

# Nicolas Halbwachs

## Curriculum Vitæ

Current position: Directeur de Recherche (Senior Scientist) at CNRS

Date of birth: June 12, 1953

Address: Verimag, Centre Equation, 2 avenue de Vignate, 38610 Gières

tel: (+33) 4 56 52 03 55

fax: (+33) 4 56 52 03 44

email: Nicolas.Halbwachs@imag.fr

## 1 Education and diplomas

- June 1984 : “State Thesis” in Mathematics, Institut National Polytechnique de Grenoble.
- March 1979 : “Third Cycle Thesis” in Computer Science, Université Scientifique et Médicale de Grenoble.
- June 1976 : Master of Computer Science, Grenoble.
- June 1975 : Bsc in Computer Science, Grenoble.

## 2 Positions occupied

- Since 2008 : First class research director at CNRS
- 1992-2008 : Second class research director at CNRS
- 1992-93 : Invited Professor at Stanford University
- 1984-92 : “Chargé de Recherche” at CNRS
- 1980-84 : “Attaché de Recherche” at CNRS

## 3 Research Activity

### 3.1 Publications

My complete list of publications is given in §8. I published a book [B3], 15 articles in international journals, 46 papers in international conferences, including 11 invited papers. According to Google Scholar, my H-number is currently 31.

### 3.2 Main research subjects and results

The general subject of my research concerns formal methods for the design of embedded systems. More precisely, my work concerns synchronous programming and program analysis and verification.

I was lucky enough to be the first doctoral student of Patrick Cousot: my “Third Cycle Thesis” [B1] was about an abstract interpretation for discovering invariant linear

inequalities among the numerical variables of a program. This “linear relation analysis” is now classical — our POPL5 paper [C1] has more than 850 citations — and still inspires ongoing research.

During my “State Thesis” [B2], supervised by Paul Caspi, I addressed the modelling and proof of real-time systems, a domain that was not much explored at these times. As a consequence, our results [C2, C3, C5, J3] were more or less ignored.

Then, still with Paul Caspi, we defined the synchronous data-flow language Lustre [C12], and I worked during more than 20 years on this language [J5, I1], its compilation [C18], the verification [C14, J8, I3] and automatic testing [C31] of synchronous programs, its use for modeling non synchronous systems [I9, C38]. Among these works, and apart from the industrial success of Lustre (see §5), I am especially happy about the following results: the use of synchronous observers to express safety properties [I3], the direct generation of minimal models [C15, J7, C20] (sometimes called “symbolic bisimulation”), the verification of parameterized networks of synchronous processes [J6, C30, J12].

Meanwhile, I came back to abstract interpretation and linear relation analysis. I applied it to the verification of synchronous programs with counters [C22], and further to timed and simple hybrid systems [C24, J9, J10]. With Bertrand Jeannet, we adapted the analysis to declarative languages (like Lustre) using dynamic partitioning [C32]. With David Merchat and Laure Gonnord, we significantly improved both the efficiency and the precision of the analysis in [J15, C36], using Cartesian partitioning in polyhedra computations and combining classical widening with abstract acceleration techniques.

More recently, I used abstract interpretation to discover the behavior of programs manipulating arrays [C39, C41]. For instance, our analysis can discover automatically that the result of an “insertion sort” procedure is a sorted permutation of the initial array.

### 3.3 Student supervision

I supervised 10 PhD theses, and about 13 Master theses (see §9).

## 4 Research Administration and Animation

Since 2007, I am director of the Verimag laboratory (about 80 people). I was in charge of the “Synchronous team” in Verimag from 1992 to 2004.

I am editor of the journal “Formal Method in System Design”. I took part in more than 30 program committees of international conferences, including CAV, TACAS, AMAST, SEFM, FTRTFT, EMSOFT. I was PC co-chair of CAV’99, TACAS’05 and EMSOFT’09. I belong to the Steering Committee of EMSOFT.

I took part in many national committees of evaluation and selection, including the co-chairmanship of the evaluation committee of Inria-Rocquencourt in 2008.

In 1994, with W.P. de Roever, I created the SYNCHRON annual workshop on synchronous programming, which is successful each year since then. I personally organized this workshop in 1995, 97, 99, and 2003.

I participated in more than 50 PhD and 10 “Habilitation” committees.

I participated actively to the following European projects: Esprit BRA SPEC and REACT, Eureka-Synchron (1993-96), BRA SYRF (1997-99), SafeAir2 (2001-03), and ASSERT. I was the coordinator of Esprit LTR 22703 SYRF, and scientific coordinator of a cluster in the FP6 integrated project ASSERT. I took part also in many national projects.

## 5 Industrial transfer

My main success in industrial cooperation is, of course, the industrial transfer of Lustre, which became the core language of the toolbox Scade. Scade is presently developed by Esterel-Technology and used all over the world for designing embedded software (e.g., flight control of Airbus A340 and A380). Lustre can be considered as a notable success of formal methods in industry.

I also participated in many industrial contracts, e.g., with Bull, Schneider-electric, Digital Equipment, EDF, EADS, Airbus, Esterel-technologies, Polyspace, ST-microelectronics.

## 6 Teaching

Being a full-time researcher, I did not teach very much. However, I designed 4 post-graduate level courses — about programming language semantics, automatic verification, synchronous programming, and abstract interpretation — that I gave several times in different masters (Grenoble University, Ecole Normale Supérieure) and in international schools.

I was in charge, during 6 years (1999-2005), of the Master level and Doctoral studies in Computer Science of the University of Grenoble.

## 7 Awards

In 2004, I received, with Paul Caspi, the “Prix Monpetit” of the French Academy of Sciences, for our work on synchronous programming.

## 8 Complete List of Publications

### 8.1 Books and Theses

- [B1] N. Halbwachs. Détermination automatique de relations linéaires vérifiées par les variables d'un programme. Thèse de troisième cycle, University of Grenoble, March 1979.
- [B2] N. Halbwachs. Modélisation et analyse du comportement des systèmes informatiques temporisés. Thèse d'Etat, Institut National Polytechnique de Grenoble, June 1984.
- [B3] N. Halbwachs. *Synchronous programming of reactive systems*. Kluwer Academic Pub., 1993.

### 8.2 Edited Proceedings

- [P1] N. Halbwachs and D. Peled, editors. *Computer Aided Verification, CAV'99*. LNCS 1633, Springer Verlag, 1999.
- [P2] N. Halbwachs and L. Zuck, editors. *Tools and Algorithms for the Construction and Analysis of Systems, TACAS'05*. LNCS 3440, Springer Verlag, 2005.
- [P3] S. Chakraborty and N. Halbwachs, editors. *Embedded Software, EMSOFT'09*. 2009.

### 8.3 Articles in Journals

- [J1] P. Amblard, P. Caspi, and N. Halbwachs. Describing and reasoning about circuits behaviour by means of time functions. *IEEE Proceedings-E*, 133(5):271–275, September 1986.
- [J2] P. Caspi and N. Halbwachs. Analyse approchée du comportement asymptotique de systèmes temporisés. *Technique et Science Informatiques*, 5(2):75–88, 1986.
- [J3] P. Caspi and N. Halbwachs. A functional model for describing and reasoning about time behaviour of computing systems. *Acta Informatica*, 22:595–697, 1986.
- [J4] N. Halbwachs, P. Caspi, P. Raymond, and D. Pilaud. Programmation et vérification des systèmes réactifs: Le langage LUSTRE. *Technique et Science Informatique*, 10(2):139–158, 1991.
- [J5] N. Halbwachs, P. Caspi, P. Raymond, and D. Pilaud. The synchronous dataflow programming language LUSTRE. *Proceedings of the IEEE*, 79(9), September 1991.
- [J6] N. Halbwachs, F. Lagnier, and Ch. Ratel. An experience in proving regular networks of processes by modular model checking. *Acta Informatica*, 29(6/7):523–543, 1992.
- [J7] A. Bouajjani, J. C. Fernandez, N. Halbwachs, P. Raymond, and C. Ratel. Minimal state graph generation. *Science of Computer Programming*, 18:247–269, 1992.

- [J8] N. Halbwachs, F. Lagnier, and C. Ratel. Programming and verifying critical systems by means of the synchronous data-flow programming language LUSTRE. *IEEE Transactions on Software Engineering, Special Issue on the Specification and Analysis of Real-Time Systems*, September 1992.
- [J9] R. Alur, C. Courcoubetis, N. Halbwachs, T. Henzinger, P. Ho, X. Nicollin, A. Olivero, J. Sifakis, and S. Yovine. The algorithmic analysis of hybrid systems. *Theoretical Computer Science B*, 138:3–34, January 1995.
- [J10] N. Halbwachs, Y.E. Proy, and P. Roumanoff. Verification of real-time systems using linear relation analysis. *Formal Methods in System Design*, 11(2):157–185, August 1997.
- [J11] N. Halbwachs. About synchronous programming and abstract interpretation. *Science of Computer Programming, Special Issue on SAS'94*, 31(1), May 1998.
- [J12] D. Lesens, N. Halbwachs, and P. Raymond. Automatic verification of parameterized networks of processes. *Theoretical Computer Science*, 256:113–144, 2001.
- [J13] A. Benveniste, P. Caspi, S.A. Edwards, N. Halbwachs, P. Le Guernic, and R. de Simone. The synchronous languages 12 years later. *Proceedings of the IEEE*, 91(1), January 2003.
- [J14] G. Pace, N. Halbwachs, and P. Raymond. Counter-example generation in symbolic abstract model-checking. *Software Tools for Technology Transfer*, 5(2–3), March 2004.
- [J15] N. Halbwachs, D. Merchat, and L. Gonnord. Some ways to reduce the space dimension in polyhedra computations. *Formal Methods in System Design*, 29(1):79–95, July 2006.

## 8.4 Invited Papers in Conferences

- [I1] F. Rocheteau and N. Halbwachs. Implementing reactive programs on circuits, a hardware implementation of LUSTRE. In *REX Workshop on Real-Time: Theory and Practice*, pages 195–208, DePlasmolen (Netherlands), June 1991. LNCS 600, Springer Verlag.
- [I2] N. Halbwachs, J.-C. Fernandez, and A. Bouajjanni. An executable temporal logic to express safety properties and its connection with the language LUSTRE. In *Sixth International Symp. on Lucid and Intensional Programming, ISLIP'93*, Quebec, April 1993.
- [I3] N. Halbwachs, F. Lagnier, and P. Raymond. Synchronous observers and the verification of reactive systems. In M. Nivat, C. Rattray, T. Rus, and G. Scollo, editors, *Third Int. Conf. on Algebraic Methodology and Software Technology, AMAST'93*, Twente, June 1993. Workshops in Computing, Springer Verlag.

- [I4] N. Halbwachs. About synchronous programming and abstract interpretation. In B. LeCharlier, editor, *International Symposium on Static Analysis, SAS'94*, Namur (Belgium), September 1994. LNCS 864, Springer Verlag.
- [I5] N. Halbwachs, X. Nicollin, P. Raymond, and D. Weber. Test automatique de systèmes réactifs. In *Ecole d'été "MODélisation et VÉRification des Processus parallèles*, Nantes, July 1998.
- [I6] N. Halbwachs. Synchronous programming of reactive systems, a tutorial and commented bibliography. In *Tenth International Conference on Computer-Aided Verification, CAV'98*, Vancouver (B.C.), June 1998. LNCS 1427, Springer Verlag.
- [I7] N. Halbwachs and P. Raymond. Validation of synchronous reactive systems: from formal verification to automatic testing. In *ASIAN'99, Asian Computing Science Conference*, Phuket (Thailand), December 1999. LNCS 1742, Springer Verlag.
- [I8] N. Halbwachs, J.-F. Héry, J.-C. Laleuf, and X. Nicollin. Stability of discrete sampled systems. In M. Joseph, editor, *6th International Symposium on Formal Techniques in Real-Time and Fault-Tolerant Systems, FTRTFT'2000*, Pune, India, September 2000. LNCS 1926.
- [I9] N. Halbwachs and S. Baghdadi. Synchronous modeling of asynchronous systems. In *ACM Conference on Embedded Systems Software, EMSOFT'02*. LNCS 2491, Springer Verlag, October 2002.
- [I10] N. Halbwachs. A synchronous language at work: the story of Lustre. In *Third ACM/IEEE International Conference on Formal Methods and Models for Codesign, MEMOCODE'2005*, Verona, Italy, July 2005.
- [I11] N. Halbwachs and L. Mandel. Simulation and verification of asynchronous systems by means of a synchronous model. In *Sixth International Conference on Application of Concurrency to System Design, ACSD 2006*, Turku, Finland, June 2006.

## 8.5 Papers in Conferences

- [C1] P. Cousot and N. Halbwachs. Automatic discovery of linear restraints among variables of a program. In *5th ACM Symposium on Principles of Programming Languages*, Tucson (Arizona), January 1978.
- [C2] P. Caspi and N. Halbwachs. Algebra of events, a model for parallel and real-time systems. In *International Conference on Parallel Processing*, Bellaire (Michigan), August 1982.
- [C3] P. Caspi and N. Halbwachs. An approach to real-time systems modeling. In *International Conference on Distributed Computing Systems*, Miami, October 1982.

- [C4] J-L. Bergerand, P. Caspi, and N. Halbwachs. Specification and formal validation of distributed systems, the real-time approach. In *IEE Conference Control 85*, Cambridge, July 1985.
- [C5] P. Amblard, P. Caspi, and N. Halbwachs. Describing and reasoning about circuits behaviour by means of time functions. In *1985 Conference on Computer Hardware Description Languages*, Tokyo, August 1985.
- [C6] J-L. Bergerand, P. Caspi, N. Halbwachs, D. Pilaud, and E. Pilaud. Outline of a real-time data-flow language. In *1985 Real-Time Symposium*, San Diego, December 1985.
- [C7] J-L. Bergerand, P. Caspi, N. Halbwachs, and J. Plaice. Automatic control systems programming using a real-time declarative language. In *IFAC/IFIP Symp. 'SOCOCO 86*, Graz (Autriche), May 1986.
- [C8] N. Halbwachs and D. Pilaud. Use of a real-time declarative language for systolic array design and simulation. In *International Workshop on Systolic Arrays*, Oxford, July 1986.
- [C9] N. Halbwachs, A. Lonchamp, and D. Pilaud. Describing and designing circuits by means of a synchronous declarative language. In *IFIP Working Conference "From HDL Descriptions To Guaranteed Correct Circuit Designs"*, Grenoble, September 1986.
- [C10] P. Caspi, N. Halbwachs, D. Pilaud, and J. Plaice. Le langage LUSTRE et sa sémantique opérationnelle. In *2e Colloque C<sup>3</sup>*, 1987.
- [C11] P. Caspi and N. Halbwachs. Suites de dates et compteurs d'occurrences d'événements. In *Séminaire "Algèbres Exotiques et Systèmes à Evénements Discrets"*, Issy-les-Moulineaux, June 1987.
- [C12] P. Caspi, D. Pilaud, N. Halbwachs, and J. Plaice. LUSTRE: a declarative language for programming synchronous systems. In *14th ACM Conf. on Principles of Programming Languages*, Munich, January 1987.
- [C13] D. Pilaud and N. Halbwachs. From a synchronous declarative language to a temporal logic dealing with multiform time. In M. Joseph, editor, *Symposium on Formal Techniques in Real-Time and Fault-Tolerant Systems*, Warwick, September 1988. LNCS 331, Springer Verlag.
- [C14] N. Halbwachs, D. Pilaud, F. Ouabdesselam, and A.C. Glory. Specifying, programming and verifying real-time systems, using a synchronous declarative language. In *Workshop on automatic verification methods for finite state systems*, Grenoble, June 1989. LNCS 407, Springer Verlag.
- [C15] A. Bouajjani, J. C. Fernandez, and N. Halbwachs. Minimal model generation. In *Workshop on Computer-Aided Verification*, Rutgers (New-Jersey), June 1990.

- [C16] F. Rocheteau and N. Halbwachs. POLLUX, a LUSTRE based hardware design environment. In P. Quinton and Y. Robert, editors, *Conference on Algorithms and Parallel VLSI Architectures II*, Chateau de Bonas, June 1991.
- [C17] N. Halbwachs, P. Caspi, P. Raymond, and D. Pilaud. The synchronous data-flow programming language Lustre (extended abstract). In *1st European Control Conference*, pages 1661–1665, Grenoble, July 1991.
- [C18] N. Halbwachs, P. Raymond, and C. Ratel. Generating efficient code from data-flow programs. In *Third International Symposium on Programming Language Implementation and Logic Programming*, Passau, August 1991.
- [C19] C. Ratel, N. Halbwachs, and P. Raymond. Programming and verifying critical systems by means of the synchronous data-flow programming language LUSTRE. In *ACM-SIGSOFT'91 Conference on Software for Critical Systems*, New Orleans, December 1991.
- [C20] R. Alur, C. Courcoubetis, N. Halbwachs, D. Dill, and H. Wong-Toi. Minimization of timed transition systems (extended abstract). In *CONCUR'92*, Stony Brook, NY, June 1992.
- [C21] R. Alur, C. Courcoubetis, D. Dill, N. Halbwachs, and H. Wong-Toi. An implementation of three algorithms for timing verification based on automata emptiness. In *13th IEEE Real-Time Systems Symposium*, Phoenix, Az, December 1992.
- [C22] N. Halbwachs. Delay analysis in synchronous programs. In *Fifth Conference on Computer-Aided Verification*, Elounda (Greece), July 1993. LNCS 697, Springer Verlag.
- [C23] A. Benveniste, P. Caspi, P. LeGuernic, and N. Halbwachs. Data-flow synchronous languages. In *REX Symposium "Ten Years of Concurrency, Reflections and Perspectives"*. LNCS 803, Springer-Verlag, June 1993.
- [C24] N. Halbwachs, Y.-E. Proy, and P. Raymond. Verification of linear hybrid systems by means of convex approximations. In B. LeCharlier, editor, *International Symposium on Static Analysis, SAS'94*, Namur (Belgium), September 1994. LNCS 864, Springer Verlag.
- [C25] N. Halbwachs and F. Maraninchi. On the symbolic analysis of combinational loops in circuits and synchronous programs. In *Euromicro'95*, Como (Italy), September 1995.
- [C26] N. Halbwachs, F. Maraninchi, and Y. E. Proy. The railroad crossing problem, modeling with Hybrid Argos - Analysis with Polka. In *Second European Workshop on Real-Time and Hybrid Systems*, Grenoble (France), June 1995.



- [C27] F. Maraninchi and N. Halbwachs. Compositional semantics of non deterministic synchronous languages. In *European Symposium on Programming, ESOP'96*, Linköping, April 1996.
- [C28] F. Maraninchi and N. Halbwachs. Compiling ARGOS into boolean equations. In *Int. Symp. on Formal Techniques for Real Time and Fault Tolerant Systems, FTRT'96*, Uppsala, September 1996.
- [C29] D. Lesens, N. Halbwachs, and P. Raymond. Automatic construction of network invariants. In *International Workshop on Verification of Infinite State Systems (INFINITY)*, Pisa, August 1996.
- [C30] D. Lesens, N. Halbwachs, and P. Raymond. Automatic verification of parameterized linear networks of processes. In *24th ACM Symposium on Principles of Programming Languages, POPL'97*, Paris, January 1997.
- [C31] P. Raymond, D. Weber, X. Nicollin, and N. Halbwachs. Automatic testing of reactive systems. In *19th IEEE Real-Time Systems Symposium*, Madrid, Spain, December 1998.
- [C32] B. Jeannet, N. Halbwachs, and P. Raymond. Dynamic partitioning in analyses of numerical properties. In *Static Analysis Symposium, SAS'99*, Venezia (Italy), September 1999.
- [C33] G. Pace, N. Halbwachs, and P. Raymond. Counter-example generation in symbolic abstract model-checking. In *6th International Workshop on Formal Methods for Industrial Critical Systems, FMICS'2001*, Paris, July 2001. Inria.
- [C34] N. Halbwachs, D. Merchat, and C. Parent-Vigouroux. Cartesian factoring of polyhedra in linear relation analysis. In *Static Analysis Symposium, SAS'03*, San Diego, June 2003. LNCS 2694, Springer Verlag.
- [C35] L. Gonnord, N. Halbwachs, and P. Raymond. From discrete duration calculus to symbolic automata. In *3rd International Workshop on Synchronous Languages, Applications, and Programs, SLAP'04*, see also *Electronic Notes in Theoretical Computer Science Volume 153, Issue 4, 27 June 2006, Pages 3-18*, Barcelona, Spain, March 2004.
- [C36] L. Gonnord and N. Halbwachs. Combining widening and acceleration in linear relation analysis. In *13th International Static Analysis Symposium, SAS'06*, Seoul, Korea, August 2006.
- [C37] M. Péron and N. Halbwachs. An abstract domain extending Difference-Bound Matrices with disequality constraints. In B. Cook and A. Podelski, editors, *8th International Conference on Verification, Model-checking, and Abstract Interpretation, VMCAI'07*, Nice, France, January 2007.

- [C38] E. Jahier, N. Halbwachs, P. Raymond, X. Nicollin, and D. Lesens. Virtual execution of AADL models via a translation into synchronous programs. In *ACM Conference on Embedded Systems Software, EMSOFT 2007*, Salzburg, Austria, 2007.
- [C39] N. Halbwachs and M. Péron. Discovering properties about arrays in simple programs. In *ACM Conference on Programming Language Design and Implementation, PLDI 2008*, pages 339–348, Tucson (Az.), June 2008.
- [C40] I. Ober and N. Halbwachs. On the timed automata-based verification of Ravenscar systems. In *13th International Conference on Reliable Software Technologies - Ada-Europe 2008*, Venice, Italy, June 2008.
- [C41] V. Perrelle and N. Halbwachs. An analysis of permutations in arrays. In G. Barthe and M. Hemenegildo, editors, *11th International Conference on Verification, Model-checking, and Abstract Interpretation, VMCAI 2010*, Madrid, Spain, January 2010.

## 9 Supervised Works

- [S1] M. Bourdon. Une approche unifiée des problèmes d’ordonnancement statique discret. Master Thesis, University of Grenoble, June 1982.
- [S2] Ch. Mauras. Implémentation de la sémantique statique de LUSTRE en mentor-typol. Master Thesis, Institut National Polytechnique de Grenoble, June 1987.
- [S3] J-L. Bergerand. LUSTRE: un langage déclaratif pour le temps réel. PhD Thesis, Institut National Polytechnique de Grenoble, 1986.
- [S4] C. Buors. Sémantique opérationnelle du langage LUSTRE. Master Thesis, University of Grenoble, June 1986.
- [S5] A-C. Glory. Vérification de propriétés de programmes flots de données synchrones. PhD Thesis, Université Joseph Fourier, Grenoble, December 1989.
- [S6] J. A. Plaice. Sémantique et compilation de LUSTRE, un langage déclaratif synchrone. PhD Thesis, Institut National Polytechnique de Grenoble, 1988.
- [S7] P. Raymond. Compilation séparée de programmes LUSTRE. Master Thesis, Institut National Polytechnique de Grenoble, June 1988.
- [S8] P. Raymond. Compilation efficace d’un langage déclaratif synchrone : Le générateur de code LUSTRE-v3. PhD Thesis, Institut National Polytechnique de Grenoble, November 1991.
- [S9] Ch. Ratel. Définition et réalisation d’un outil de vérification formelle de programmes Lustre: Le systeme Lesar. PhD Thesis, Université Joseph Fourier, Grenoble, July 1992.

- [S10] F. Rocheteau. Programmation d'un circuit massivement parallèle à l'aide d'un langage déclaratif synchrone. Master Thesis, Institut National Polytechnique de Grenoble, June 1989.
- [S11] Ch. Dubois. Un pré-processeur de compilation séparée pour le langage Lustre. Mémoire d'ingénieur, CNAM, July 1992.
- [S12] F. Rocheteau. Extension du langage Lustre et application à la conception de circuits: Le langage Lustre-V4 et le système Pollux. PhD Thesis, Institut National Polytechnique de Grenoble, June 1992.
- [S13] D. Lesens. Synthèse de programmes réactifs. Master Thesis, Ecole Polytechnique, Paris, July 1994.
- [S14] B. Jeannet. Langages de description d'architecture et vérification de propriétés temps réel : une première approche. Master Thesis, Université Paris VII, September 1997.
- [S15] D. Lesens. Vérification et synthèse de systèmes réactifs. PhD Thesis, Institut National Polytechnique de Grenoble, September 1997.
- [S16] D. Weber. Un générateur automatique de jeux de test de programmes Lustre. Mémoire d'ingénieur, Conservatoire National de Arts et Métiers, March 1998.
- [S17] B. Jeannet. Partitionnement dynamique dans l'analyse de relations linéaires et application à la vérification de programmes synchrones. These, Institut National Polytechnique, Grenoble, September 2000.
- [S18] D. Merchat. Représentation d'ensembles numériques, en vue de la vérification et du test de programmes. Master Thesis, Université Joseph Fourier, June 2001.
- [S19] L. Danthony-Gonnord. Du calcul des durées aux automates symboliques. Master thesis, Universités Paris VI/VII, June 2003.
- [S20] D. Merchat. Réduction du nombre de variables en analyse de relations linéaires. These, Université Joseph Fourier, May 2005.
- [S21] M. Péron. IS, un domaine numérique abstrait pour l'analyse de programmes manipulant des adresses. Master Thesis, Université Joseph Fourier, June 2005.
- [S22] L. Gonnord. Accélération abstraite pour l'amélioration de la précision en analyse des relations linéaires. Thèse, Université Joseph Fourier, October 2007.
- [S23] M. Péron. Analyse de programmes manipulant des tableaux. Thèse, en cours.
- [S24] V. Perrelles. Analyse de propriétés non positionnelles des tableaux. Master thesis, MPRI, Ecole Normale Supérieure de Cachan, 2008.