

Curriculum Vitæ

2011

Radhia Cousot

Directrice de Recherche
Centre National de la Recherche Scientifique



École Normale Supérieure
45 rue d'Ulm, 75230 Paris cedex 05, France
rcousot@ens.fr, www.di.ens.fr/~rcousot/

CAREER

SHORT BIOGRAPHY

Radhia Cousot is a CNRS ¹ senior research scientist ² in Computer Science, at the École Normale Supérieure, Paris, France. She is Doctor ès Sciences in Mathematics.

Radhia Cousot was appointed from 1980 as CNRS junior research scientist, research scientist and senior research scientist at the Computer Science laboratories of the University Henri Poincaré of Nancy (1980–1983), University Paris-Sud at Orsay (1984–1988), École Polytechnique (1989–2008) where from 1991 she headed the research team "*Semantics, Proof and Abstract interpretation*" and École Normale Supérieure (since 2006).

Before, she was an associate research scientist (1975–1979) and a UNESCO ³ fellow (1971–1974) at the University Joseph Fourier of Grenoble, after a master of research degree in Computer Science (1972) and an engineer degree in Applied Mathematics (1971).

She is the inventor, with Patrick Cousot, of *Abstract Interpretation*.

She taught essentially at the graduate level (since 1987).

ABSTRACT INTERPRETATION

Abstract Interpretation, introduced in the seventies by Patrick Cousot and Radhia Cousot, is a theory of sound abstraction and approximation of complex mathematical structures, in particular those involved in the description of computer and biological systems.

The essential idea extensively developed and deepened in Abstract Interpretation is that any manual or automatic reasoning on complex systems requires abstractions of the semantics defining their behavior to intrinsic, more abstract, properties. Moreover, full automation must involve sound approximations of these properties. The theory guaranties soundness so that all claims made in the abstract are always valid in the concrete, although sometimes incomplete, due to undecidability.

¹French National Center for Scientific Research.

²Equivalent to a tenured professor at an American University (with no obligation of teaching).

³United Nations Educational, Scientific and Cultural Organisation.

A distinctive and very powerful characteristic of Abstract Interpretation is the use of a composition of infinitary abstractions to infer complex properties (using widenings and narrowings to abstract induction and co-induction in fixpoint computations). A consequence is that Abstract Interpretation is provably strictly more powerful than checking finite models of computations.

Abstract Interpretation provides a unifying algebraic theory of syntax, semantics and formal methods. In practice, it offers the rigorous basis for the systematic derivation of sound methods and algorithms for approximating undecidable or highly complex problems in various areas of computer science (such as syntax, semantics, specification and design, safety and security verification and proof, model-checking, sound static analysis, invariance inference, compilation, program transformation and optimization, parallelization, typing, software obfuscation and watermarking, malware detection, refactoring, etc.).

Abstract Interpretation does scale up to automatically verify very large systems without requiring handmade simplified models or human interaction. The current main industrial applications of Abstract Interpretation are automatic tools for the precise verification of safety and security of complex hardware and software computer systems including programs of several millions lines of code as found in the avionics, automotive, banking, medical, nuclear and space industries. Its latest emerging application is the analysis of complex molecular networks in cellular signaling systems.

HIGHEST ACADEMIC DEGREE

- Docteur d'état ès sciences in Mathematics, 1985

POSITIONS HELD SINCE ENGINEER DEGREE

- *École normale supérieure (2006–Present)* : CNRS senior research scientist
- *École polytechnique (1989–2008)* : CNRS senior research scientist (1996–2008) — CNRS research scientist (1989–1995) — Direction of the research team *Semantics, Proof and Abstract interpretation* (1991–2008) — Member of the direction committees of the laboratories (LIX, 1991–2002) & (STIX, 2003–2004) — Member of the *council* of the Computer Science department (DIX, 2003–2004)
- *University Paris-Sud at Orsay (1983–1988)* : CNRS research scientist
- *University Henri Poincaré of Nancy (1980–1983)* : CNRS junior research scientist
- *University Joseph Fourier of Grenoble (1971–1979)* : Associate research scientist (1975–1979) — UNESCO fellow (1971–1974)

RECENT VISITING SCIENTIST POSITIONS

- Microsoft Research, Redmond, WA, USA, Summers 2009, 2010 & 2011
- IBM Thomas J. Watson Research Center, Hawthorne, NY, USA, 2006 & 2007

RESEARCH INTERESTS

- *Abstract interpretation*: systematic mathematical design of sound methods for approximating undecidable or highly complex problems as found in computer and biological systems
- *Semantics of programming languages*: formal definition of the execution of programs of a programming language
- *Static analysis* of programming and specification languages: automatic compile-time inference and verification of runtime properties of programs
- *Safety* (absence of catastrophic behaviors) and *security* (resistance to malevolent uses) of computer systems.

PHD STUDENTS

- Ferdinanda CAMPORESI (in progress) — Caterina URBAN (in progress) — Matteo ZANIOLI (in progress) — Pietro FERRARA (2009, presently post-doc at ETH Zurich) — Élodie-Jane SIMS (2007, presently research scientist at CMU Silicon Valley) — Charles HYMANS (2004, presently research scientist at EADS) — Francesco LOGOZZO (2004, presently research scientist at MSR Redmond) — Damien MASSÉ (2002, presently associate professor at Brest University) — Stanislav TZOLOVSKI (2002) — Arnaud VENET (1998, presently Senior research scientist at NASA Ames Research Center)

- *Visiting PhD students & Post-Docs* : from — Aarhus Universitet — Birmingham University — Cambridge University — Carnegie Mellon University — Copenhagen University — Edinburg University — Imperial College — Kansas State University — Katholieke Universiteit Leuven — Korea Advanced Institute of Science and Technology — Novosibirsk State University — Politecnico di Milano — Seoul National University — Sofia University — University of Kent — Università Verona — Università di Padova — Università di Pisa — Università di Torino — Università di Verona — University of Crete

PERSONAL

- *Address*: 10 Le Pré Launay, 91440 Bures-sur-Yvette, France. +33 1 69 28 12 83, +33 6 32 19 60 27
- *Civil status*: Born August 6, 1947. Married to Patrick Cousot. Two sons, Laurent & Thibault
- *Citizenship*: French

MEMBERSHIPS, BOARDS AND COMMITTEES

MEMBERSHIPS

- *Scientific Associations* : ACM — EAPLS — IEEE

CNRS PROGRAMME

- *Steering Committees* : CNRS Interdisciplinary Research Network Programme – Sécurité des accès, des échanges et des contenus

RECENT JOURNAL AND CONFERENCE COMMITTEES

- *Advisory Boards* : Higher-order and Symbolic Computation Journal (HOSC), Springer — Central European Journal of Computer Science (CEJCS), Versita & Springer
- *Steering Committees* : International Static Analysis Symposium (SAS) — International Workshop on Numerical and Symbolic Abstract Domains (NSAD) — International Workshop on Static Analysis and Systems Biology (SASB)
- *Program Committees Member and Chair* ⁴ : Symposium on Principles of Programming Languages (ACM SIGACT-SIGPLAN POPL) — Conference on Programming Language Design and Implementation (ACM SIGPLAN PLDI) — Workshop on Partial Evaluation and Program Manipulation (ACM SIGPLAN PEPM) — International Symposium on Principles and Practice of Declarative Programming (ACM SIGPLAN PPDP) — Asian Symposium on Programming Languages and Systems (APLAS) — International Workshop on Abstractions for Petri Nets and Other Models of Concurrency (APNOC) — International Workshop on Emerging Applications of Abstract Interpretation (ETAPS EAAl) — European Symposium on Programming (ETAPS ESOP) — International Conference on Compiler Construction (ETAPS CC) — Formal Methods for Parallel Programming: Theory and Applications (FMPPTA) — International Conference on Computer Languages (IEEE ICCL) — International Symposium On Leveraging Applications of Formal Methods, Verification and Validation (ISOLA) — Mathematical Foundations of Programming Semantics, Invited session on abstract interpretation (MFPS) — Programs as Data Objects: Second Symposium (PADO) — International Static Analysis Symposium (SAS) — Workshop on Specification, Analysis and Validation for Emerging Technologies (SAVE) — Tools and Algorithms for the Construction and Analysis of Systems (TACAS) — International Conference on Verification, Model Checking and Abstract Interpretation (VMCAI)
- *Organization* : Symposium on Principles of Programming Languages (ACM SIGACT-SIGPLAN POPL) ⁵ (Paris 1997) — Workshop on Automated Analysis of Software (ACM SIGPLAN AAS) (Paris 1997) — Workshop on Continuations (ACM SIGPLAN CW) (Paris 1997) — ACM SIGPLAN Workshop on Domain-Specific Languages (ACM SIGPLAN DSL) (Paris 1997) — Foundations of Object-Oriented Languages (FOOL) (Paris 1997) — International Static Analysis Symposium (SAS) (Paris 1997 & 2001, Perpignan 2010) — International Workshop on Static Analysis and Systems Biology (SASB) (Perpignan 2010) — International Workshop on Numerical and Symbolic Abstract

⁴In particular PC Chair of the upcoming ACM SIGACT-SIGPLAN POPL'13, Rome, Italy, Jan. 23-25, 2013.

⁵Report by B. Ryder (ACM SIGPLAN ECC) in ACM SIGPLAN Notices 32(4):1 & 1c-8c, 1997.

Domains (NSAD) (Paris 2005, Perpignan 2010) — Tools for Automatic Program Analysis (TAPAS) (Perpignan 2010) — International Conference on Verification, Model Checking and Abstract Interpretation (VMCAI) (Paris 2005) — Dagstuhl seminar on Abstract Interpretation (Germany 1995) — Industrial Day on abstract Interpretation, affiliated to VMCAI (Paris 2005)

GRANTS

RECENT EUROPEAN RESEARCH GRANTS

- [1] DAEDALUS: Validation of critical software by static analysis and abstract testing – FP5-IST Fifth Framework Programme, (2000–2002)
AIRBUS, École Normale Supérieure, École polytechnique, CEA, Univ. of Saarbrücken & Trier, Copenhagen, Tel-Aviv, the start-ups AbsInt and Polyspace Technologies.
- [2] SSVAI: Validation of Space Software using Abstract Interpretation – EUROPEAN SPACE AGENCY Innovation Triangle Initiative, (2007–2008)
ASTRIUM SPACE TRANSPORTATION École Normale Supérieure, CEA, École polytechnique
- [3] ES-PASS: Embedded Software Product-based ASSurance – ITEA2 programme, (2007–2009)
ABSINT GmbH, AIRBUS, EADS ASTRIUM, CEA, CS Systèmes d'Information, DAIMLER, EADS Innovation Works, Ecole Normale Supérieure, Esterel Technologies, Fraunhofer FIRST, Institut für Bahntechnik IFB, IRIT, ONERA, Saarland University, Siemens VDO Technical University of Madrid, Technical University of Munich, THALES Avionics, THALES.
- [4] MBAT: Combined Model-based Analysis and Testing of Embedded Systems – ARTEMIS programme – Advanced Research & Technology for EMbedded Intelligence and Systems, (2011–2014)
AIRBUS, DAIMLER AG, AIT Austrian Institute of Tech., Aalborg Univ., ABSINT GmbH, Alenia Sia Spa, Advanced Lab. on Embedded Syst., ALSTHOM Transport, AVL List GmbH, BTC Embedded Systems AG, CEA, EADS UK & Deutschland, École Normale Supérieure, Elvior, Enea Services Stockholm AB, FRAUNHOFER, Geensoft, Infineon Tech. Austria AG, IBM SVENSKA AB, MBtech Group GmbH & Co. KGaA, OFFIS E.V, PikeTec GmbH, Prover Technology AB, Ricardo UK Ltd, Rockwell Collins France, Selex Sistemi Integrati, Siemens AG, THALES, Technische Univ. Gratz, Tech. Univ. München, Verified Systems International GmbH, Kompetenzzentrum - Das virtuelle Fahrzeug Forschungsgesellschaft mbH, VOLVO Technolgy AB.

ROYAL SOCIETY RESEARCH GRANT

- [5] Abstract Interpretation and Code Obfuscation. – Royal Society Grant, (2010–2012)
Imperial College.

RECENT PUBLIC RESEARCH GRANTS

- [6] TUAMOTU: Tatouage électronique sémantique de code mobile Java – Réseau National de la Recherche en Télécommunications programme, RNRT, (1999–2001)
École Normale Supérieure, École polytechnique and THALES Communications.
- [7] Analyse de circuits – CEA grant, (2001–2003)
École polytechnique.
- [8] APRON: Domaines abstraits numériques – ACI Sécurité Informatique, (2004–2007)
Armines, École Normale Supérieure, École polytechnique, IRISA, Verimag.
- [9] ASTRÉE: Analyse statique de logiciels Temps-RÉel Embarqués – Réseau National de la Recherche en Technologies Logicielles programme, (2002–2006)
AIRBUS, École Normale Supérieure, École polytechnique.
- [10] CONTROVERT: Vérification de systèmes de contrôle – ANR Sécurité, Systèmes embarqués et Intelligence ambiante, (2006–2009)
CNRS, École Normale Supérieure, Univ. Paul Sabatier de Toulouse.
- [11] THÉSÉE: Analyse statique de logiciels asynchrones de contrôle-commande – Réseau National de la Recherche en Technologies Logicielles programme of the ANR, (2005–2009)
AIRBUS, CNRS, École Normale Supérieure.
- [12] ASTRÉE: Static Analysis of Embedded Asynchronous Real-Time Software – ANR Grant, Programme Ingénierie Numérique et Sécurité, (2012–2015)
Airbus, École Normale Supérieure.

RECENT INDUSTRIAL & FOUNDATIONS RESEARCH GRANTS

- [13] Méthodes d'interprétation abstraite pour vérifier des logiciels avioniques par approximation de leurs propriétés temporelles – AIRBUS Grant, (2002–2004)
École polytechnique.
- [14] ASBAPROD: Assurance Basée Produit – AIRBUS Grant, (2006–2009)
École Normale Supérieure.
- [15] ANASTASY: Analyse statique et dynamique – AIRBUS Grant, (2010–2014)
École Normale Supérieure.
- [16] SURVOL: Autonomie des systèmes aéronautiques et spatiaux – FNRAE (Fondation de Recherche pour l'Aéronautique et l'Espace) Grant, (2008–2010)
École Normale Supérieure, Univ. Paul Sabatier de Toulouse.
- [17] SARDANES: Sémantique, analyse et transformation des applications numériques embarquées synchrones – FNRAE (Fondation de Recherche pour l'Aéronautique et l'Espace) Grant, (2009–2012)
École Normale Supérieure, Univ. de Perpignan.
- [18] ASCERT: Analyses statiques certifiées – FNRAE (Fondation de Recherche pour l'Aéronautique et l'Espace) Grant, (2009–2012)
École Normale Supérieure, INRIA Rennes.

SOFTWARE

RECENT SOFTWARE

- [19] P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné, D. Monniaux and X. Rival. – The ASTRÉE⁶, Static Analyzer. – November 2001 – December 2010. <http://www.astree.ens.fr/>.
- [20] P. Cousot, R. Cousot and A. Miné. – ASTRÉE: Extension of ASTRÉE for Static Analysis of Asynchronous Control/command Software. (July 2006 – in progress).
- [21] P. Cousot and R. Cousot. – ARRAYAL: an abstract domain library functor for array content static analysis by parametric segmentation, September 2009. It was included by F. Logozzo in MSR CLOUSOT (a language agnostic abstract interpretation-based static contract analyzer and checker for .NET, as part of *Visual Studio Ultimate*).

SOFTWARE REFERENCE MANUALS

- [22] B. Blanchet, P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné, D. Monniaux and X. Rival. – *Mode d'emploi de l'analyseur ASTRÉE*. – Paris, France, 2004, revised 2006, 2007, 2008, 2009.
- [23] P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné, X. Rival and E.-J. Sims. – *Mode d'emploi et manuel de référence de l'analyseur ASTRÉE*. – Paris, France, 2008.

OPERATING LICENSE

- [24] B. Blanchet, P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné, D. Monniaux and X. Rival. – The ASTRÉE Static Analyzer. – Licence CNRS–ENS d'exploitation / ABSINT ANGEWANDTE INFORMATIK – 2008.

SELECTED PUBLICATIONS

REFEREED JOURNAL PUBLICATIONS

- [25] P. Cousot and R. Cousot. – Constructive versions of Tarski's fixed point theorems. *Pacific Journal of Mathematics*, Vol. 82, n° 1, 1979, pp. 43–57.
- [26] P. Cousot and R. Cousot. – A constructive characterization of the lattices of all retractions, pre-closure, quasi-closure and closure operators on a complete lattice. *Portugalica Mathematica*, Vol. 38, n° 2, 1979, pp. 185–198.

⁶Le Monde : April 27, 2005 (1st flight of the Airbus-380), *L'avion qui "bat des ailes" a fédéré de nombreux chercheurs*.

- [27] P. Cousot and R. Cousot. – Sometime = Always + Recursion \equiv Always: on the equivalence of the intermittent and invariant assertions methods for proving inevitability properties of programs. *Acta Informatica*, Vol. 24, 1987, pp. 1–31.
- [28] P. Cousot and R. Cousot. – A language independent proof of the soundness and completeness of generalized Hoare logic. *Information and Computation*, Vol. 80, n° 2, 1989, pp. 165–191.
- [29] P. Cousot and R. Cousot. – Abstract Interpretation and Application to Logic Programs. *Journal of Logic Programming*, Vol. 13, n° 2–3, 1992, pp. 103–179. – (The editor of Journal of Logic Programming has mistakenly published the unreadable galley proof. For a correct version of this paper, see <http://www.di.ens.fr/~rcousot>.)
- [30] P. Cousot and R. Cousot. – Abstract Interpretation Frameworks. *Journal of Logic and Computation*, Vol. 2, n° 4, August 1992, pp. 511–547.
- [31] P. Cousot and R. Cousot. – “À la Burstall” intermittent assertions induction principles for proving inevitability properties of programs. *Theoretical Computer Science*, Vol. 120, 1993, pp. 123–155.
- [32] P. Cousot and R. Cousot. – Refining Model Checking by Abstract Interpretation. *Automated Software Engineering*, Vol. 6, 1999, pp. 69–95.
- [33] P. Cousot and R. Cousot. – Parsing as Abstract Interpretation of Grammar Semantics. *Theoretical Computer Science*, Vol. 290, n° 1, January 2003, pp. 531–544.
- [34] P. Cousot and R. Cousot. – Bi-inductive structural semantics. *Information and Computation*, Vol. 207, n°2, pp. 258–283, February 2009.
- [35] P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné and X. Rival. – Why Astrée does scale up? *Formal methods in systems design journal*. Special issue on numerical abstractions for software verification, Vol. 35, n°3, December, 2009, pp. 229-264.
- [36] P. Cousot, R. Cousot and R. Giacobazzi. – Abstract interpretation of resolution-based semantics. *Theoretical Computer Science*, Vol. 410, n°46, 2009, pp. 4724–4746.
- [37] J. Bertrane, P. Cousot, J. Feret, L. Mauborgne, A. Miné, and X. Rival. Static analysis by abstract interpretation of embedded critical software. *ACM SIGSOFT Software Engineering Notes*, Vol. 36, n°1, January 2011, pp. 1–8.
- [38] J. Bertrane, P. Cousot, J. Feret, L. Mauborgne, A. Miné, and X. Rival. Static Analysis and Verification of Aerospace Software by Abstract Interpretation. *AIAA Journal of Aerospace, Computing, Information, and Communication* Special Issue Invitation.
- [39] P. Cousot and R. Cousot. – Grammar semantics, analysis, and parsing by abstract interpretation. *Theoretical Computer Science*, Vol. 412, n°44, October 2011, pp. 6135-6192.

INVITED BOOK CHAPTERS

- [40] P. Cousot and R. Cousot. – Induction principles for proving invariance properties of programs. *In : Tools & Notions for Program Construction*, edited by D. Néel, pp. 43–119. – Cambridge University Press, 1982.
- [41] P. Cousot and R. Cousot. – Invariance Proof Methods and Analysis Techniques For Parallel Programs. *In : Automatic Program Construction Techniques*, edited by A. Biermann, G. Guiho and Y. Kodratoff, Chapter 12, pp. 243–271. – Macmillan, 1984.
- [42] P. Cousot and R. Cousot. – ‘À la Floyd’ induction principles for proving inevitability properties of programs. *In : Algebraic Methods in Semantics*, edited by M. Nivat and J. Reynolds, Chapter 8, pp. 277–312. – Cambridge University Press, 1985.
- [43] B. Blanchet, P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné, D. Monniaux and X. Rival. – Design and Implementation of a Special-Purpose Static Program Analyzer for Safety-Critical Real-Time Embedded Software. *In : The Essence of Computation: Complexity, Analysis, Transformation. Essays Dedicated to Neil D. Jones*, edited by T. Mogensen, D. Schmidt and I. Sudborough, pp. 85–108. – LNCS 2566, Springer, 2002.
- [44] P. Cousot and R. Cousot. – Basic Concepts of Abstract Interpretation. *In : Building the Information Society*, edited by P. Jacquart, Chapter 4, pp. 359–366. – Kluwer Academic Publishers, 2004.
- [45] P. Cousot and R. Cousot. – Grammar Analysis and Parsing by Abstract Interpretation. *In : Program Analysis and Compilation, Theory and Practice: Essays dedicated to Reinhard Wilhelm*, edited by T. Reps, M. Sagiv and J. Bauer, pp. 178–203. – LNCS 4444, Springer, 2006.

- [46] R. Cousot and M. Martel. – Static Analysis Symposium 2010. Lecture Notes in Computer Science – Advanced Research in Computing and Software Science 6337, Springer, 2010.
- [47] P. Cousot, R. Cousot and L. Mauborgne. – A Scalable Segmented Decision Tree Abstract Domain. *In : Time for Verification, Essays in Memory of Amir Pnueli*, edited by Z. Manna and D. Peled, pp. 72–95. – LNCS 6200, Springer, 2010.
- [48] P. Cousot and R. Cousot. – A Scalable Introduction to Formal Verification of Computer Systems by Abstract Interpretation. *In : Logics and Languages for Reliability and Security*, edited by J. Esparza, B. Spanfelner and O. Grumberg, pp. 1–29. – NATO Science for Peace and Security Series D: Information and Communication Security, Volume 25. IOS Press, 2010.
- [49] P. Cousot, R. Cousot and L. Mauborgne. – Logical Abstract Domains and Interpretations. *In : The Future of Software Engineering*, edited by S. Nanz, pp. 48–71. – Springer, 2011.

INVITED BOOK CHAPTERS (IN FRENCH)

- [50] P. Cousot and R. Cousot. – Principe des Méthodes de Preuve de Propriétés d’Invariance et de Fatalité des Programmes Parallèles. *In : Parallélisme, Communication et Synchronisation*, edited by J.-P. Verjus and G. Roucairol, pp. 129–149. – Éditions du CNRS, 1985.
- [51] J. Bertrane, P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné and X. Rival. – L’analyseur statique Astrée. *In : Utilisations industrielles des techniques formelles : interprétation abstraite*, edited by J.-L. Boulanger, Collection IC2, Éditions Hermès - Lavoisier, 2011.

REFEREED CONFERENCE OR WORKSHOP PROCEEDINGS PUBLICATIONS

- [52] P. Cousot and R. Cousot. – Static determination of dynamic properties of programs. *In : Proc. of the 2nd Int. Symp. on Programming*, Paris, France, 1976. pp. 106–130. – Dunod.
- [53] P. Cousot and R. Cousot. – Abstract interpretation: a unified lattice model for static analysis of programs by construction or approximation of fixpoints. *In : Conf. Record of the 4th Annual ACM SIGACT- SIGPLAN Symp. on Principles of Programming Languages (POPL)*, Los Angeles, 1977. pp. 238–252. – ACM Press.
- [54] P. Cousot and R. Cousot. – Automatic synthesis of optimal invariant assertions: mathematical foundations. *In : ACM Symposium on Artificial Intelligence & Programming Languages*, Rochester, NY, USA, ACM SIGPLAN Notices 12(8):1–12, 1977. – ACM Press.
- [55] P. Cousot and R. Cousot. – Static determination of dynamic properties of generalized type unions. *In : ACM Symposium on Language Design for Reliable Software*, Raleigh, North Carolina, ACM SIGPLAN Notices 12(3):77–94, 1977.
- [56] P. Cousot and R. Cousot. – Static determination of dynamic properties of recursive procedures. *In : IFIP Conf. on Formal Description of Programming Concepts, St-Andrews, N.B., Canada*, edited by E. Neuhold. pp. 237–277. – North-Holland Pub. Co., 1977.
- [57] P. Cousot and R. Cousot. – Systematic design of program analysis frameworks. *In : Conf. Record of the 6th Annual ACM SIGACT- SIGPLAN Symp. on Principles of Programming Languages (POPL)*, San Antonio, Texas, 1979. pp. 269–282. – ACM Press.
- [58] P. Cousot and R. Cousot. – Semantic analysis of communicating sequential processes. *In : 7th Int. Colloquium on Automata, Languages and Programming*, edited by J. de Bakker and J. van Leeuwen. LNCS 85, pp. 119–133. – Springer, July 1980.
- [59] P. Cousot and R. Cousot. – Inductive Definitions, Semantics and Abstract Interpretation. *In : Conf. Record of the 19th Annual ACM SIGACT- SIGPLAN Symp. on Principles of Programming Languages (POPL)*, Albuquerque, New Mexico, USA, 1992. pp. 83–94. – ACM Press.
- [60] P. Cousot and R. Cousot. – Galois Connection Based Abstract Interpretations for Strictness Analysis. *In : Proc. of the Int. Conf. on Formal Methods in Programming and their Applications*, edited by D. Bjørner, M. Broy and I. Pottosin. Akademgorodok, Novosibirsk, Russia, LNCS 735, pp. 98–127. – Springer, 28 June – 2 July 1993.
- [61] P. Cousot and R. Cousot. – Formal Language, Grammar and Set-Constraint-Based Program Analysis by Abstract Interpretation. *In : Proc. of the 7th ACM Conf. on Functional Programming Languages and Computer Architecture*, La Jolla, CA, USA, 25–28 June 1995. pp. 170–181. – ACM Press.

- [62] P. Cousot and R. Cousot. – Abstract Interpretation of Algebraic Polynomial Systems. *In : Proc. of the 6th Int. Conf. on Algebraic Methodology and Software Technology, AMAST '97*, edited by M. Johnson. Sydney, Australia, LNCS 1349, pp. 138–154. – Springer, 13–18 December 1997.
- [63] P. Cousot and R. Cousot. – Parallel Combination of Abstract Interpretation and Model-Based Automatic Analysis of Software. *In : Proc. of the 1st ACM SIGPLAN Workshop on Automatic Analysis of Software, AAS '97*, edited by R. Cleaveland and D. Jackson, Paris, France, January 1997. pp. 91–98. – ACM Press.
- [64] P. Cousot and R. Cousot. – Temporal Abstract Interpretation. *In : Conf. Record of the 27th Annual ACM SIGACT- SIGPLAN Symp. on Principles of Programming Languages (POPL)*, Boston, USA, January 2000. pp. 12–25. – ACM Press.
- [65] P. Cousot and R. Cousot. – A Case Study in Abstract Interpretation Based Program Transformation: Blocking Command Elimination. *In : 17th Int. Conf. on Mathematical Foundations of Programming Semantics, MFCS, Århus, Denmark, 23–26 May 2001, Electronic Notes in Theoretical Computer Science*, edited by S. Brookes and M. Mislove. Volume 45. – Elsevier, 2001.
- [66] P. Cousot and R. Cousot. – Systematic Design of Program Transformation Frameworks by Abstract Interpretation. *In : Conf. Record of the 29th Annual ACM SIGACT- SIGPLAN Symp. on Principles of Programming Languages (POPL)*, Portland, Oregon, USA, January 2002. pp. 178–190. – ACM Press.
- [67] B. Blanchet, P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné, D. Monniaux and X. Rival. – A Static Analyzer for Large Safety-Critical Software. *In : Proc. of the ACM SIGPLAN '2003 Conf. on Programming Language Design and Implementation (PLDI)*, San Diego, CA, USA, 7–14 June 2003. pp. 196–207. – ACM Press.
- [68] P. Cousot and R. Cousot. – An Abstract Interpretation-Based Framework for Software Watermarking. *In : Conf. Record of the 31st Annual ACM SIGACT- SIGPLAN Symp. on Principles of Programming Languages (POPL)*, Venice, Italy, 14–16 January 2004. pp. 173–185. – ACM Press.
- [69] P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné, D. Monniaux and X. Rival. – The ASTRÉE analyser. *In : Proc. of the 14th European Symp. on Prog. Languages and Systems, (ESOP 2005), Edinburg, Scotland*, edited by M. Sagiv, pp. 21–30. – Springer, 2–10 April 2005, LNCS, Vol. 3444.
- [70] P. Cousot and R. Cousot. – Bi-inductive Structural Semantics. *In : Structural Operational Semantics, SOS' 07*, edited by R. van Glabbeek and M. Hennessy. – July 9, 2007, Wroclaw, Poland, Elsevier, 24 October 2007, *Electronic Notes in Theoretical Computer Science*, Vol. 191, n° 1.
- [71] P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné, D. Monniaux and X. Rival. – Combination of Abstractions in the ASTRÉE Static Analyzer. *In : 11th Annual Asian Computing Science Conf., ASIAN '06*, edited by M. Okada and I. Satoh, Tokyo, 6–8 December 2006, 2008. pp. 272–300. – LNCS 4435, Springer.
- [72] O. Bouissou, E. Conquet, P. Cousot, R. Cousot, J. Feret, E. Goubault, K. Ghorbal, D. Lesens, L. Mauborgne, A. Miné, S. Putot, X. Rival and M. Turin. – Space Software Validation Using Abstract Interpretation. *In : The International Space System Engineering Conference, Data Systems In Aerospace (DASIA 2009)*, E. publications, Istanbul, Turkey, 26–29 May 2009.
- [73] D. Kästner, S. Wilhelm, S. Nenova, P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné and X. Rival. – ASTRÉE: Proving the Absence of Runtime Errors. *In : Embedded Real Time Software and Systems (ERTS2 2010)*, Toulouse, France, 19–21 May 2010.
- [74] P. Cousot, R. Cousot and F. Logozzo. – Precondition Inference from Intermittent Assertions and Application to Contracts on Collections. *In : Proc. of the 9th Int. Conf. on Verification, Model Checking and Abstract Interpretation (VMCAI 2011)*, edited by R. Jhala and D. Schmidt, Austin, Texas, 23–25 January 2011. – LNCS 6538 Springer.
- [75] P. Cousot, R. Cousot and F. Logozzo. – A Parametric Segmentation Functor for Fully Automatic and Scalable Array Content Analysis. *In : Conf. Record of the 38th Annual ACM SIGACT- SIGPLAN Symp. on Principles of Programming Languages (POPL)*, Austin, Texas, 26–28 January 2011. – ACM Press.
- [76] P. Cousot, R. Cousot and L. Mauborgne. – The Reduced Product of Abstract Domains and the Combination of Decision Procedures. *In : Proc. of the 14th on Foundations of Software Sciences and Computation Structures, (FoSSaCS 2011)*, edited by M. Hofmann, Saarbrücken, Germany, March 26–April 3, 2011. – LNCS 6604, Springer.

- [77] P. Cousot and R. Cousot. – A, Abstract Interpretation Framework for Termination. *In : Conf. Record of the 39th Annual ACM SIGACT- SIGPLAN Symp. on Principles of Programming Languages (POPL)*, Philadelphia, PA, 25–27 January 2012. – ACM Press.

INVITED CONFERENCE OR WORKSHOP PROCEEDINGS PUBLICATIONS

- [78] P. Cousot and R. Cousot. – Comparison of the Galois connection and widening/narrowing approaches to abstract interpretation. *In : Actes JTASPEFL '91, Bordeaux, France. BIGRE*, edited by M. Billaud, P. Castéran, M.-M. Corsini, K. Musumbu and A. Rauzy. Volume 74, pp. 107–110. – IRISA, Rennes, France, October 1991.
- [79] P. Cousot and R. Cousot. – Relational abstract interpretation of higher-order functional programs. *In : Actes JTASPEFL '91, Bordeaux, France. BIGRE*, edited by M. Billaud, P. Castéran, M.-M. Corsini, K. Musumbu and A. Rauzy. Volume 74, pp. 33–36. – IRISA, Rennes, France, October 1991.
- [80] P. Cousot and R. Cousot. – Comparing the Galois Connection and Widening/Narrowing Approaches to Abstract Interpretation. *In : Proc. of the 4th Int. Symp. on Programming Language Implementation and Logic Programming, PLILP '92*, edited by M. Bruynooghe and M. Wirsing. Leuven, Belgium, 26–28 August 1992, LNCS 631, pp. 269–295. – Springer, 1992.
- [81] P. Cousot and R. Cousot. – *Abstract interpretation of functional languages*. *In : Atlantique Workshop on Semantics Based Program Manipulation*, edited by N. Jones and C. Talcott, DIKU Publication. Portland, Oregon 1992, 19–21 January 1994.
- [82] P. Cousot and R. Cousot. – Higher-Order Abstract Interpretation (and Application to Comportment Analysis Generalizing Strictness, Termination, Projection and PER Analysis of Functional Languages). *In : Proc. of the 1994 Int. Conf. on Computer Languages*, Toulouse, France, 16–19 May 1994. pp. 95–112. – IEEE Press.
- [83] P. Cousot and R. Cousot. – Compositional and Inductive Semantic Definitions in Fixpoint, Equational, Constraint, Closure-condition, Rule-based and Game-Theoretic Form. *In : Proc. of the 7th Int. Conf. on Computer Aided Verification, CAV '95*, edited by P. Wolper. Liège, Belgium, LNCS 939, pp. 293–308. – Springer, 3–5 July 1995.
- [84] P. Cousot and R. Cousot. – Abstract Interpretation Based Program Testing. *In : Proc. of the SSGRR 2000 Computer & eBusiness International Conference*, Compact Disk Paper 248 and Electronic Proceedings, <http://www.ssgrr.it/en/ssgrr2000/proceedings.htm>, l'Aquila, Italy, 31 July – 6 August 2000. – Scuola Superiore G. Reiss Romoli.
- [85] P. Cousot and R. Cousot. – Compositional Separate Modular Static Analysis of Programs by Abstract Interpretation. *In : Proc. of the 2nd Int. Conf. on Advances in Infrastructure for E-Business, E-Science and E-Education on the Internet*, SSGRR 2001 Compact Disk, l'Aquila, Italy, 6–12 August 2001. – Scuola Superiore G. Reiss Romoli.
- [86] P. Cousot and R. Cousot. – Static Analysis of Embedded Software: Problems and Perspectives. *In : Proc. of the 1st Int. Workshop on Embedded Software, EMSOFT '2001*, edited by T. Henzinger and C. Kirsch. LNCS, Vol. 2211, pp. 97–113. – Springer, 2001.
- [87] P. Cousot and R. Cousot. – Modular Static Program Analysis. *In : Proc. of the 11th Int. Conf. on Compiler Construction, CC '2002*, edited by R. Horspool, Grenoble, France, 6–14 April 2002. pp. 159–178. – LNCS 2304, Springer.
- [88] P. Cousot and R. Cousot. – On Abstraction in Software Verification. *In : Proc. of the 14th Int. Conf. on Computer Aided Verification, CAV '2002*, edited by E. Brinksma and K. Larsen. Copenhagen, Denmark, LNCS 2404, pp. 37–56. – Springer, 27–31 July 2002.
- [89] P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné, D. Monniaux and X. Rival. – Varieties of Static Analyzers: A Comparison with ASTRÉE. *In : Proc. of the 1st IEEE & IFIP Int. Symp. on Theoretical Aspects of Software Engineering, TASE '07*, edited by M. Hinchey, H. Jifeng and J. Sanders, Shanghai, China, 6–8 June 2007. pp. 3–17. – IEEE Press.
- [90] R. Cousot. – Abstract interpretation of non-monotone bi-inductive semantic definitions. *In : Proc. of the 9th Int. Conf. Int. Conf. on Verification, Model Checking and Abstract Interpretation (VMCAI 2008)*, edited by F. Logozzo, D. Peled and L. Zuck. San Francisco, CA, USA, LNCS 4905 – Springer, January 2008.

- [91] J. Bertrane, P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné, and X. Rival. – Static Analysis by Abstract Interpretation of Embedded Critical Software. *In : Third IEEE International workshop UML and Formal Methods*, Shanghai, China, 16 November 2010. IEEE Press.
- [92] J. Bertrane, P. Cousot, R. Cousot, J. Feret, L. Mauborgne, A. Miné, and X. Rival. – Static Analysis and Verification of Aerospace Software by Abstract Interpretation. *In : AIAA Infotech@Aerospace 2010*, AIAA Paper 2010-3385, American Institute of Aeronautics and Astronautics, Atlanta, GA, 20–22 April 2010.

ES SCIENCES THESIS

- [93] R. Cousot. – *Fondements des méthodes de preuve d'invariance et de fatalité de programmes parallèles*. – Thèse d'État ès sciences mathématiques, Institut national polytechnique de Lorraine, Nancy, France, 15 November 1985.

RESEARCH REPORTS

- [94] P. Cousot and R. Cousot. – *Static Verification of Dynamic Type Properties of Variables*. – Research report n° R.R. 25, Grenoble, France, Laboratoire IMAG, Université scientifique et médicale de Grenoble, November 1975. 18 p.
- [95] P. Cousot and R. Cousot. – *Vérification statique de la cohérence dynamique des programmes*. – Rapport du contrat IRIA SESORI n° 75-035, Grenoble, France, Laboratoire IMAG, Université scientifique et médicale de Grenoble, September 1975. 125 p.
- [96] P. Cousot and R. Cousot. – *Fixed Point Approach to the Approximate Semantic Analysis of Programs*. – June 1977. Unpublished manuscript, Laboratoire IMAG, Université scientifique et médicale de Grenoble, Grenoble, France, 48 p.
- [97] P. Cousot and R. Cousot. – *Constructive versions of Tarski's fixed point theorems*. – Research report n° R.R. 85, Grenoble, France, Laboratoire IMAG, Université scientifique et médicale de Grenoble, September 1977. 15 p.
- [98] P. Cousot and R. Cousot. – *Towards a Universal Model for Static Analysis of Programs*. – January 1977. Unpublished manuscript, Laboratoire IMAG, Université scientifique et médicale de Grenoble, Grenoble, France, 90 p.
- [99] P. Cousot and R. Cousot. – *A constructive characterization of the lattices of all retractions, pre-closure, quasi-closure, and closure operators on a complete lattice*. – Research report n° R.R. 128, Grenoble, France, Laboratoire IMAG, Université scientifique et médicale de Grenoble, July 1978. 15 p.
- [100] P. Cousot and R. Cousot. – *Reasoning about program invariance proof methods*. – Research report n° CRIN-80-P050, Centre de Recherche en Informatique, Université Henri Poincaré, Nancy, July 1980.
- [101] R. Cousot. – *Proving invariance properties of parallel programs by backward induction*. – Research report n° CRIN-81-P026, Centre de Recherche en Informatique, Université Henri Poincaré, Nancy, 1981.
- [102] P. Cousot and R. Cousot. – *Invariance proof methods and analysis techniques for parallel programs*. – Research report n° LRIM-82-01, Laboratoire de Recherche en Informatique, Université Paul Verlaine, Metz, December 1981.
- [103] P. Cousot and R. Cousot. – *"À la Floyd" induction principles for proving inevitability properties of programs*. – Research report n° CRIN-82-P082, Centre de Recherche en Informatique, Université Henri Poincaré, Nancy, June 1982.
- [104] P. Cousot and R. Cousot. – *On the soundness and completeness of generalized Hoare logic*. – Research report n° CRIN-82-P093, Centre de Recherche en Informatique, Université Henri Poincaré, Nancy, December 1982.
- [105] P. Cousot and R. Cousot. – *Sometimes = Always + Recursion = Always : On the equivalence of the intermittent and invariant assertions methods for proving inevitability properties of programs*. – Research report n° LRIM-83-03, Laboratoire de Recherche en Informatique, Université Paul Verlaine, Metz, July 1983.
- [106] P. Cousot and R. Cousot. – *Abstract Interpretation Frameworks*. – Research report n° LIX/RR/91/03 revised in n° LIX/RR/92/10, École polytechnique, Palaiseau, France, Laboratoire d'Informatique, February 1991.

- [107] P. Cousot and R. Cousot. – *Abstract Interpretation and Application to Logic Programs*. – Research report n° LIENS-92-12, École normale supérieure, Paris, France, Laboratoire d’Informatique, June 1992.
- [108] P. Cousot and R. Cousot. – *Comparing the Galois connection and widening/narrowing approaches to abstract interpretation*. – Research report n° LIX/RR/92/09, École polytechnique, Palaiseau, France, Laboratoire d’Informatique, June 1992.
- [109] P. Cousot and R. Cousot. – *Forward and Backward Strictness Analysis by Abstract Interpretation of a Relational Semantics*. – Research report n° LIX/RR/94/05, École polytechnique, Palaiseau, France, Laboratoire d’Informatique, February 1994.
- [110] P. Cousot and R. Cousot. – *Compositional and Inductive Semantical Definitions in Fixpoint, Equational, Constraint, Closure-condition, Rule-based and Game-Theoretic Form*. – Research report n° LIX/RR/95/03, École polytechnique, Palaiseau, France, Laboratoire d’Informatique, January 1995.
- [111] P. Cousot and R. Cousot. – *Formal Language, Grammar and Set-Constraint-Based Program Analysis by Abstract Interpretation*. – Research report n° LIX/RR/95/02, École polytechnique, Palaiseau, France, Laboratoire d’Informatique, January 1995.
- [112] P. Cousot and R. Cousot. – *Grammar analysis by abstract interpretation*. – Research report n° LIX/RR/98/02, École polytechnique, Palaiseau, France, Laboratoire d’Informatique, 1998.

MISCELLANEA

- [113] R. Cousot. – *Ordonnancement des contraintes pour minimiser les dégénérescences en programmation linéaire en nombres entiers*. – Projet de fin d’études d’Ingénieur, ENPA, June 1971.
- [114] R. Cousot. – *Analyse syntaxique d’Algol 68 par la méthode de précédence totale*. – Rapport de DEA Informatique, Université scientifique et médicale de Grenoble, September 1972.

JOURNAL SPECIAL ISSUE & CONFERENCE PROCEEDINGS EDITION

- [115] P. Cousot, R. Cousot and A. Mycroft. – *Report on Dagstuhl Seminar 9535 on Abstract interpretation*. – Schloß Dagstuhl – Leibniz Center for Informatics, Wadern, Germany, 1995.
- [116] R. Cousot and D.A. Schmidt. – *Static Analysis*. – SAS’96, Lecture Notes in Computer Science 1145. Springer-Verlag, 1996.
- [117] R. Cousot and D. Schmidt. – *Special issue on static analysis*. – *Science of Computer Programming Journal*, 35(2-3), Elsevier, 1999.
- [118] R. Cousot. – *Static Analysis*. – SAS’03, Lecture Notes in Computer Science 2694. Springer, 2003.
- [119] R. Cousot. – *Special issue on Static analysis*. – *Science of Computer Programming Journal*, vol. 58, nbs. 1-2, Elsevier, 2005.
- [120] R. Cousot. – *Verification, Model Checking and Abstract Interpretation*. – VMCAI’05, Lecture Notes in Computer Science 3385. Springer, 2005.
- [121] R. Cousot and M. Martel. – *Static Analysis*. – SAS’10, Lecture Notes in Computer Science 6337. Springer, 2010.

TEACHING

BOOKS

- [122] L. Cousot, P. Cousot, R. Cousot and T. Cousot. – *Premières leçons de programmation en Turbo Pascal* (in french). – McGraw-Hill, Paris, France, 1991. 297 p.

RECENT COURSE NOTES

- [123] P. Cousot and R. Cousot. – *Fondements des méthodes de preuve*. – Magistère de mathématiques fondamentales et appliquées et d’informatique. École Normale Supérieure, Paris, 1987–1989.
- [124] P. Cousot and R. Cousot. – *Analyse statique par interprétation abstraite*. – DEA informatique, mathématiques et applications. École Normale Supérieure, École Polytechnique and Universities Paris 6, 7 and 11, 1989–1995.

- [125] P. Cousot and R. Cousot. – Vérification par interprétation abstraite. – DEA Programmation: sémantique, preuve, langages. École Normale Supérieure, École Polytechnique, École Normale Supérieure de Cachan and Universities Paris 6, 7 and 11, 1997–2003.
- [126] P. Cousot and R. Cousot. – *Interprétation abstraite : application à la vérification et à l'analyse statique* (in french). – Master Parisien De Recherche En Informatique (MPRI), Paris, France, M2–2.6, since 2004.