Invited at the University of Turku (Finland) from March till June 2006, for research under the supervision of Prof. Juhani Karhumäki.

Attended Conferences and Workshops

- *Workshop on Words and Complexity*: Lyon 2018.
- *WORDS*: Montreal 2017 and 2005, Kiel (Germany) 2015, Turku (Finland) 2013, Prague 2011, Salerno 2009 (also member of the organizing committee), Marseille 2007.
- *Incontro di Combinatoria delle Parole* workshop: Palermo 2017 and 2013.
- *Journées Montoises d'Informatique Théorique*: Liège 2016, Mons (Belgium) 2008, Rennes (France) 2006.

- *Combinatorics on Words* workshop: Marseille 2016.
- *FLA* (Formal Languages and Automata) workshop: Naples 2016.
- *DLT* (Developments in Language Theory): Paris-Est 2013 (also member of the Program committee), Milan 2011, London, ON (Canada) 2010, Stuttgart 2009, Kyoto 2008, Palermo 2005.
- *Workshop on Challenges in Combinatorics on Words at the Fields Institute*: Toronto 2013.
- *RuFiDiM* (Russian-Finnish symposium on Discrete Mathematics): Turku 2012 and St. Petersburg 2011.
- *GAMES* workshop: Naples 2012.
- *Combinatorial and Algorithmic Aspects of Sequence Processing* seminar: Dagstuhl (Germany) 2011.
- *Highlights of AutoMathA*: Vienna 2010.
- *Sage Day 25.5* and *GASCom* (Génération aléatoire de structures combinatoires): Montreal 2010.
- *LaCIM 2010*: Montreal 2010.
- *Interaction entre Géometrie discrete et combinatoire des mots* workshop: Marseille 2010.
- *DGCI* (Discrete Geometry for Computer Imagery): Montreal 2009.
- *LATA* (Language and Automata Theory and Applications): Tarragona (Spain) 2009.
- *AutoMathA*: Palermo 2007.
- *Workshop on Fibonacci Words*, Turku 2006.
- *Workshop on Words and Automata*, St. Petersburg 2006.

Talks

- *The sequence of open and closed prefixes of a Sturmian word*, at the ICP workshop in Palermo, January 20, 2017.
- *Derivatives of Christoffel and standard words*, at the FLA workshop in Naples, January 14, 2016.
- *Stern's diatomic sequence, fraction trees, and Christoffel words*, at the University of Liège, November 13, 2014 and again at University of Palermo, November 27, 2014.

- *Numeri pseudo-casuali e parole con occorrenze ben distribuite (WDO)*, at the ICP workshop in Palermo, October 11, 2013.
- *Reversible Christoffel factorizations*, at the RuFiDiM conference in St. Petersburg, September 22, 2011.
- *Palindromic Richness in Finite and Infinite Words*, for the Séminaire du LaCIM in Montreal, November 27, 2009.
- *On a Family of Morphic Images of Arnoux-Rauzy Words*, at the LATA conference in Tarragona, April 6, 2009.
- *Special factors and images of Arnoux-Rauzy words*, at the JM08 conference in Mons, August 30, 2008.
- *Some generalizations of episturmian words and morphisms*, at the WORDS conference in Marseille, September 18, 2007.
- *Sturmian Words. Some characterisations and extensions*, at the University of Turku, May 24, 2006.
- *Sequenze Sturmiane. Teoria e Applicazioni*, at the University of Naples Federico II, October 24, 2005.
- *Palindromes in Sturmian Words*, at the DLT conference in Palermo, July 8, 2005.

Publications

[1] A. D'Aniello, A. de Luca, and A. De Luca. "On Christoffel and standard words and their derivatives". *Theoret. Comput. Sci.* 658 (2017), pp. 122–147.

[2] A. De Luca, G. Fici, and L. Q. Zamboni. "The sequence of open and closed prefixes of a Sturmian word". *Advances in Applied Mathematics* 90 (2017), pp. 27–45.

[3] Ľ. Balková, M. Bucci, A. De Luca, J. Hladký, and S. Puzynina. "Aperiodic pseudorandom number generators based on infinite words". *Theoret. Comput. Sci.* 647 (2016), pp. 85–100.

[4] A. de Luca and A. De Luca. "Sturmian words and the Stern sequence". *Theoret. Comput. Sci.* 581 (2015), pp. 26–44.

[5] Ľ. Balková, M. Bucci, A. De Luca, and S. Puzynina. "Infinite Words with Well Distributed Occurrences". In: *Combinatorics on Words*. Ed. by J. Karhumäki, A. Lepistö, and L. Zamboni. Vol. 8079. Lecture Notes in Computer Science. Springer, 2013, pp. 46–57.

[6] M. Bucci, A. De Luca, and G. Fici. "Enumeration and structure of trapezoidal words". *Theoret. Comput. Sci.* 468 (2013), pp. 12–22.

[7] M. Bucci, A. De Luca, and L. Q. Zamboni. "Reversible Christoffel factorizations". *Theoret. Comput. Sci.* 495 (2013), pp. 17–24.

[8] A. De Luca and G. Fici. "Open and Closed Prefixes of Sturmian Words". In: *Combinatorics on Words*. Ed. by J. Karhumäki, A. Lepistö, and L. Zamboni. Vol. 8079. Lecture Notes in Computer Science. Springer, 2013, pp. 132–142.

[9] M. Bucci, A. De Luca, and L. Q. Zamboni. “Some characterizations of Sturmian words in terms of the lexicographic order”. *Fund. Inform.* 116.1–4 (2012), pp. 25–33.

[10] A. de Luca and A. De Luca. “A generalized palindromization map in free monoids”. *Theoret. Comput. Sci.* 454 (2012), pp. 109–128.

[11] A. De Luca and C. Reutenauer. “Christoffel words and the Calkin-Wilf tree”. *Electron. J. Combin.* 18.2 (2011), P22.

[12] M. Bucci, A. de Luca, and A. De Luca. “On the number of episturmian palindromes”. *Theoret. Comput. Sci.* 411 (2010), pp. 3668–3684.

[13] M. Bucci and A. De Luca. “On a Family of Morphic Images of Arnoux-Rauzy Words”. In: *Language and Automata Theory and Applications*. Ed. by A. H. Dediu, A. M. Ionescu, and C. Martín-Vide. Vol. 5457. Lecture Notes in Computer Science. Springer, 2009, pp. 259–266.

[14] M. Bucci, A. De Luca, A. Glen, and L. Q. Zamboni. “A connection between palindromic and factor complexity using return words”. *Adv. in Appl. Math.* 42 (2009), pp. 60–74.

[15] M. Bucci, A. De Luca, A. Glen, and L. Q. Zamboni. “A new characteristic property of rich words”. *Theoret. Comput. Sci.* 410 (2009), pp. 2860–2863.

[16] M. Bucci, A. de Luca, and A. De Luca. “Characteristic morphisms of generalized episturmian words”. *Theoret. Comput. Sci.* 410 (2009), pp. 2840–2859.

[17] M. Bucci, A. de Luca, and A. De Luca. “Rich and Periodic-like Words”. In: *Developments in Language Theory*. Ed. by V. Diekert and D. Nowotka. Vol. 5583. Lecture Notes in Computer Science. Springer, 2009, pp. 145–155.

[18] M. Bucci, A. de Luca, A. De Luca, and L. Q. Zamboni. “On θ-episturmian words”. *European J. Combin.* 30 (2009), pp. 473–479.

[19] M. Bucci and A. De Luca. “Special factors and images of Arnoux-Rauzy words”. In: *Local Proceedings of the 12th Journées Montoises d’Informatique Théorique*. 2008.

[20] M. Bucci, A. de Luca, and A. De Luca. “On a Generalization of Standard Episturmian Morphisms”. In: *Developments in Language Theory*. Ed. by M. Ito and M. Toyama. Vol. 5257. Lecture Notes in Computer Science. Springer, 2008, pp. 158–169.

[21] M. Bucci, A. de Luca, A. De Luca, and L. Q. Zamboni. “On different generalizations of episturmian words”. *Theoret. Comput. Sci.* 393 (2008), pp. 23–36.

[22] M. Bucci, A. de Luca, A. De Luca, and L. Q. Zamboni. “On some problems related to palindrome closure”. *Theor. Inform. Appl.* 42 (2008), pp. 679–700.

[23] M. Bucci, A. de Luca, and A. De Luca. “Some generalizations of episturmian words and morphisms”. In: *Proceedings of WORDS 2007*. Ed. by P. Arnoux, N. Bédaride, and J. Cassaigne. 2007, pp. 100–108.

[24] A. de Luca and A. De Luca. “Combinatorial properties of Sturmian palindromes”. *Internat. J. Found. Comput. Sci.* 17 (2006), pp. 557–574.

[25] A. de Luca and A. De Luca. “Pseudopalindrome closure operators in free monoids”. *Theoret. Comput. Sci.* 362 (2006), pp. 282–300.

[26] A. de Luca and A. De Luca. “Some characterizations of finite Sturmian words”. *Theoret. Comput. Sci.* 356 (2006), pp. 118–125.

[27] A. de Luca and A. De Luca. “Palindromes in Sturmian Words”. In: *Developments in Language Theory*. Ed. by C. De Felice and A. Restivo. Vol. 3572. Lecture Notes in Computer Science. Springer, 2005, pp. 199–208.