

CURRICULUM VITAE

of

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Born the 24 Avril 1947 in Paris (France).

Present position

CNRS Senior Research Scientist (Directeur de Recherche)
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Research area

Theoretical Computer Science. Automata theory on finite and infinite words, functions realized by finite automata, pushdown automata and context-free languages. Models for parallelism: trace theory, automata resynchronization. Automata and number systems. Combinatorics of words, combinatorial theory of groups and semigroups.

Diplomas

1979 Docteur ès Sciences Mathématiques (mention Informatique)
1976 Docteur 3ème cycle Mathématiques (mention Informatique)
1968 Ingénieur de l’Ecole Polytechnique (Paris)

Professional curriculum

Positions

1973 – : Research Scientist at the *Centre National de la Recherche Scientifique*
1972 – 1973 : Assistant Professor in Mathematics at *University Paris 7*
1969 – 1972 : Research Scientist at the *Research Institut for Transportation*

Administrative positions

1989 – 1996 : Director of the *Institut Blaise Pascal*,
federation of the computer science laboratories of the Univ. Paris 6 and Paris 7.
1986 – 1988 : Deputy Director of the *LITP*.
1982 – 1983 : *Chargé de mission* for Computer Science
at the *Scientific and Technical Mission* of the *Ministry for Industry and Research*.

Visiting positions

1984 – 1985 : *Professor* at the Computer Science Department of the *Saarbrücken University*.
1980 – 1981 : *Researcher* at *Research Institute for Mathematical Sciences, Kyoto*.

Teaching activities

Automata Theory, Undergraduate course at ENST (2001–)
Automata Theory, Graduate course (DEA and Master) at Univ. Paris 6 and Paris 7 (1983–)
Data Structures and Algorithms, for the Bull Company Continuous Education Center (1986–1991)
Short courses at Auckland (2004), Come (2002), Turku (1997), Saõ Paulo (1991), Palerme (1984).

SCIENTIFIC ACTIVITY — A SHORT ACCOUNT

For almost 30 years now, my area of research is automata theory, under its many various aspects, from deterministic pushdown automata to star height of regular languages, from combinatorics of words to non standard numeration systems, as it can be observed when browsing through my publication list.

Automata theory is the *linear algebra* of computer science, and this is a sentence with a double meaning. First, automata theory is literally linear algebra, or can be seen as such, a theory of matrices with entries taken in adequate structures. But the metaphorical sense is even more interesting. Automata theory — especially the theory of finite automata — is a basic knowledge in computer science, known by all and used by everyone, which belongs to the framework for such a long time that it is hardly noticed anymore. A finite automaton is the simplest model of a computing machine, so simple that it takes forms, it appears in contexts, it underlies applications as numerous as diverse. The concepts of automata theory, its methods and results are used from one end of computer science to the other — from computational linguistics to system verification for instance.

In 2003, I completed a comprehensive work where I tried to render the richness and the diversity of the subject while making clear its profound unity. This was a several year project in the course of which I gave an original presentation to several results of the theory and developed some new ones, all of which are not included in that book itself. Let me quote some of these.

1. Systematic use of the notion of *covering* of automata, borrowed to Stallings, and reinterpretation in this framework of a construct due to Schützenberger that allows to establish the structure theorems for finite transducers.

2. Definition of the universal automaton of a regular language, based on an idea of Conway; description from this automaton of all (non-deterministic) automata accepting a given language with a minimum number of states; links with the star height in the case of reversible languages.

3. Generalisation of an idea due to Antimirov in order to construct an automaton equivalent to a given expression *with multiplicity*.

4. Elaboration on a result by Fliess for the definition of a new class of semirings in order to establish a stable theory for rational relations with multiplicity.

5. Study of the synchronized rational relations and of the resynchronization algorithms for automata.

6. Study of the realization by finite automata of the transition between different kinds of numeration system associated to a quadratic Pisot unit.

7. Study of the development of integers in a rational base.

A characteristic of automata theory is that the results, or to be more precise their proofs, are algorithms. Many softwares exist that implement these algorithms but only one deals with automata with multiplicity or with transducers and no one really integrate the versatility of the model. Since several years, I am supervising a team of students who write a C++ platform for computing with transducers and automata with multiplicity and whose modules are both generic and efficient. We have now a beta version and the experiments may begin.

In the last ten years, I have been invited to more than 20 conferences to give talks or tutorials, I have presented 8 communications, and I have been invited to give lectures in the universities of Palermo, Jerusalem, Bar-Ilan (Tel-Aviv), Turku, Hanoi, Hong-Kong, Como, Nigata, Ookayama, Auckland and Montréal.

RESEARCH ADMINISTRATION AND ORGANISATION

Since the beginning of my career as a researcher, I have been interested in the organisation and the administration of research. I have sit in several committees and occupied a few direction positions.

- 1989 – 1996 : Director of the *Institut Blaise Pascal*,
federation of the computer science laboratories of the Univ. Paris 6 and Paris 7.
- 1989 – 1996 : Coordinator of the *ASMICS Working Group*,
an ESPRIT Basic Research Action project.
- 1989 – 1994 : Director of the *Graduate School Blaise Pascal*.
- 1986 – 1988 : Deputy Director of the *LITP*.
- 1982 – 1983 : *Chargé de mission* for Computer Science
at the *Scientific and Technical Mission* of the *Ministry for Industry and Research*.
- 1975 – 1980 : Secretary of the section “Computer Science, Control Theory and
Signal Processing” of the *Comité National de la Recherche Scientifique*.

Direction of the Institut Blaise Pascal, 1989–1996

In 1988, I was asked by the CNRS to organise the federation of the four computer science laboratories on the Jussieu campus and appointed the head of it. This was rather a big institute with more than 200 faculty members and about the same number of Ph. D. students.

A number of projects were launched but this federation eventually did not survive the strained relationship between the two universities Paris 6 and Paris 7. A stressful but instructive experience.

Direction of the Graduate School Blaise Pascal, 1989–1994

I had anticipated the move taken since then by the French Ministry of Higher Education and proposed the creation of a *Graduate School* that brought together the 7 DEA’s in Computer Science that were taught on the Jussieu campus. Among other things, it allowed to provide their students with computing facilities that were lacking at that time.

This organisation is still alive through its descendant, the EDITE graduate school.

Coordination of ASMICS Working Group, 1989–1996.

ASMICS is the acronym for *Algebraic and Syntactic Methods in Computer Science*. The ASMICS Working Group was a Basic Research Action contract of the ESPRIT II & III programmes. I was its coordinator, together with Jean-Eric Pin and Maurice Nivat for the first phase, by myself for the second.

Moneywise, ASMICS was rather a modest project (120 KECU per year during 6 years). But it brought together 17 european teams (5 German, 5 French, 4 Italian, 1 Belgian, 1 Portugese and 1 Netherlands) and has been very effective. It is noteworthy that this cooperation programme between partners who already knew eachother well had such an impact on the number and on the strength of their relations. Not only the scientific information has been exchanged at a higher rate but true collaborations have been engaged that have produced new results and developments of the domain.

Miscellaneous

I have been elected or appointed to the following committees: French representative at the IFIP Technical Committee TC1 *Foundations of Computer Science* (1989–), Research Committee of ENST (2000–), Board of Directors of the University Paris 6 (1994–1996), Scientific Committee of AFCET (the French IT professionnall society) (1993–1996).

PUBLICATION LIST

Books or chapter in books

- [1] Subwords, Chapter 6 of *Combinatorial Problems on Words*, M. Lothaire ed., Addison Wesley, 1983. Reprint by Cambridge University Press, 1997. Joint work with I. Simon.
- [2] *Manuel d'Informatique, Logique et Automates*, Ellipses, 1998. Joint work with P. Bellot.
- [3] *Eléments de théorie des automates*, Vuibert, 2003.
- [4] *Elements of Automata Theory*, Cambridge University Press, (English trans. of the above.) to appear.

Journal papers

- [5] Monoïdes pointés, *Semigroup Forum* **18**, 1979, 235–264.
- [6] Sur une propriété d'itération des langages algébriques déterministes, *Mathematical System Theory* **14**, 1981, 247–288.
- [7] Description des monoïdes de type fini, *E.I.K.* **17**, 1981, 417–434.
- [8] On the Hotz group of a context-free grammar, *Acta Informatica* **18**, 1982, 109–115. Joint work with Ch. Frougny and E. Valkema.
- [9] Deux remarques sur un théorème de S. Eilenberg, *RAIRO Informatique Théorique* **17**, 1983, 23–48.
- [10] Recurrent words for substitutions, *Mathematical System Theory* **17**, 1984, 199–215. Joint work with Y. Kobuchi and T. Nishida.
- [11] A problem on rational subsets of the free group, *Amer. Math. Monthly* **91**, 1984, 499–501.
- [12] Une application de la représentation matricielle des transductions, *Theoret. Comput. Sci.* **35**, 1985, 271–293. Joint work with J.E. Pin.
- [13] On the complexity of some extended word problems defined by cancellation rules, *Information Processing Newsletter* **23**, 1986, 281–287. Joint work with M. Benois.
- [14] Easy multiplications I. The realm of Kleene's theorem, *Information and Computation* **74**, 1987, 173–197.
- [15] On regular trace languages, *Theoret. Comput. Sci.* **52**, 1987, 59–75.
- [16] Finiteness conditions on subgroups and formal language theory, *Proc. London Math. Soc.* **58**, 1989, 74–88. Joint work with Ch. Frougny and P. Schupp.
- [17] Easy multiplications II, Extensions of rational semigroups, *Information and Computation* **88**, 1990, 18–59. Joint work with M. Pelletier.
- [18] Synchronized rational relations, *Theoret. Comput. Sci.* **108**, 1993, 45–82. Joint work with Ch. Frougny.
- [19] Synchronisation déterministe des automates à délai borné, *Theoret. Comput. Sci.* **182**, 1998, 61–77. Joint work with Ch. Frougny.
- [20] A construction on finite automata that has remained hidden, *Theoret. Comput. Sci.* **204**, 1998, 205–231.
- [21] On the representation of finite deterministic 2-tape automata, *Theoret. Comput. Sci.* **225**, 1999, 1–63. Joint work with M. Pelletier.
- [22] Automatic conversion from Fibonacci numeration system to golden mean base, and generalization, *Int. J. of Algebra and Computation* **9**, 1999, 351–384. Joint work with Ch. Frougny.
- [23] Two groups associated with quadratic Pisot units, *Int. J. of Algebra and Computation* **12**, 2002, 825–847. Joint work with Ch. Frougny.
- [24] Squaring transducers, *Theoret. Comput. Sci.* **292**, 2003, 45–63. Joint work with M.P. Béal, O. Carton and Ch. Prieur.

- [25] The finite power property in free groups, *Theoret. Comput. Sci.* **293**, 2003, 55–82. Joint work with F. d’Alessandro.
- [26] Introducing Vaucanson, *Theoret. Comput. Sci.* **328**, 2004, 77–96. Joint work with S. Lombardy et Y. Régis-Gianas.
- [27] Derivation of rational expressions with multiplicity, *Theoret. Comput. Sci.* **332**, 2005, 141–177. Joint work with S. Lombardy.
- [28] How expressions can code for automata, *RAIRO – Theoret. Informatics and Applications* **39**, 2005, 217–237. Joint work with S. Lombardy.

Communications to conferences

- [29] Langages algébriques déterministes et groupes abéliens, in *Automata Theory and Formal Languages, 2nd G.I. Conference*, LNCS 33, 1975, 20–30.
- [30] Sur les monoïdes syntactiques des langages algébriques déterministes, in *Automata, Languages and Programming, 3rd International Colloquium* (S. Michaelson and R. Milner, eds), Edinburgh University Press, 1976, 52–65.
- [31] An algebraic framework for the study of the syntactic monoids; application to the group languages, in *Proc. of MFCS’76* (A. Mazurkiewics ed.), LNCS 45, 1976, 510–516.
- [32] Sur les groupes infinis, considérés comme monoïdes syntaxiques des langages formels, in *Séminaire d’Algèbre Paul Dubreil*, Lecture Notes in Mathematics 586, 1977, 168–179.
- [33] On deterministic commutative context-free languages, in *Proc. of a Conference on Theoret. Comput. Sci.*, Waterloo University, Canada, 1977, 88–93.
- [34] A theory of syntactic monoids for context-free languages, in *Information Processing 77, Proc. of IFIP Congress 77*, North Holland, 1977, . Joint work with J.F. Perrot.
- [35] Un théorème de transversale rationnelle pour les automates à pile déterministes, in *Proc. of the 4th G.I. Conf. on Theoret. Comput. Sci.* (K. Weihrauch ed.), LNCS 67, 1979, 276–285.
- [36] Sur la définition du produit en couronne, in *Codages et Transductions* (G. Pirillo ed.), Institut U. Dini, Florence, C.N.R., 1979, 285–299.
- [37] Pushdown automata with terminal languages, in *Languages and Automata Symposium*, Publication du RIMS 421, Kyoto University, 1981, 15–29.
- [38] Some operations and transductions that preserve rationality, in *Proc. of the 6th G.I. Conference on Theoret. Comput. Sci.*, LNCS 145, 1982, 277–288. Joint work with J.E. Pin.
- [39] One-sided Dyck reduction over two-letter alphabet and deterministic context-free languages, in *Proc. of MFCS’86*, LNCS 233, 1986, 554–563. Joint work with F. Romian.
- [40] Recent results in the theory of rational sets, in *Proc. of MFCS’86*, LNCS 233, 1986, 15–28. Joint work with J. Berstel.
- [41] Kleene’s Theorem revisited, in *Trends, Techniques and Problems in Theoret. Comput. Sci.* (A. Kelemenova, K. Kelemen eds), LNCS 281, 1987, 39–50.
- [42] Rational relations with bounded delay, in *Proc. of STACS’91* (M. Jantzen ed.), LNCS 480, 1991, 50–63. Joint work with Ch. Frougny.
- [43] The “last” decision problem for rational trace languages, in *Proc. of LATIN 92* (I. Simon ed.), LNCS 583, 1992, 460–473.
- [44] From the Fibonacci numeration system to the golden mean base and some generalizations, in *Proc. of a Conference on Power Series and Algebraic Combinatorics* (A. Barlotti, M. Delest, R. Pinzani, eds), Firenze, 1993, 231–244. Joint work with Ch. Frougny.
- [45] On the Lexicographic Uniformisation of Deterministic 2-tape Automata, in *Proc. of IFIP Congress’94, vol. I* (B. Pehrson, I. Simon, eds), Elsevier Science (North Holland), 1994, 485–490. Joint work with M. Pelletier.

- [46] The Finite Power Property for Rational sets of the Free Group, in *Idempotency* (J. Gunawardena, ed.), Cambridge University Press, 1998, 80–87. Joint work with F. d’Alessandro.
- [47] The Schützenberger construct and two applications, in *Proc. of the Conference on Semigroups and Applications, St Petersburg, 1995* (S. Kublanovskiy, A. Mikhalev, J. Pionizovskii, P. Higgins, eds.), TPO Severny Ochag, 1999, 331–356.
- [48] A rewrite system associated with quadratic Pisot unit, in *Proc. of RTA’99* (P. Narendran & M. Rusinowitch eds.), LNCS 1641, 1999, 356–370. Joint work with Ch. Frougny.
- [49] Squaring transducers, in *Proc. of LATIN 2000* (G. Gonnet & D. Panario eds.), LNCS 1776, 2000, 397–406. Joint work with M.P. Béal, O. Carton and Ch. Prieur.
- [50] The rational skimming theorem, in *Proc. of Mathematical Foundations of Informatics, Hanoi 99* (M. Ito & Do Long Van eds.), World Scientific, , to appear.
- [51] Star height of reversible languages and universal automata, in *Proc. of LATIN 2002* (S. Rajsbaum, ed.), LNCS 2286, 2002, 76–90. Joint work with S. Lombardy.
- [52] Derivation of rational expressions with multiplicity, in *Proc. of MFCS 2002* (K. Diks, W. Ritter, eds.), LNCS 2420, 2002, 471–482. Joint work with S. Lombardy.
- [53] Introducing Vaucanson, in *Proc. of CIAA 2003* (O. Ibarra, Z. Dang, eds.), LNCS 2759, 2003, 96–107. Joint work with S. Lombardy, R. Poss and Y. Régis-Gianas.
- [54] On the star height of rational languages, a new presentation for two old results, in *Words, Languages & Combinatorics III* (M. Ito, T. Imaoka, eds.), World Scientific, 2003, 266–285. Joint work with Sylvain Lombardy.
- [55] How expressions can code for automata, in *Proc. of LATIN 2004* (M. Farach-Colton, ed.), LNCS 2976, 2004, 242–251. Joint work with S. Lombardy.
- [56] On the equivalence of Z-automata, in *Proc. of ICALP 2005* (L. Caires et al., eds.), LNCS 3580, 2005, 397–409. Joint work with M.-P. Béal and S. Lombardy.
- [57] Inside Vaucanson, *Proc. of CIAA 2005*, to appear. Joint work with T. Claveirole, S. Lombardy, S. O’Connor and L.-N. Pouchet.
- [58] The Language, the Expression and the (small) Automaton, *Proc. of CIAA 2005*, to appear.
- [59] On the Representation of Numbers in a Rational Base, *Proc. of WORDS 2005*, to appear. Joint work with S. Akiyama and Ch. Frougny.

Miscellaneous publications

- [60] Monoïdes syntaxiques des langages algébriques, Thèse 3ème c. Math., Univ. Paris 7, 1976.
- [61] Syntaxe des langages de Chomsky, Thèse Sci. Math., Univ. Paris 7, 1979.
- [62] Deux expériences de mise au point interactive de programmes de commande numérique: Vulcain et Promog, in *Revue du GAMI*, 1979. Joint work with J.P. Crestin, G. Gras, and J. Péchaud.
- [63] L’informatisation de la recherche publique en France, Annex to the report *Informatisation de la France*, Agence de l’Informatique, 1986. Excerpts published in *Sciences & Techniques* **24** and **25**, 1986.

Software

- [64] $\overline{\text{VAUCANSON}}$ -G, package of \LaTeX macros for automata and graphs drawing (2002). <http://www.enst.fr/~jsaka>. Joint work with S. Lombardy.
- [65] VAUCANSON, C++ platform for computing with automata and transducers (2003). <http://vaucanson.lrde.epita.fr>. Joint work with S. Lombardy and EPITA Vaucanson Group.