

Curriculum Vitae

Antoine Girard

Born August 27, 1978
French nationality

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Research Interests

- Algorithmic analysis of continuous and hybrid systems
- Approximation and abstraction of discrete, continuous and hybrid systems
- Hierarchical and multiscale approaches to control

Position

Sept 2006- *Maître de Conférences* (Assistant Professor), Université Joseph Fourier, Grenoble, France.

Education

2001-2004 **Ph.D., Applied Mathematics**
Institut National Polytechnique de Grenoble, INPG, Grenoble, France
Advisor : Jean Della Dora
Thesis : *Algorithmic Analysis of Hybrid Systems.*

2000-2001 **Master Degree, Applied Mathematics**, with honours
Université Joseph Fourier, Grenoble, France
Advisor : Jean Della Dora
Thesis : *Analysis of Piecewise Affine Hybrid Systems.*

1998-2001 **Diplôme d'Ingénieur**, with honours
Ecole Nationale Supérieure d'Informatique et de Mathématiques Appliquées de Grenoble, ENSIMAG, INPG, Grenoble, France

Research Employment

2006 Postdoctoral researcher, Verimag Laboratory, Grenoble, France.

2004-2005 Postdoctoral researcher, Department of Electrical and Systems Engineering, University of Pennsylvania, Philadelphia, PA, USA.

2001-2004 Ph.D. student, Laboratoire de Modélisation et Calcul, IMAG, Grenoble, France.

Teaching Employment

2006 *Vacataire* at the ENSIMAG.

2001-2004 *Moniteur* at the ENSIMAG.

Scholarships and Awards

- Scholarship, *Bourse “Initiative Post-Doc”*, from Ministère délégué à l’Enseignement supérieur et à la Recherche, 2005.
- Scholarship, *Bourse Internationale de Recherche*, from Région Rhône-Alpes, 2004-2005.
- Scholarship, *Allocation de Recherche*, from Région Rhône-Alpes, 2001-2004.

Visits

1. University of Pennsylvania, Department of Electrical Engineering, Philadelphia, PA, USA, March 2006.
2. University of California at Berkeley, Department of Electrical Engineering, Berkeley, CA, USA, November 2005.
3. Carnegie Mellon University, Department of Electrical Engineering, Pittsburgh, PA, USA, August 2005.

Publications

A. Refereed Journal Publications

1. G.E. Fainekos, H. Kress-Gazit, A. Girard and G.J. Pappas, Temporal logic planning for dynamic models. *Automatica*, 2006, **submitted**.
2. A. Girard, A.A. Julius and G.J. Pappas, Approximate simulation relations for hybrid systems. *Discrete Event Dynamic Systems*, 2006, **submitted**.
3. E. Asarin, T. Dang and A. Girard, Hybridization methods for the analysis of non-linear systems. *Acta Informatica*, 2006, **accepted**.
4. A. Girard and G.J. Pappas, Approximate bisimulation relations for constrained linear systems. *Automatica*, 2005, **accepted**.
5. A. Girard and G.J. Pappas, Approximation metrics for discrete and continuous systems. *IEEE Transactions on Automatic Control*, 2005, **accepted**.
6. A. Girard, Towards a multiresolution approach to linear control. *IEEE Transactions on Automatic Control*, 51(8) :1261-1270, 2006.

B. Refereed Book Chapters

1. G.E. Fainekos, Antoine Girard and G.J. Pappas, Hierarchical synthesis of hybrid controllers from temporal logic specifications. In *Hybrid Systems : Computation and Control*, 2007, **to appear**.
2. A. Girard, Approximately bisimilar finite abstractions of stable linear systems. In *Hybrid Systems : Computation and Control*, 2007, **to appear**.
3. G.E. Fainekos, Antoine Girard and G.J. Pappas, Temporal logic verification using simulation. In E. Asarin and P. Bouyer, editors, *Formal Modelling and Analysis of Timed Systems*, LNCS 4202, pp 171-186, Springer, 2006.
4. A. Girard and G.J. Pappas, Verification using simulation. In J.P. Hespanha and A. Tiwari, editors, *Hybrid Systems : Computation and Control*, LNCS 3927, pp 272-286, Springer, 2006.

5. A. Girard, C. Le Guernic and O. Maler, Efficient computation of reachable sets of linear time-invariant systems with inputs. In J.P. Hespanha and A. Tiwari, editors, *Hybrid Systems : Computation and Control*, LNCS 3927, pp 257-271, Springer, 2006.
6. A. Girard, Reachability of uncertain linear systems using zonotopes. In M. Morari and L. Thiele, editors, *Hybrid Systems : Computation and Control*, LNCS 3414, pp 291-305, Springer, 2005.
7. E. Asarin, T. Dang and A. Girard, Reachability analysis of non-linear systems using conservative approximation. In O. Maler and A. Pnueli, editors, *Hybrid Systems : Computation and Control*, LNCS 2623, pp 20-35, Springer, 2003.

C. Refereed International Conference Proceedings

1. A. Girard and G.J. Pappas, Hierarchical control using approximate simulation relations. In the proceedings of the *45th IEEE Conference on Decision and Control*, San Diego, California, December 2006.
2. T. Nghiem, G.J. Pappas, A. Girard and R. Alur, Time-triggered implementations of dynamic controllers. In the proceedings of the *6th ACM and IEEE Conference on Embedded Software*, Seoul, South Korea, October 2006.
3. E. Asarin, T. Dang, G. Frehse, A. Girard, C. Le Guernic and O. Maler, Recent progress in continuous and hybrid reachability analysis. In the proceedings of the *IEEE International Symposium on Computer-Aided Control Systems Design*, Munich, Germany, October 2006.
4. A. Girard, A.A. Julius and G.J. Pappas, Approximate simulation relations for hybrid systems. In the proceedings of the *2nd IFAC Conference on Analysis and Design of Hybrid Systems*, pp 106-111, Alghero, Italy, June 2006.
5. A.A. Julius, A. Girard and G.J. Pappas, Approximate bisimulation for a class of stochastic hybrid systems. In the proceedings of the *American Control Conference*, Portland, Oregon, June 2006.
6. A. Girard and G.J. Pappas, Approximate bisimulations for constrained linear systems. In the proceedings of the *44th IEEE Conference on Decision and Control and European Control Conference*, pp 4700-4705, Seville, Spain, December 2005.
7. A. Girard and G.J. Pappas, Approximate bisimulations for nonlinear dynamical systems. In the proceedings of the *44th IEEE Conference on Decision and Control and European Control Conference*, pp 684-689, Seville, Spain, December 2005.
8. H. Yazarel, A. Girard, G.J. Pappas et R. Alur, Quantifying the gap between embedded control models and time-triggered implementations. In the proceedings of the *26th IEEE Real-Time Systems Symposium*, pp 111-120, Miami, Florida, USA, December 2005.
9. A. Girard, Optimal control of linear systems : a multiresolution approach. In the proceedings of the *43rd IEEE Conference on Decision and Control*, pp 1806-1811, Nassau, Bahamas, December 2004.
10. A. Girard, Computation and stability analysis of limit cycles in piecewise linear hybrid systems. In the proceedings of the *1st IFAC Conference on Analysis and Design of Hybrid Systems*, pp 181-186, Saint-Malo, France, June 2003.
11. A. Girard, Detection of event occurrence in piecewise linear hybrid systems. In the proceedings of the *4th International Conference on Recent Advances in Soft Computing*, pp 19-25, Nottingham, United Kingdom, December 2002.
12. A. Girard, Approximate solutions of ODEs using piecewise linear vector fields. In the proceedings of the *5th International Workshop on Computer Algebra in Scientific Computing*, pp 107-120, Big Yalta, Crimea, Ukraine, September 2002.

D. Book Reviews

1. A. Girard, Linear Time-Invariant Systems by Martin Schetzen. *Automatica*, 41 :2014-2015, 2005.

E. National Conference Proceedings

1. T. Dang and A. Girard, Introduction à la théorie des systèmes hybrides. In the proceedings of *Ecole Jeunes Chercheurs en Algorithmique et Calcul Formel*, pp 243-267, Grenoble, France, April 2004.

F. Thesis

1. A. Girard, Analyse algorithmique des systèmes hybrides. Ph.D. Thesis, Institut National Polytechnique de Grenoble, France, September 2004.
2. A. Girard, Etude de systèmes dynamiques hybrides affines par morceaux. Master Thesis, Université Joseph Fourier, Grenoble, France, June 2001.

G. Unpublished Technical Reports

1. A. Girard, Analysis of differential equations using hybrid computation. Technical Report, IMAG, January 2002.

Talks (Outside Conferences)

1. Modélisation hiérarchique des systèmes dynamiques. *CASYS-BIPOP Seminar*, Laboratoire Jean Kuntzmann, Grenoble, France, November 2006.
2. Méthodes algorithmiques pour l'analyse des systèmes hybrides. *MOSAIC Seminar*, Laboratoire de Modélisation et Calcul, Grenoble, France, April 2006.
3. Méthodes algorithmiques pour l'analyse des systèmes hybrides. *Pop Art project Seminar*, INRIA, Grenoble, France, April 2006.
4. Méthodes algorithmiques pour l'analyse des systèmes hybrides. *Verimag Seminar*, Grenoble, France, April 2006.
5. Approximation metrics for discrete and continuous systems. *Workshop Topics in Computation and Control*, UC Santa Barbara, Santa Barbara CA, USA, March 2006.
6. Zonotope techniques for reachability analysis. *Workshop Topics in Computation and Control*, UC Santa Barbara, Santa Barbara CA, USA, March 2006.
7. Approximate abstraction for verification of continuous and hybrid systems. *Guest lecture, Hybrid System Course ESE 601*, University of Pennsylvania, Philadelphia PA, USA, March 2006.
8. Relation de simulation approchées pour la vérification des systèmes dynamiques continus et hybrides. *GT Systèmes Dynamiques Hybrides du GDR MACS*, Paris, France, February 2006.
9. Approximation metrics for discrete, continuous and hybrid systems. *CHESS seminar*, UC Berkeley, Berkeley, CA, USA, November 2005.
10. Reachability analysis of continuous systems. *Systems Design Research Lab meeting*, University of Pennsylvania, Philadelphia, PA, USA, November 2005.
11. Bisimulations approchées et application à la vérification de sûreté. *Seminar of the team Automatique des Systèmes Hybrides*, Supélec, Rennes, France, November 2005.
12. Approximate bisimulations and application to safety verification. *GRASP Student Seminar*, University of Pennsylvania, Philadelphia, PA, USA, October 2005.
13. Approximate bisimulation : from transition systems to linear systems. *Meeting Carnegie Mellon University - University of Pennsylvania - Verimag*, Carnegie Mellon University, Pittsburgh, PA, USA, August 2005.

14. Approximation metrics for discrete and continuous systems. *Verimag Seminar*, Grenoble, France, March 2005.
15. Reachability of large scale systems. *GRASP Seminar in Control Systems*, University of Pennsylvania, Philadelphia, PA, USA, January 2005.
16. Analyse algorithmique des systèmes hybrides. *Seminar of the LISA*, Angers, France, October 2004.
17. Introduction aux systèmes hybrides, application à l'approximation de dynamiques non-linéaires. *GT Méthodes Ensemblistes pour l'Automatique du GDR MACS*, Paris, France, May 2004.
18. Introduction aux systèmes hybrides. *Ecole Jeunes Chercheurs en Algorithmique et Calcul Formel*, Grenoble, France, April 2004 (with T. Dang).
19. Contrôle des systèmes linéaires, splines et analyse multirésolution. *MOSAIC Seminar*, Laboratoire de Modélisation et Calcul, Grenoble, France, January 2004.
20. Systèmes hybrides : exemples, définition, systèmes affines par morceaux et application aux équations différentielles ordinaires. *IMAG-JLL project, Modélisation et calcul pour les sciences du vivant*, Grenoble, France, February 2003 (with J. Della Dora).
21. Reachability for non-linear systems using triangulations. *Meeting of the European Project Computation and Control*, Ascona, Switzerland, October 2002.
22. Calcul hybride pour l'approximation des solutions de systèmes d'équations différentielles. *Journée des Thésards du LMC Grenoble*, France, June 2002.
23. Calcul hybride pour l'approximation des solutions d'EDO. *Seminar of the team Mosaic*, Grenoble, France, May 2002.
24. Analysis and simulation of ODE using hybrid systems. *Meeting of the European Project Computation and Control*, Grenoble, France, January 2002 (with J.-G. Dumas).

Software

1. A. Girard, MATISSE : Metrics for Approximate TransItion Systems Simulation and Equivalence, 2005.
Available from <http://www.seas.upenn.edu/~agirard/Software/MATISSE/>.
2. A. Girard, CASCADE : Computational Analysis and Simulation using Continuous Approximations of Differential Equations, 2002.
Available from <http://www-lmc.imag.fr/MOSAIC/CASCADE/>.

Teaching Activities

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| 2006-2007 | <ul style="list-style-type: none"> – MAT112 : Elementary Agebra and Geometry, 54h, Université Joseph Fourier. – Dynamical systems, 45h, ENSIMAG. – Introduction to hybrid systems (part of the course Biocomputing), 9h, Université Joseph Fourier and ENSIMAG. |
| 2005-2006 | <ul style="list-style-type: none"> – Dynamical systems, 15h, ENSIMAG. – Tutoring of a student project : <i>Hybridization approaches for control synthesis</i>, ENSIMAG. |
| 2003-2004 | <ul style="list-style-type: none"> – Dynamical systems, 22.5h, ENSIMAG. – Probability theory, 36h, ENSIMAG. |
| 2002-2003 | <ul style="list-style-type: none"> – Dynamical systems, 22.5h, ENSIMAG. – Probability theory, 18h, ENSIMAG. – Scientific computing project, 24 h, ENSIMAG. |

- Tutoring of a student project : *Computation and stability analysis of limit cycles in hybrid systems*, ENSIMAG.
- 2001-2002
- Dynamical systems, 22.5h, ENSIMAG.
 - Probability theory, 10.5h, ENSIMAG.
 - Ada language programming project, 24 h, ENSIMAG.
 - Tutoring of a student project : *Computation and stability analysis of limit cycles in continuous systems*, ENSIMAG.

Professional Activities

A. Organization Committee Member

- Congrès de la SMAI (*French Society for Industrial and Applied Mathematics*), 2007.

B. Program Committee Member

- Hybrid Systems : Computation and Control, 2007.

C. Reviewer for International Journals

- Automatica, 2006.
- Discrete Event Dynamic Systems, 2006.
- International Journal of Statistics and Systems, 2005.
- IEEE Transactions on Automatic Control, 2004, 2005 and 2006.
- Journal Européens des Systèmes Automatisés, 2006.
- Nonlinear Analysis, special issue on Hybrid Systems Applications, 2005.
- Systems and Control Letters, 2006.
- Theoretical Computer Science, 2006.

D. Reviewer for International Conferences

- Algebraic Methodology and Software Technology, 2006.
- American Control Conference, 2006.
- Analysis and Design of Hybrid Systems, 2006.
- Conference on Control Applications, 2006.
- European Control Conference, 2007.
- Hybrid Systems : Computation and Control, 2003, 2004, 2005 and 2006.
- IEEE Conference on Decision and Control, 2005.
- IFAC World Congress, 2005.

E. Session Chair

- Optimal Control I, *43rd IEEE Conference on Decision and Control*, Nassau, Bahamas, December 2004.

Projects

A. Current Projects

- **VAL-AMS** : High confidence validation of analog and mixed signal circuits. (2007-2009)
Project funded by ANR-SETIN.
Participants : Verimag, Laboratoire Jean Kuntzmann, INRIA BIPOP.
Coordinator : Thao Dang.
Coordinator for LJK : Antoine Girard.

B. Past Projects

- **CalCel** : Calcul Cellulaire. (2004-2006)
Project funded by the Région Rhône-Alpes.
Participants : Laboratoire de Modélisation et Calcul.
Coordinator : Jean Della Dora.
- **ADeMo** : Acquisition et Décision conduite par le Modèle. (2000-2003)
Project funded by the Région Rhône-Alpes.
Participants : Laboratoire de Modélisation et Calcul.
Coordinator : Jean Della Dora.

January 2007.