

Pierre Roux

PhD

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born on May 26, 1987; french citizen

Since December 1st 2014 **Researcher, ONERA, Toulouse.**
Researcher in team LAPS (Languages, Architectures and Proofs for embedded Systems).

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.**

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.

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 (ENSEEIH, Toulouse).
- Mathematical Tools for Computer Science.**
Tutorials (24,5 hours) to initiate computer science engineer students (ENSEEIH, Toulouse) to the COQ proof assistant and deductive methods.
- Functional Programming.**
Tutorials (22,75 hours) to initiate computer science engineer students (ENSEEIH, Toulouse) to the Caml language.
- First semester 2012 – 2013 **Validation by mean of Static Analysis, Abstract Interpretation.**
Tutorials (5,25 hours) of abstract interpretation (ENSEEIH, Toulouse).
- Mathematical Tools for Computer Science.**
Tutorials (12,25 hours) to initiate computer science engineer students (ENSEEIH, Toulouse) to the COQ proof assistant and deductive methods.
- Functional Programming.**
Tutorials (45,5 hours) to initiate computer science engineer students (ENSEEIH, 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 (ENSEEIH, Toulouse).
- Imperative Programming.**
Tutorials (38.5 hours) to initiate students (ENSEEIH, Toulouse) to the C language.
- Second semester 2011 – 2012 **JEE.**
Tutorials (21 hours) to initiate computer science engineer students (ENSEEIH, 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 (ENSEEIH, Toulouse) to the Caml language.
- Imperative Programming.**
Tutorials (14 hours) to initiate computer science engineer students (ENSEEIH, Toulouse) to the C language.
- Imperative Programming.**
Tutorials (31.5 hours) to initiate students (ENSEEIH, Toulouse) to the C language.

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
ETFA 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.

Distinctions

2013 **Best paper, FMICS**

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

Miscellaneous

Mother tongue : french

Others : english (fluent), german (basis)

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

L^AT_EX, HTML,

Unix, Windows