

# Pierre Roux

PhD

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born on May 26, 1987; french citizen

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## Education

- December 18, 2013 **PhD, ISAE, Toulouse.**  
Thesis entitled: Static Analysis of Control Command Systems: synthesizing non linear invariants.
- October 2010 to December 2013 **PhD student, ONERA/ISAE, Toulouse.**  
PhD student at ONERA (The French Aerospace Lab), DTIM (Information Processing and Modeling Department), working on analysis of critical embedded systems using abstract interpretation methods based on mathematical optimization tools.
- September 2009 to February 2010 **First semester of second year of MSc, MPRI, Paris.**
- April to July 2009 **Second semester of first year of MSc, TUM, Munich.**  
Second semester of master spent as an ERASMUS exchange student at the Technische Universität München.
- September 2008 to January 2009 **First semester of first year of MSc, ÉNS Lyon.**  
First semester of MSc in fundamental computer science at ÉNS Lyon.
- 2007 – 2008 **Third year of BSc, ÉNS Lyon.**  
Third year of BSc in fundamental computer science at ÉNS Lyon.
- September 2007 **Entrance examination, ÉNS Lyon.**  
Admitted at ÉNS Lyon (civil servant).
- 2005 – 2007 **“Classes préparatoires”, Lycée Fermat, Toulouse.**  
“Classes préparatoires” MPSI and MP\*.
- June 2005 **High school diploma.**

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## Internships and Visits

- January to August 2014 **Postdoctoral Visit, LRI, Gif sur Yvette.**  
Formal proof using Coq proof assistant of properties about double rounding of floating point operations, under the supervision of Sylvie Boldo and Guillaume Melquiond.
- From April 4 to May 16, 2011 **Visit, School of aerospace engineering, Georgia Tech, Atlanta.**  
Six weeks visit in the school of aerospace engineering at Georgia Tech, Atlanta under the supervision of prof. Eric Féron. Formal methods for control systems.
- August 2010 **Visit, NIA, Hampton.**  
Four weeks visit at NIA (National Institute of Aerospace, funded by NASA) in Hampton, Virginia (advisor: Radu Siminiceanu). Study of symbolic model checking algorithms.
- February 22 to August 27, 2010 **MSc internship, ONERA, Toulouse.**  
Master thesis internship at ONERA/DTIM (advisor: Pierre-Loïc Garoche). Implementation of a prototype abstract interpreter to be used as a lemma generator by a  $k$ -induction procedure on Lustre synchronous programs.
- January 26 to April 16, 2009 **First year of MSc internship, NIA, Hampton.**  
First year of master internship at NIA (advisor: Radu Siminiceanu). Comparison of two BDD variants for arithmetic functions. Implementation of a symbolic model checking library with state of the art algorithms for reachable state space construction. A simple model checker using it proved on a few examples to be orders of magnitude faster and more memory efficient than the CUDD library used by tools such as SAL or NuSMV.
- June 3 to July 18, 2008 **BSc internship, ONERA, Toulouse.**  
Internship at ONERA/DTIM (advisor: Pierre-Loïc Garoche). Proof of functional properties on C programs. Testing Frama-C/Jessie/Why tool on a small industrial case study and comparison with older Caveat tool used in production. Although very promising, Jessie was at the time clearly still under intensive development. Fixing many small bugs.

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## Teaching

- First semester 2016 – 2017 **Simulation, bisimulation and process calculus.**  
Lecture/tutorials (26,25 hours, ENSEEIHT, Toulouse).
- Functional Programming.**  
Tutorials (22,75 hours) to initiate computer science engineer students (ENSEEIHT, Toulouse) to the Caml language.
- First semester 2015 – 2016 **Simulation, bisimulation and process calculus.**  
Lecture/tutorials (26,25 hours, ENSEEIHT, Toulouse).

- First semester 2013 – 2014 **Validation by mean of Static Analysis, Abstract Interpretation.**  
Lecture (5,25 hours) and tutorials (5,25 hours) of abstract interpretation (ENSEEIHT, Toulouse).  
**Mathematical Tools for Computer Science.**  
Tutorials (24,5 hours) to initiate computer science engineer students (ENSEEIHT, Toulouse) to the COQ proof assistant and deductive methods.  
**Functional Programming.**  
Tutorials (22,75 hours) to initiate computer science engineer students (ENSEEIHT, Toulouse) to the Caml language.
- First semester 2012 – 2013 **Validation by mean of Static Analysis, Abstract Interpretation.**  
Tutorials (5,25 hours) of abstract interpretation (ENSEEIHT, Toulouse).  
**Mathematical Tools for Computer Science.**  
Tutorials (12,25 hours) to initiate computer science engineer students (ENSEEIHT, Toulouse) to the COQ proof assistant and deductive methods.  
**Functional Programming.**  
Tutorials (45,5 hours) to initiate computer science engineer students (ENSEEIHT, Toulouse) to the Caml language.
- First semester 2011 – 2012 **Validation by mean of Static Analysis, Abstract Interpretation.**  
Lecture (5,25 hours) and tutorials (5,25 hours) of abstract interpretation (ENSEEIHT, Toulouse).  
**Imperative Programming.**  
Tutorials (38,5 hours) to initiate students (ENSEEIHT, Toulouse) to the C language.
- Second semester 2011 – 2012 **JEE.**  
Tutorials (21 hours) to initiate computer science engineer students (ENSEEIHT, Toulouse) to the development of web applications using JEE.
- First semester 2010 – 2011 **Functional Programming.**  
Tutorials (31,5 hours) to initiate computer science engineer students (ENSEEIHT, Toulouse) to the Caml language.  
**Imperative Programming.**  
Tutorials (14 hours) to initiate computer science engineer students (ENSEEIHT, Toulouse) to the C language.  
**Imperative Programming.**  
Tutorials (31,5 hours) to initiate students (ENSEEIHT, Toulouse) to the C language.

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## Publications

- A reflexive tactic for polynomial positivity using numerical solvers and floating-point computations.**  
Érik Martin-Dorel, Pierre Roux  
CPP 2017, Paris, January 2017.
- Formal Proofs of Rounding Error Bounds - With Application to an Automatic Positive Definiteness Check.**  
Pierre Roux,  
Journal of Automated Reasoning, 57(2):135-156, 2016.
- Validating Numerical Semidefinite Programming Solvers for Polynomial Invariants.**  
Pierre Roux, Yuen-Lam Voronin, Sriram Sankaranarayanan  
SAS 2016, Edinburgh, September 2016.
- Embedding network calculus and event stream theory in a common model.**  
Marc Boyer, Pierre Roux  
ETF A 2016, Berlin, September 2016.
- Formal Analysis of Robustness at Model and Code Level.**  
Timothy E. Wang, Pierre-Loïc Garoche, Pierre Roux, Romain Jobredeaux, Éric Féron  
HSCC 2016, Vienna, April 2016.
- Practical Policy Iterations.**  
Pierre Roux, Pierre-Loïc Garoche  
Formal Methods in System Design, 46(2):163-196, 2015.
- Closed Loop Analysis of Control Command Software.**  
Pierre Roux, Romain Jobredeaux, Pierre-Loïc Garoche  
HSCC 2015, Seattle, April 2015.
- Innocuous Double Rounding of Basic Arithmetic Operations.**  
Pierre Roux,  
Journal of Formalized Reasoning, 7(1):131-142, 2014.
- Computing Quadratic Invariants with Min- and Max-Policy Iterations: a Practical Comparison.**  
Pierre Roux, Pierre-Loïc Garoche,  
FM 2014, Singapour, May 2014.
- Integrating Policy Iterations in Abstract Interpreters.**  
Pierre Roux, Pierre-Loïc Garoche,  
ATVA 2013, Hanoi, October 2013.

**Formal Methods for the Analysis of Critical Control Systems Models: Combining Non-Linear and Linear Analyses.**

Adrien Champion, Rémi Delmas, Michael Dierkes, Pierre-Loïc Garoche, Romain Jobredeaux, Pierre Roux, FMICS 2013, Madrid, September 2013.

**Formal Methods for the Analysis of Critical Control Systems Models: Combining Non-Linear and Linear Analyses.**

Adrien Champion, Rémi Delmas, Michael Dierkes, Pierre-Loïc Garoche, Romain Jobredeaux, Pierre Roux, SAE Aerotech 2013, Montreal, September 2013.

**A Polynomial Template Abstract Domain based on Bernstein Polynomials.**

Pierre Roux, Pierre-Loïc Garoche, NSV 2013, Philadelphie, April 2013.

**A Generic Ellipsoid Abstract Domain for Linear Time Invariant Systems.**

Pierre Roux, Romain Jobredeaux, Pierre-Loïc Garoche, Éric Féron, HSCC 2012, Beijing, April 2012.

**Towards Cooperation of Formal Methods for the Analysis of Critical Control Systems.**

Adrien Champion, Rémi Delmas, Pierre-Loïc Garoche, Pierre Roux, SAE International Journal of Aerospace, 4(2):850-858, 2011.

**Dessine moi un domaine abstrait fini – une recette à base de Camlp4 et de solveurs SMT.**

Pierre Roux, Pierre-Loïc Garoche, JFLA 2011, La Bresse, February 2011.

**SMT-AI : an Abstract Interpreter as Oracle for  $k$ -induction.**

Pierre Roux, Rémi Delmas, Pierre-Loïc Garoche, TAPAS 2010 (workshop de SAS 2010), Perpignan, September 2010.

**Model Checking with Edge-valued Decision Diagrams, (short paper).**

Pierre Roux, Radu Siminiceanu, NASA Formal Methods Symposium (NFM 2010), Washington DC, April 2010.

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## Distinctions

2013 **Best paper, FMICS**

2011 **Arch T. Colwell Merit Award, SAE**

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## Miscellaneous

Mother tongue : french

Others : english (fluent), german (basis)

Computer science : C/C++, OCaml, Python, Lisp,

L<sup>A</sup>T<sub>E</sub>X, HTML,

Unix, Windows