Stéphane Le Roux

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Main research interests

- Game theory, complex systems and economics.
- Computability and complexity analysis in various computational models.
- Proof theory and (as a user) automated proof verification.

Education

2008	Economics (no degree expected)	Ecole Polytechnique
2004-2007	Ph.D. (information science)	Ecole Normale Supérieure de Lyon
2003-2004	M.Sc (information science)	Ecole Normale Supérieure de Lyon
1999-2001	Sinology (no degree expected)	Xi'An JiaoTong University
1997-1999	Generalist Engineer	Ecole Centrale de Lyon

- Economics: at master level, about 15 hours a week.
- Ph.D. dissertation title: Generalisation and formalisation in game theory.
  Awarded on: 16 January 2008.
  Awarded by: Ecole Normale Supérieure de Lyon, France.
  Supervisor: Pierre Lescanne, ENS Lyon.
  Jury: Pierre Castéran, Jean-Paul Delahaye, Sylvain Sorin.
  Referees: Franck Delaplace, Jean-François Monin.
- M.Sc dissertation title: Solving equations in a calculus that is related to classical logic
  Awarded on: July 2004.
  Awarded by: Ecole Normale Supérieure de Lyon, France.
  Supervisor: Pierre Lescanne, ENS Lyon.
- 3 semesters of Chinese studies, plus 1 semester of 4 master's computer science courses in Chinese (all exams passed).
- Here, generalist engineering ($\simeq$ master of engineering) means: First, "classe préparatoire" ($\simeq$ B.Sc in Mathematics and Physics). Second, two years of broad studies of engineering techniques (electrical, material, mechanics, mathematics, etc). Third, one specialising semester (in China for me), and one internship semester (in France Telecom R&D for me). Engineer dissertation title: Fare sharing and QoS in an Internet connection.

Employement history

2007-2008	Postdoc at INRIA-Microsoft Research, Orsay
2004-2007	Researcher and teacher at ENS Lyon
2002-2003	Representative for Gerflor in China
2001	Engineer intern (5 months) at France Telecom R&D
1998	Worker intern (1 month) at Polyclad, France

Gerflor is a French company producing PVC flooring, part of it being dedicated to the industry. When a sales manager for Gerlfor, Chinese was my working language and my mission was to develop our market in the whole China. My activities were: First, sales force training in our few Gerlfor offices in China. Second, advertising Gerlfor to retailers, contractors, architects, industrial projects, or decision makers in the administration. I would either found these persons in professional forums, in their offices, and near building sites, or invite them to seminars.

Research activities

- My Ph.D. thesis questions classic concepts and results of game theory, especially existence of Nash equilibrium. Traditionally, these equilibria involve only real-valued payoffs. In various kinds of games, I fully abstract over the notion of payoff function and substantially generalise existing results. My abstract formalism helps define general objects and study necessary and sufficient conditions for equilibrium existence. Especially, most of the traditional assumptions are usually followed as dogmas or even implicit. Stating and using these assumptions explicitly shows that part of them is useless or even harmful w.r.t. the intended insight. For some of my results, I wrote formal proofs, *i.e.* electronic proofs verifiable by a computer. The rest of my definitions and results are handle with (almost) the same rigour.

- Three game-theory-related proof scripts using Coq (developed at INRIA) are available on my webpage. Also, part of my Coq work was used in the Color library (on rewriting termination) developped at LORIA by Frédéric Blanqui.

- In the INRIA-Microsoft Research joint centre, I worked on Georges Gonthier's project. This project aims at writing a formal proof of the Feit-Thomson theorem. This theorem is one of the main result in finite groups classification, and even experts are not fully convinced by the historical 250-page proof. The project uses ssreflect to write definitions, statements, and proofs. Ssrefelct is a formal language developed by Georges Gonthier on top of Coq. Before starting the actual proof, one must develop in ssrelfect an efficient library for finite group theory. This activity tells a lot on how to design proof-related libraries in general. I wrote a tutorial for the language ssreflect and I wrote a proof of the existence of a base for Abelian

finite groups.

- With Martin Ziegler, I work on real number computable analysis. In connection with game equilibrium computation, we first explored computable versions of Brouwer fixed point theorem which is intrinsically non-constructive. Then we quickly moved on other problems such as non-computable existence of computable point in specific subsets of R^n. Victor Poupet started working with us.
- In my M.Sc dissertation, I designed a method to solve equations in a calculus related to classical logic, just like Gérard Huet solved equations in a calculus related to intuitionist logic *i.e.* lambda calculus.
- With Victor Poupet, I started studying lower bound of complexity of simple languages such as the square-free words in different computational models such as one-tape Turing machine or one-way cellular automaton. This has not yet led to any publication.
- In connection with game theory and complex systems I intend to explore economics from a very abstract viewpoint.
- During my postdoc at LIX, I shall work on complex system with Daniel Krob and Leo Liberti, and on static program analysis with Eric Goubault and Leo Liberti.

Grants and sponsorship

- MENRT Ph.D. research scholarship (French government)
- Monitorat Ph.D. teaching scholarship (French government)
- Collège doctoral franco-japonais Ph.D. scholarship (for my stay in Japan)
- Eurodoc Ph.D. scholarship (for my stay in Japan)
- Trip to conference CIE 2008 was sponsored by CIE.

International journals

[1] Stéphane Le Roux and Martin Ziegler. Singular coverings and non-uniform notions of closed set computability. *Mathematical Logic Quarterly*, 5:545–560, 2008.

International conferences

[1] Stéphane Le Roux. Acyclicity and finite linear extendability: a formal and constructive equivalence. In Klaus Schneider and Jens Brandt, editors, *Theorem Proving in Higher Order Logics: Emerging Trends Proceedings*, pages 154–169. Department of Computer Science, University of Kaiserslautern, September 2007.

[2] Stéphane Le Roux. Acyclicity of preferences, Nash equilibria, and subgame perfect equilibria: a formal and constructive equivalence. In S Barry Cooper, Thomas F. Kent, Benedikt Löwe, and Andrea Sorbi, editors, *Computation and Logic in the Real World, CiE 2007*, Quaderni del Dipartimento di Scienze Matematiche e Informatiche "Roberto Magari". University of Siena, June 2007.

[3] Stéphane Le Roux. Discrete non determinism and Nash equilibria for strategy-based games. In Arnold Beckmann, Costas Dimitracopoulos, and Benedikt Löwe, editors, *CiE 2008: Abstracts and extended abstracts of unpublished papers*. University of Athens, June 2008.

[4] Stéphane Le Roux. Graphs and path equilibria. In *Algorithmic Aspects in Information and Management, 4th International Conference*, Lecture Notes in Computer Science, pages 247–258. Springer, June 2008.

[5] Stéphane Le Roux and Martin Ziegler. Singular coverings and non-uniform notions of closed set computability. In *Fourth International Conference on Computability and Complexity in Analysis*, Electronic Notes in Theoretical Computer Science, pages 73–88. Elsevier, 2008.

International workshops

[1] Stéphane Le Roux. Non-determinism and Nash equilibria for sequential game over partial order. In *Computational Logic and Applications, CLA '05*, Discrete Mathematics & Theoretical Computer Science, 2006.

[2] Stéphane Le Roux and Pierre Lescanne. Solving equations in a language with control operators. In *18th International Workshop on Unification*, June 2004. online at http://www.mpi-inf.mpg.de/ baumgart/ijcar-workshops/.

Theses

[1] Stéphane Le Roux. Résolution d'équations dans des calculs interprétant la logique classique. M.sc. thesis, Ecole Normale Supérieure de Lyon, July 2004.

[2] Stéphane Le Roux. *Generalisation and formalisation in game theory*. Ph.d. thesis, Ecole Normale Supérieure de Lyon, January 2008.

Other

[1] Stéphane Le Roux, Pierre Lescanne, and René Vestergaard. A discrete Nash theorem with quadratic complexity and dynamic equilibria. Research report IS-RR-2006-006, Japan Advanced Institute of Science and Technology, 2006.

Visiting terms and seminars

- Université Denis Diderot - Paris 7 (2008, 1 seminar, invited by Arnaud Durand and Guillaume Malod)
- Grenoble University (2008, 1 talk for a workshop without publication, invited by Corinne Touati)
- LABRI (2008, 1 seminar, invited by Olivier Ly and Yvan Le Borgne)
- IRISA (2008, 1 seminar, invited by Loic Helouet and Anne Bouillard)
- LIAFA (2008, 1 seminar, invited by Emmanuelle Lebhar)
- LIF (2008, 1 seminar, invited by Victor Poupet)
- LORIA (2007, 1 seminar, invited by Olivier Bournez)
- University of Cambridge (2007, one week for seminar and research, invited by Timothy Griffin)
- INRIA-Microsoft Research (2007, 1 seminar, invited by Georges Gonthier)
- University of Paderborn/Heinz Nixdorf Institute (2007, one week for seminar and research, invited by Martin Ziegler)
- Japan Advanced Institute of Science and technology (2006, 5 months for research, invited by René Vestergaard)
- Japan Advanced Institute of Science and technology (2005, 1 month for research, invited by René Vestergaard)
- Japan Advanced Institute of Science and technology (2004, 1 month for seminar and research, invited by René Vestergaard)

Teaching experience

Each entry but the last one amounts to 32 hours practising class:

- Logic, proof theory, and lambda calculus, fall 2004 and 2005 (L3, ENS Lyon, assistant of Pierre Lescanne)
- Formal languages and automata, fall 2004 (L3, ENS Lyon, assistant of Marianne Delorme)

- Programming in O'Caml and C, fall 2005 (L3, assistant of Daniel Hirschkoff)
- Student tutoring, fall 2006 (M2, on a course of Pascal Koiran)
- Basics in database, operating system, text editing... fall 2005 (L1, INSA Lyon, assistant of Jean-François Ponsignon).
- One two-hour game theory lecture, fall 2008 (M2, ENS Lyon, invited by Pierre Lescanne)

Languages

- Mother tongue: French
- Fluent: English and Chinese (Chinese reading and writing need brushing up).
- Once basic: German (7-year study) and Japanese (studied in Japan).
- Very short school studies: Spanish, Latin, and Arabic.