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Positions

since 2016 : Professor in computer science at Aix Marseille University. Since October 2015, head of the research group “Modelization and Verification” of the LIF.

2014-2015 : On leave at CNRS, researcher at LIF.

2008-2016 : Assistant professor in computer science at Aix Marseille University. Member of the research group “Modelization and Verification” of the LIF.

2007-2008 : Post-doctoral researcher at the Free University of Brussels (Belgium) in the team of Prof. Jean-François Raskin.

2004-2007 : PhD student at Laboratoire Spécification et Vérification (ENS Cachan) under the supervision of Patricia Bouyer and François Laroussinie.

Education

2015 : Habilitation thesis in Computer Science defended on December 4, 2015

: *Title*: Contributions to timed systems and transducers

: *Department*: LIF, Aix-Marseille Université & CNRS

: *Committee*:

Rajeev Alur	Prof. University of Pennsylvania, USA	reviewer
François Denis	Prof. Aix-Marseille Université, France	
Anca Muscholl	Prof. Université de Bordeaux & IUF, France	reviewer
Jean-François Raskin	Prof. Université Libre de Bruxelles, Belgium	
Philippe Schnoebelen	DR CNRS, ENS Cachan, France	
Jean-Marc Talbot	Prof. Aix-Marseille Université, France	
Sophie Tison	Prof. Université de Lille, France	
James Worrell	Prof. Oxford University, England	reviewer

2004-2007 : PhD thesis in Computer Science defended on June 21, 2007

: *Title*: Verification of timed and distributed systems: models, algorithms and implementability

: *Department*: Laboratoire Spécification et Vérification, CNRS & ENS Cachan

: *Committee*:

Parosh A. Abdulla	Prof. Univ. Uppsala, Sweden	
Ahmed Bouajjani	Prof. Université Paris Diderot, France	reviewer
Patricia Bouyer-Decitre	DR CNRS, ENS Cachan, France	supervisor
Serge Haddad	Prof. ENS Cachan, France	
Claude Jard	Prof. Université de Nantes, France	
François Laroussinie	Prof. Université Paris Diderot, France	supervisor
Jean-François Raskin	Prof. Université Libre de Bruxelles, Belgium	reviewer

2003–2004 : “DEA” in Computer Science (with distinction TB, ranked 2nd)

2002–2003 : “Agrégation” in Mathematics (ranked 47)

2001–2002 : “Maîtrises” in Computer Science and Mathematics (both with distinction TB)

Sept. 2001 : Entrance at “École Normale Supérieure de Cachan”, department of Mathematics

Awards

2016 Prime d’Encadrement Doctoral et de Recherche – french grant for outstanding research, awarded for four years

2012 Prime d’Excellence Scientifique – french grant for outstanding research, awarded for four years

2007 Lavoisier fellowship for a one year post-doctoral stay at Free University of Brussels

Research interests

My research works fall into the framework of formal methods for software verification. More precisely, I study automata based approaches and their connection with logics, and I am particularly interested in timed systems, transducers, weighted automata and distributed systems. The application domains range from embedded systems to static analysis of databases and transformations of XML documents.

Projects

- Participation to the ANR ¹ Delta on logic, transducers and automata, 2016–2021
- Principal Investigator of the CNRS PEPS Project SoSI on security of timed systems, 2016
- Principal Investigator of the PHC Project VAST on Verification and Synthesis of Transformations (collaboration with ULB), 2016
- Participation to the ANR Macaron on distributed computing, 2013–2017
- Participation to the FP7-IT european project Cassting on system synthesis with non-zero sum games, 2013–2016
- Participation to the CNRS PICS Project SOSP on synthesis of stream processors, 2013–2014
- Principal Investigator of the ANR ECSPER on study and conception of systems under perturbations, 2009–2013

¹The ANR is the french agency for research.

- Principal Investigator of the regional project in collaboration with Novadem on formal methods for unmanned quadricopters, 2009–2012
- Participation to the ANR IMPRO on implementability and robustness of timed systems, 2011–2013
- Participation to the program Quasimodo (funded by European Commission) on Quantitative System Properties in Model-Driven Design of Embedded Systems, 2008–2010
- Participation to the IAP MoVES (Interuniversity Attraction Poles Programme) on Modelling, Verification and Evolution of Software, 2007–2011
- Participation to the ANR DOTS on distributed, open and timed systems, 2007–2010
- Participation to the ACI CORTOS on control of timed systems, 2003–2006

Responsibilities in Schools and Conferences _____

Steering committee

- MOVEP: from 2012 to 2016 (International School on Modelling and Verifying Parallel Processes)

Program committee

- MFCS'18 (43rd International Symposium on Mathematical Foundations of Computer Science)
- RP'18 -chair- (12th International Workshop on Reachability Problems)
- MSR'17 -co-chair- (11th french Colloquium on Modelization of Reactive Systems)
- Highlights of Games, Automata and Logic, 2016
- ATVA'14 (12th International Symposium on Automated Technology for Verification and Analysis)
- MOVEP'12 -chair- (10th Int. Winter School on Modelling and Verifying Parallel Processes)

Organizing committee

- RP'18 -chair- (12th International Workshop on Reachability Problems)
- MSR'17 -co-chair- (11th french Colloquium on Modelization of Reactive Systems)
- ALGA'16 (organizer of the annual meeting of working group ALGA -Automata, Logic, Games and Algebra)
- CSL'16 (25th Annual Conference on Computer Science Logic)
- MOVEP'12 -chair- (10th Int. Winter School on Modelling and Verifying Parallel Processes)
- FORMATS'06 (4th Int. Conference on Formal Modelling and Analysis of Timed Systems)

Collaborations _____

Apart from collaborations in France (LSV, IRIF, IRCCyN, LINA, LACL, IRISA), I also work with the following colleagues abroad:

- Free university of Brussels (Belgium): Jean-François Raskin, Emmanuel Filiot
- University of Bremen (Germany): Sebastian Maneth
- Aalborg university (Denmark): Kim G. Larsen
- Macquarie University (Australia): Franck Cassez
- IIT Mumbai (India): S. Akshay

Reviews

- Reviewer for international journals (approx. 3 each year): Distributed Computing, Logical Methods in Computer Science, Theoretical Computer Science, Discrete Event Dynamic Systems, Information and Computation, Mathematical Reviews, Fundamenta Informaticae, Journal Européen des Systèmes Automatisés
- Reviewer for international conferences (between 5 and 10 each year): LICS, ICALP, STACS, TACAS, FOSSACS, FORMATS, ICATPN, LATA, MFCS, QEST, MSR, CONCUR, WODES, SOFSEM, CAV...
- Reviewer for the selection of a CIFRE PhD thesis
- Reviewer for the french agency of research (ANR)
- Reviewer for the canadian agency for research (NSERC), 2017
- Reviewer of PhD thesis:
 - Thanh Tung Tran, Verification of timed automata: reachability, liveness and modelling, Université de Bordeaux, 2016
 - Félix Baschenis, Université de Bordeaux, 2017

Supervision

Short internships:

- Rémi Cheval (6 weeks in 2010, L3 ENS Cachan), co-supervised (50%) with Jean-Marc Talbot
- Rémi Poulain (6 weeks in 2013, L3 ENS Cachan)
- Pierre Salles (1 week in 2017, ECM)

Master 2 internships:

- Rémi Jaubert (2009, M2 Aix-Marseille University)
- Mathieu Caralp (2011, M2 Aix-Marseille University), co-supervised (50%) with Jean-Marc Talbot
- Damien Busatto-Gaston (2016, M2 Paris University - MPRI), co-supervised (50%) with Benjamin Monmege

PhD Thesis:

- Rémi Jaubert: Quantitative robustness of timed automata, 2009-2012, abort due to illness
- Mathieu Caralp: Finite valuedness of visibly pushdown transducers, 2011-2015, defended on December 18, 2015, co-supervised (50%) with Jean-Marc Talbot
- Didier Villevalois: Synthesis of transformations, 2015–, defense expected in 2018
- Damien Busatto-Gaston: Timed games: costs and robustness, 2016–, defense expected in 2019, co-supervised (50%) with Benjamin Monmege
- Léo Exibard: Synthesis of systems with data, 2017–, defense expected in 2020, co-supervised (50%) with Emmanuel Filiot (ULB, Belgium)

Post-doctoral students:

- Youssouf Oualhadj: Synthesis of robust controllers, funded by ANR ECSPER, 2012-2013, now assistant professor at Univ. Paris Est Créteil
- Luc Dartois: First-order definable regular string functions, ATER Centrale Marseille, 2014-2015, now post-doc at ULB
- Laure Daviaud: Cost functions for nested words, funded by Labex Archimède, 2014-2015, co-supervised (50%) with JM Talbot, now post-doc at University of Warwick
- Antoine Durand-Gasselín: Transductions of data-words, ATER Centrale Marseille, 2015-2016

Talks

- Invited talk at LSV' 15th Anniversary (Cachan) on *Simplifying transducers*, May 2017
- Invited talk at Dastuhl seminar 17142 on *Two twinning properties for transducers*, April 2017
- Invited talk at CFV (Brussels) on *A survey on transducers*, May 2016
- Invited lecture at MOVEP' 14 on *Robustness of Timed Systems*
- Talks at international conferences: RP' 17, CONCUR' 14, FSTTCS' 11, Petri Nets' 11, CONCUR' 09, HSCC' 09, FoSSaCS' 08, ICALP' 06, ATVA' 06, FORMATS' 05
- Several talks at working groups or meetings of research projects
- Several talks in the following laboratories: LACL, IRISA, ULB, LaBRI, LIF, LIAFA.

Teaching

Teaching at the department of Computer Science of Aix-Marseille University since september 2008. Approximately 200h of lectures, exercises and practical sessions each year.

Main teaching responsibilities:

- Head of the Master 2 on Research in Fundamental Computer Science, since 2013. This is the single master oriented towards research and relying on research done at the LIF. We have approximately ten students each year.
- Lecture on Automata and Logic, M2 Research, since 2013

- Lecture on Introduction to computer science, L1, since 2008
- Lecture on XML Technologies, M1, 2009-2011, 2015-2017
- Lecture on Discrete Event Systems, M1, 2013, 2014, 2017
- Lecture on Formal Methods, M2
- Lecture on Real-time scheduling, M1
- Practical sessions on Prolog, L3

Previously, I was a teaching assistant at ENS Cachan during my PhD and I was also examiner in “Classes Préparatoires” in mathematics and computer science.

Administrative responsibilities

- Co-head, with Nathalie Bertrand (INRIA Rennes), of the working group on Verification (GT Vérif), part of the Research Network on Informatics and Mathematics of the CNRS (GDR IM), since September 2017. This group gathers approximately 200 researchers in France.
- Head of the research group “Modelization and Verification” of the LIF since october 2015 (currently composed of 5 professors, 5 assistant professors, 1 researcher and 5 non-permanent members).
- Member of the selection committee for assistant professor positions:
 - University of Provence, 2010
 - University Paris-Diderot, 2013 and 2015
 - University Paris-Est Créteil, 2015
- Responsibilities in my laboratory:
 - selection committee for ATER positions at the computer science department (2014)
 - in charge of the visit of the LIF by the computer science department of ENS Cachan (2013)
 - representative member at the CCS27 (2011)
 - strong implication in the different groups working on the definition of a new research lab, resulting of the merging of LIF and LSIS
- Responsibilities in my research group:
 - representative member at the FRIIAM
 - in charge of the weekly seminar (2008-2015)
 - in charge of the webpage (2008-2014)
 - in charge of the valorisation (2008-)

Publications

My publications are available at:

<http://www.lif.univ-mrs.fr/~preynier/index.php?page=publis>

A summary of these publications is:

- 4 books or book chapters
- 10 publications in international journals
- 29 publications in international conferences with proceedings and reviewing committee
- 2 invited publications
- 2 publications in international workshops

Chapters in books

- [1] F. Cassez, K. Larsen, J.-F. Raskin, and P.-A. Reynier. *Quantitative Model-Based Analysis of Real-Time Embedded Systems*, chapter An Introduction to Automatic Synthesis of Discrete and Timed Controllers. Springer, 2012.
- [2] F. Cassez, K. Larsen, J.-F. Raskin, and P.-A. Reynier. *Quantitative Model-Based Analysis of Real-Time Embedded Systems*, chapter Timed Controller Synthesis: An Industrial Case Study. Springer, 2012.
- [3] P.-A. Reynier. *Models and Analysis in Distributed Systems*, chapter Verification of Timed Systems, pages 271–306. Wiley, 2011.

Edited books

- [1] P.-A. Reynier, editor. *MOVEP 2012 - Modelization and Verification of Parallel Processes, 10th International Winter School, Marseille, France, December 3-7, 2012. Proceedings*, 2012.

Articles in international journals

- [1] E. Filiot and P.-A. Reynier. Transducers, logic and algebra for functions of finite words. *SIGLOG News*, 3(3):4–19, 2016.
- [2] E. Filiot, S. Maneth, P.-A. Reynier, and J.-M. Talbot. Decision problems of tree transducers with origin. *Information and Computation*, 2016. Accepted with minor revisions.
- [3] E. Filiot, J.-F. Raskin, P.-A. Reynier, F. Servais, and J.-M. Talbot. Visibly pushdown transducers. *Journal of Computer and System Sciences*, 2016. Accepted with minor revisions.
- [4] P.-A. Reynier and J.-M. Talbot. Visibly pushdown transducers with well-nested outputs. *International Journal of Foundations of Computer Science*, 27(2):235–258, 2016.
- [5] S. Akshay, L. Hélouët, C. Jard, and P.-A. Reynier. Robustness of time petri nets under guard enlargement. *Fundamenta Informaticae*, 143(3-4):207–234, 2016.
- [6] M. Caralp, P.-A. Reynier and J.-M. Talbot. Trimming Visibly Pushdown Automata. *Theoretical Computer Science*, 578:13–29, 2015.
- [7] P.-A. Reynier and F. Servais. Minimal coverability set for petri nets: Karp and Miller algorithm with pruning. *Fundamenta Informaticae*, 122(1-2):1–30, 2013.
- [8] O.-L. Nguena-Timo and P.-A. Reynier. On characteristic formulae for event-recording automata. *RAIRO - Theoretical Informatics and Applications*, 47(1):69–96, 2013.

- [9] P. Bouyer, S. Haddad, and P.-A. Reynier. Undecidability Results for Timed Automata with Silent Transitions. *Fundamenta Informaticae*, 92(1-2):1–25, 2009.
- [10] P. Bouyer, S. Haddad, and P.-A. Reynier. Timed Petri nets and timed automata: On the discriminating power of Zeno sequences. *Information and Computation* 206 (1), pp. 73-107, 2008. Elsevier.

Articles in proceedings of international conferences

- [1] E. Filiot and P.-A. Reynier. Copyful streaming string transducers. In *Proc. of 11th International Workshop on Reachability Problems (RP 2017)*, volume 10506 of *Lecture Notes in Computer Science*, pages 75–86. Springer, 2017.
- [2] D. Busatto-Gaston, B. Monmege, and P.-A. Reynier. Optimal reachability in divergent weighted timed games. In *Proc. 20th International Conference on Foundations of Software Science and Computation Structures (FoSSaCS 2017)*, volume 10203 of *Lecture Notes in Computer Science*, pages 162–178. Springer, 2017.
- [3] L. Daviaud, I. Jecker, P.-A. Reynier, and D. Villevalois. Degree of sequentiality of weighted automata. In *Proc. 20th International Conference on Foundations of Software Science and Computation Structures (FoSSaCS 2017)*, volume 10203 of *Lecture Notes in Computer Science*, pages 215–230. Springer, 2017.
- [4] L. Dartois, I. Jecker, and P.-A. Reynier. Aperiodic string transducers. In *Proc. 20th International Conference on Developments in Language Theory (DLT 2016)*, volume 9840 of *Lecture Notes in Computer Science*, pages 125–137. Springer, 2016.
- [5] L. Daviaud, P.-A. Reynier, and J.-M. Talbot. A generalized twinning property for minimisation of cost register automata. In *Proc. 31st Annual ACM/IEEE Symposium on Logic in Computer Science (LICS'16)*, pages 857–866. ACM, 2016.
- [6] L. Dartois, E. Filiot, P.-A. Reynier, and J.-M. Talbot. Two-way visibly pushdown automata and transducers. In *Proc. 31st Annual ACM/IEEE Symposium on Logic in Computer Science (LICS'16)*, pages 217–226. ACM, 2016.
- [7] E. Filiot, S. Maneth, P.-A. Reynier, and J.-M. Talbot. Decision problems of tree transducers with origin. In *Proc. 42nd International Colloquium on Automata, Languages, and Programming (ICALP 2015)*, volume 9135 of *Lecture Notes in Computer Science*, pages 209–221. Springer, 2015.
- [8] Y. Oualhadj, P.-A. Reynier and O. Sankur. Probabilistic Robust Timed Games. In *Proc. 25th International Conference on Concurrency Theory (CONCUR'14)*, volume 8704 of *Lecture Notes in Computer Science*, pages 204–217. Springer, 2014.
- [9] P.-A. Reynier and J.-M. Talbot. Visibly Pushdown Transducers with Well-nested Outputs. In *Proc. 18th International Conference on Developments in Language Theory (DLT'14)*, volume 8633 of *Lecture Notes in Computer Science*, pages 129–141. Springer, 2014.
- [10] O. Sankur, P. Bouyer, N. Markey, and P.-A. Reynier. Robust controller synthesis in timed automata. In *Proc. 24th International Conference on Concurrency Theory (CONCUR'13)*, volume 8052 of *Lecture Notes in Computer Science*, pages 546–560. Springer, 2013.
- [11] M. Caralp, P.-A. Reynier, and J.-M. Talbot. Trimming visibly pushdown automata. In *Proc. 18th International Conference on Implementation and Application of Automata (CIAA'13)*, volume 7982 of *Lecture Notes in Computer Science*, pages 84–96. Springer, 2013.

- [12] M. Caralp, E. Filiot, P.-A. Reynier, J.-M. Talbot, and F. Servais. Expressiveness of Visibly Pushdown Transducers. In *Proc. 2nd International Workshop on Trends in Tree Automata and Tree Transducers (TTATT'13)*, pages 17–26. EPTCS, 2013.
- [13] E. Filiot, O. Gauwin, P.-A. Reynier, and F. Servais. From two-way to one-way finite state transducers. In *Proc. 28th Annual IEEE Symposium on Logic in Computer Science (LICS'13)*, pages 468–477. IEEE Computer Society, 2013.
- [14] S. Akshay, L. Hélouet, C. Jard, and P.-A. Reynier. Robustness of time petri nets under guard enlargement. In *Proc. 6th International Workshop on Reachability Problems (RP'12)*, volume 7550 of *Lecture Notes in Computer Science*, pages 92–106. Springer, 2012.
- [15] P. Bulychev, F. Cassez, A. David, K. G. Larsen, J.-F. Raskin, and P.-A. Reynier. Controllers with minimal observation power (application to timed systems). In *Proc. 10th International Symposium on Automated Technology for Verification and Analysis (ATVA'12)*, volume 7561 of *Lecture Notes in Computer Science*, pages 223–237. Springer, 2012.
- [16] M. Caralp, P.-A. Reynier, and J.-M. Talbot. Visibly pushdown automata with multiplicities: Finiteness and k-boundedness. In *Proc. 16th International Conference on Developments in Language Theory (DLT'12)*, volume 7410 of *Lecture Notes in Computer Science*, pages 226–238. Springer, 2012.
- [17] E. Filiot, O. Gauwin, P.-A. Reynier, and F. Servais. Streamability of nested word transductions. In *Proc. 31st Annual International Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS'11)*, volume 13 of *LIPICs*, pages 312–324. Schloss Dagstuhl - Leibniz-Zentrum fuer Informatik, 2011.
- [18] J. Malinowski, P. Niebert, and P.-A. Reynier. A hierarchical approach for the synthesis of stabilizing controllers for hybrid systems. In *Proc. 9th International Symposium on Automated Technology for Verification and Analysis (ATVA'11)*, volume 6996 of *Lecture Notes in Computer Science*, pages 198–212. Springer, 2012.
- [19] P.-A. Reynier and F. Servais. Minimal coverability set for petri nets: Karp and Miller algorithm with pruning. In *Proc. 32nd International Conference on Application and Theory of Petri Nets and Concurrency (ICATPN'11)*, volume 6709 of *Lecture Notes in Computer Science*, pages 69–88. Springer, 2011.
- [20] R. Jaubert and P.-A. Reynier. Quantitative robustness analysis of flat timed automata. In *Proc. 14th International Conference on Foundations of Software Science and Computation Structures (FoSSaCS'11)*, volume 6604 of *Lecture Notes in Computer Science*, pages 229–244. Springer, 2011.
- [21] E. Filiot, J.-F. Raskin, P.-A. Reynier, F. Servais, and J.-M. Talbot. Properties of visibly pushdown transducers. In *Proc. 35th International Symposium on Mathematical Foundations of Computer Science (MFCS'10)*, volume 6281 of *Lecture Notes in Computer Science*, pages 355–367. Springer, 2010.
- [22] P.-A. Reynier and A. Sangnier. Weak time petri nets strike back! In *Proc. 20th International Conference on Concurrency Theory (CONCUR'09)*, volume 5710 of *Lecture Notes in Computer Science*, pages 557–571. Springer, 2009.
- [23] F. Cassez, J. J. Jessen, K. G. Larsen, J.-F. Raskin, and P.-A. Reynier. Automatic synthesis of robust and optimal controllers - an industrial case study. In *Proc. 12th International Conference on Hybrid Systems: Computation and Control (HSCC'09)*, volume 5469 of *Lecture Notes in Computer Science*, pages 90–104. Springer, 2009.

- [24] P. Bouyer, N. Markey, and P.-A. Reynier. Robust Analysis of Timed Automata via Channel Machines. In *Proc. 11th Int. Conf. on Foundations of Software Science and Computation Structures (FoSSaCS'08)*, vol. 4962 de LNCS, pages 157–171. Springer.
- [25] P. Bouyer, S. Haddad, and P.-A. Reynier. Timed unfoldings for networks of timed automata. In *Proc. 4th Int. Symp. on Automated Technology for Verification and Analysis (ATVA'06)*, vol. 4218 de LNCS, pages 292–306. Springer.
- [26] P. Bouyer, S. Haddad, and P.-A. Reynier. Timed Petri nets and timed automata: On the discriminating power of Zeno sequences. In *Proc. 33rd Int. Coll. on Automata, Languages and Programming (ICALP'06) — Part II*, vol. 4052 de LNCS, pages 420–431. Springer.
- [27] P. Bouyer, S. Haddad, and P.-A. Reynier. Extended timed automata and time Petri nets. In *Proc. 6th Int. Conf. on Application of Concurrency to System Design (ACSD'06)*, pages 91–100. IEEE Computer Society Press.
- [28] P. Bouyer, N. Markey, and P.-A. Reynier. Robust model-checking of linear-time properties in timed automata. In *Proc. 7th Latin American Symposium on Theoretical Informatics (LATIN'06)*, vol. 3887 de LNCS, pages 238–249. Springer.
- [29] P. Bouyer, F. Laroussinie, and P.-A. Reynier. Diagonal constraints in timed automata: Forward analysis of timed systems. In *Proc. 3rd Int. Conf. on Formal Modelling and Analysis of Timed Systems (FORMATS'05)*, vol. 3829 de LNCS, pages 112–126. Springer.

Invited Contributions

- [1] P.-A. Reynier. Robustness of Timed Systems. In *Actes de la 11ème École d'été sur la Modélisation et la Vérification des Systèmes Parallèles (MOVEP'14)*.
- [2] K. Altisen, N. Markey, P.-A. Reynier, and S. Tripakis. Implémentabilité des automates temporisés. In *Actes du 5ème Colloque sur la Modélisation des Systèmes Réactifs (MSR'05)*, pages 395–406. Hermès.

Publications with informal proceedings (Workshops)

- [1] O.-L. Nguena-Timo and P.-A. Reynier. On characteristic formulae for event-recording automata. In *Proc. Workshop on Fixpoints In Computer Science (FICS'09)*, pages 70–78, 2009.
- [2] P.-A. Reynier. Forward analysis of timed automata. In *Proc. 5th Winter School on Modelling and Verifying Parallel Processes (MOVEP'04)*, pages 52–57, 2004.

Thesis

- [1] P.-A. Reynier. Contributions to timed systems and transducers. Habilitation à diriger des recherches. Laboratoire d'informatique fondamentale de Marseille, Aix-Marseille Université, France, 2015.
- [2] P.-A. Reynier. Vérification de systèmes temporisés et distribués : modèles, algorithmes et implémentabilité. Thèse de doctorat, Laboratoire Spécification et Vérification, ENS de Cachan, France, juin 2007.
- [3] P.-A. Reynier. Analyse en avant des automates temporisés. Master's thesis, DEA Algorithmique, Paris, 2004.