

CURRICULUM VITÆ

ROBERTO GIACOBazzi
Professor in Computer Science

General information

Address:

Dipartimento di Informatica, Università degli Studi di Verona (University of Verona),
Strada Le Grazie 15, Ca' Vignal 2, 37134 Verona (Italy)
Phone: (+39) 045 809 7995
Mobile: (+39) 340 789 0128
Fax: (+39) 045 809 7928
E-mail: roberto.giacobazzi@univr.it (professional) and rgiacobazzi@gmail.com (personal)
Web: <http://profs.sci.univr.it/~giaco/>

Birthday and birthplace: November 6, 1964; Modena (Italy).

Citizenship: Italian.

Known foreign languages: English and French.

Diplomas:

- PhD in Computer Science, University of Pisa (1993);
- Master (*Laurea*) degree in Computer Science, University of Pisa (1988);
- Scientific Lyceum (*Maturità Scientifica*) Diploma (1983).

Past and current positions:

(2000–) Full Professor in Computer Science at the Dipartimento di Informatica, University of Verona;
(1998–2000) Associate Professor in Computer Science at the Dipartimento Scientifico e Tecnologico,
University of Verona;
(1995–98) Assistant Professor in Computer Science at the Dipartimento di Informatica, University of
Pisa;
(1993–95) Post-doc at the Laboratoire d'Informatique (LIX), École Polytechnique, Paris (France).

Main research interests:

- Abstract interpretation and static program analysis;
- Program and system verification and (abstract) model checking;
- Program transformation and optimization;
- Language-based security and malware detection;
- Code protection: obfuscation, software watermarking, and fingerprinting;
- Semantics and foundation of programming languages and systems;
- Logic and constraint programming;
- Universal algebra, lattice theory, congruence lattices, and closure operators.

Curriculum vitae

(2009–2012) He was member of the restricted board of Deans of the Italian Colleges of Science and Technology, and responsible for the coordination of the nation-wide admission for undergraduate students to the majors in Science and Technology.

(2006–2012) In 2006 he has been elected Dean (Preside) of the College of Science of the University of Verona. The College of (Mathematical, Physical, and Natural) Sciences in Verona has now 98 tenure faculty members (31 full professors, 16 associate professors and 51 tenured assistant professors) and 35 administrative and technical staff, with a growth of 42% in the last 4 years. It is composed of two main departments: the Department of Computer Science, with 51 tenure faculty members, and the Department of Biotechnology, with 46 tenure faculty members. The College of Science hosts undergraduate majors in: Computer Science, Biotechnology, Wine and Grape Technology, Bioinformatics, and Applied Mathematics; master programs in Computer Science and Engineering, Agro-food Biotechnology, Bioinformatics and Medical Biotechnology, and Mathematics, and Ph.D. programs in: Computer Science and Biotechnology; with 1466 undergraduate students, 174 master-level students, and 60 graduate students. The College of Science of Verona has been ranked first in term of quality of education and research in 2006 and 2009, and ranked second in 2007, 2008 and 2010, among the Italian Colleges of Science and Technology, by the CENSIS Foundation (Centro Studi Investimenti Sociali), established in Rome in 1964.

He conferred in June 29, 2007 the *Laurea Honoris Causa* in Biotechnology to Prof. Kurt Wüthrich (ETH), Nobel Prize in Chemistry in 2002 and in May 20, 2009 the *Laurea Honoris Causa* in Computer Science to Dr. Federico Faggin, for his outstanding contribution to the development of modern computers.

(2005–2006) He has been member of the *Nucleo di Valutazione* of the University of Verona (Academic Evaluation Committee for Education and Research of the University of Verona).

(2004–2006) In November 2004 he has been elected for the second time as representative of the full professors of the College of Science in the Academic Senate. He has been in charge of a position equivalent to Provost for Research of the Academic Senate of the University of Verona. He developed a budget distribution model for the allocation of assistant-level tenure-track positions to the 23 departments of the University of Verona. He introduced the JOINT-PROJECT framework, devoted to co-funding joint academic/industrial research, involving the University of Verona and SMEs, with annual budget of 1M€. He promoted the reorganization of the Graduate Schools at the University of Verona, reorganizing the PhD curricula in all disciplines in the areas of Science, Humanities, Economics, Law, and Medicine.

(2004) From June 28 to November 01, 2004 he has been appointed to coordinate and control the administrative activities of the University of Verona, playing a temporary role of vice-rector of the University.

(2001–2003) He has been elected as representative of the full professors of the College of Science in the Academic Senate of the University of Verona. During the same time, he has been elected by the Senate to a position equivalent to Provost for Education, including e-learning, of the Academic Senate of the University of Verona. He has been in charge of coordinating the carrying out the *Bologna Process* for all the undergraduate and master-level degrees of the University of Verona. In 2002 he developed the very first budget distribution model for allocating faculty tenure positions (assistant, associate, and full level professorships) to all Colleges. The total budget distributed in this period was 5M€ in 2 years. He introduced the TANDEM Project, promoting and coordinating common introductory courses for careers guidance purposes between High Schools and the University of Verona.

(2000–2003) He has been Chair of the Education Committee for Computer Science at the University of Verona. Under his direction, he was responsible of the reform of the undergraduate and master-level curricula in Computer Science according to the directions of the *Sorbonne Joint Declaration for Higher Education* on the constitution of the *EU Higher Education Space* and the guidelines of the *Bologna Process*.

(2000–) Full-time tenure position as Full Professor in Computer Science at the University of Verona, appointed in May 2000.

- (1998–2000) Full-time tenure position as Associate Professor in Computer Science at the University of Verona, appointed in October 1998.
- (1995–98) Full-time tenure position as Assistant Professor in Computer Science at the University of Pisa, appointed in February 1995.
- (1993–95) Post-doctoral fellowship within the *Human Capital and Mobility – HCM* programme of the 5thFP of EU, for two years at the Laboratoire d’Informatique (LIX), École Polytechnique, France, under the supervision of Dr. Radhia Cousot. During the same time he has been involved as Assistant Professor in the D.E.A.– I.M.A. (Informatique, Mathématiques et Applications), a joint programme among École Polytechnique, École Normale Supérieure, and Univ. de Paris VI, VII & XI.
- (1990–92) PhD in Computer Science at the University of Pisa, with a PhD thesis on *Semantic aspects of logic program analysis* defended in Pisa in 1992, under the supervision of Prof. Giorgio Levi. PhD Thesis TD-18/93.
- (1988–90) Teaching Assistant in *Numerical Analysis* and *Programming Languages* at the Military Academy of Modena Italy, for the courses 170 and 171 “Allievi Ufficiali” (Army Military Officers).
- (1988) Master (*Laurea*) degree in Computer Science at the University of Pisa in 1988. Advisors: Prof. Giorgio Levi and Prof. Roberto Barbuti.

Research activity and achievements

The primary interest of Roberto Giacobazzi is in the foundational aspects beyond practical methods and tools for program understanding, analysis, verification and transformation. He is mostly interested in abstract interpretation with applications in any area of computer science, such as: semantics, static program analysis, software and hardware verification, model-checking, program transformation and optimization, software watermarking and code obfuscation, complexity and computability, logic and constraint-based programming, security, malware detection and intrusion systems, and safety critical systems. In all these fields he is interested in studying systematic methods for approximating undecidable or highly complex problems in discrete/continuous dynamic systems by means of abstract interpretation. Abstract interpretation represents in this perspective an ideal unifying theory for understanding most phenomena connected with computation, at different levels of abstraction. He contributed to the definition of a number of formal and constructive systematic methods for abstraction design, refinement, simplification, composition, decomposition and compression in abstract interpretation. The obtained results are universal, independent from specific programming languages, and can be applied to any semantics specification and abstract interpretation. As a relapse of his research in abstract interpretation theory, he is interested in Universal Algebra, in particular in lattice theory and closure systems. The following is a brief summary of his research achievements in the last few years:

Semantics: He introduced the very first hierarchy of semantics for pure logic programs, based on abstract interpretation. This work has been recently extended to resolution based-systems, including a number of resolution strategies. He also studied semantic models for characterizing control features in Prolog programs, such as: cut, backtracking, and arbitrary selection rules. He studied the semantics of programming languages from the point of view of systematic semantic design and observation power. In this field he applied systematic methods developed for domain construction to the design of semantics for programming languages as composition of abstractions of arbitrary transition systems, including trace models, compositional denotational models, transfinite models of computation, and logic-based models.

Static analysis: He introduced deductive bottom-up and compositional methods for static analysis of logic programs. He introduced the notion of *abductive program analysis* in 1994. Specific domains have been studied in these contexts, notably for the type analysis, depth- k determinate computations for pipeline optimizations, aliasing, and numeric constraint optimization. He developed the notion of Heyting Completion and Linear refinement for abstract interpretations. These notions have been applied in the context

of abstractions of idempotent substitutions, with a characterization of the notion of condensing analyses for (constraint) logic programs in the case of groundness, linearity and aliasing. These methods have been applied also to specify static analyzers of concurrent constraint programs. He developed the very first GPU-based implementation of an abstract interpreter based on weakly-relational numerical abstract domains (octagons).

Verification: He studied the structure of complete abstractions of Kripke structures, proving the connection between counter-example guided abstraction refinement (CEGAR) and complete refinements for abstract interpretation. He also proved the intrinsic incompleteness of the state abstraction with respect to traces in a *la Kozen* temporal μ -calculus.

Language-based security: He introduced the notion of *Abstract Non-Interference* as a generalization of non-interference by abstract interpretation. The idea is weakening non-interference by considering properties of data. In language-based security. This allows to formally specify attack models as approximate analyses (static or dynamic) of programs and systematically derive maximal attack models for breaking non-interference, by mapping programs into the lattice of abstract interpretations. This notion has been extended towards concurrent and timed programming languages for catching the amount of timing and synchronization leakage. He is now interested in using Abstract Non Interference as unifying paradigm for modeling dependency notions in program slicing, program transformation and intrusion detection with active attack models.

Code protection: He contributed to the introduction of the first semantic-based model for specifying code obfuscation algorithms. The idea is to view code obfuscation as a transformation making a (possibly dynamic) analysis (attacker) incomplete in the sense of abstract interpretation for the transformed program. Bits of information can then be hidden in incomplete zones, where only selected observers can extract the hidden information. This provides a comprehensive theory of obscurity for programming languages with a strong mathematical background. Robust algorithms for code obfuscation and SW watermarking have been derived systematically by specializing distorted interpreters driven by the attacker to defeat, with applications in in control/data code obfuscation and in loop-based transformations for code fingerprinting.

Malware analysis and detection: He contributed to the semantic-based analysis of metamorphic malware. The idea is to introduce a semantics for self-modifying code, called *Phase Semantics*, which is a sound approximation of the standard trace semantics of a self-modifying program. Phase semantics precisely models the metamorphic code behavior by providing a set of traces of programs which correspond to the possible evolutions of the metamorphic code during execution. Metamorphic signatures have been automatically extracted by abstract interpretation of the phase semantics. In particular he introduced the notion of *regular metamorphism*, corresponding to abstractions of phase semantics into finite state automata. He studied vulnerability aspects of Address Space Layout Randomization procedures (ASLR), in particular in the Windows 7 OS. In this context he exploited an ASLR vulnerability to make compatible with Windows 7 an obfuscation technique based on memory relocations, implemented for the first time in the W32.Relock virus.

Lattice theory: Standard abstract interpretation theory is based on the isomorphism between the lattice of all abstractions on a given domain and the lattice of all its closure operators. The study of abstract interpretation theory have therefore lead to original results in the theory of closure operators on complete lattices. He proved the weakly relative pseudo-complemented structure of the lattice of all closure operators of a continuous lattice. This is the theoretical foundation for abstract domain complementation. He introduced the notion of meet- and join-uniformity for closure operators on complete lattices and proved the relevance of uniformity for reasoning about adjoint closure systems. He contributed to prove an embedding of the lattice of complete congruences on a continuous lattice into the lattice of all its closure operators. This provides a way to extend most properties of the lattice of closure operators to the lattice of complete congruences on continuous lattices.

Key results in the last decade

The main scientific achievements in the last decade are rooted in the theoretical and practical consequences of the notion of completeness and incompleteness in abstract interpretation. The main lines of research originated from the early result dated 2000 (initially appeared in 1997) from which Roberto Giacobazzi initiated the investigation into the notion of completeness and precision of an abstraction in dynamic (discrete or continuous) systems:

R. Giacobazzi, F. Ranzato, and F. Scozzari. Making abstract interpretations complete. *Journal of the ACM*, 47(2):361-416, 2000. ACM Press, New York. ISSN 0004-5411.

This result establishes that any abstraction (viz., approximation in the standard Galois connection based abstract interpretation theory) of a Scott-continuous function (viz., a model of computable functions) can be minimally refined or simplified in order to achieve completeness. Completeness here means that no loss of precision is accumulated by approximating program computations (i.e., semantics) on abstract (approximate) objects with respect to the approximation of the final result of a computation carried on concrete objects. This result is recognized as a key theoretical result in abstract interpretation with applications in static program analysis and abstract model checking, and more recently in security. The notion of completeness/incompleteness in abstract interpretation provides a deep insight into the meaning of precise/imprecise analyses of computational systems. The main recent achievements were to consider completeness as a foundational paradigm in order to model a large variety of phenomena concerning programming languages and systems: verification by model checking [55, 20, 22, 72, 77], non-interference [59, 26, 25, 66], obscurity & code-obfuscation [70, 24, 76, 80, 81], watermarking [71], and more recently metamorphic and packing/unpacking malware code [75] can all be modeled as problems of making an abstraction complete/incomplete with respect to the concrete semantics of a program. The idea is to model the analyzer/attacker as an approximate (static or dynamic) abstract interpretation of the concrete program behavior. In this case, making the abstraction incomplete means making the attacker losing information about the run-time behavior of the program, therefore obscuring/protecting/blocking information. This view is now emerging as a concrete model for proving properties about the potency of protection mechanisms and the corresponding degree of security of information flow in code [29]. These ideas provide innovative models in program analysis, language-based security and code protection by abstract interpretation, which have flourished in national and international research projects with total budget of more than 800,000.00€ for basic/applied research (see the Research projects since Y2000), invited lectures in conferences and workshops, and international collaborations with: École Normale Supérieure & INRIA, Gent University, IMDEA Software, Imperial College, Universidad Complutense de Madrid, Université de Rennes, University of Arizona, University of Louisiana, University of Virginia, University of Washington, Microsoft Research and IRDETO.

Awards

He obtained the *Microsoft Research Software Engineering Innovation Foundation (SEIF) Award 2013*. The award is: \$25,000.00.

Relevant invited lectures

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| 2012 | Title: Calcolabile e non calcolabile, un omaggio ad Alan Turing, Italian Parliament (Camera dei Deputati) – Nuova Aula dei Gruppi Parlamentari, in occasion of the 100 years from the birth of Alan Turing. |
| 2012 | Title: Software Security by Obscurity - A Programming Language Perspective. <i>6th Int. Conference on Information Systems, Technology and Management</i> . Communications in Computer and Information Science 285, Springer-Verlag, pp. 427-432, 2012. Grenoble, March 28-30, 2012. |
| 2012 | Title: Algebraic Structures in Program Understanding: A Case Study in Program Protection. <i>11th Biennial IQSA Meeting Quantum Structures</i> , 23 - 27 July, Cagliari (Italy). |

2010–2012	Title: Theory and practice of code attack: Static analysis, semantics and transformation. <i>1st, 2nd, & 3rd Int. Summer School on Information Security and Protection in Software Security and Protection</i> , Chinese Academy of Science, Beijing July 26-30, 2010; Gent July 4-8, 2011; Tucson AZ, May 20-25, 2012.
2010	Title: Abstract Interpretation-Based Protection. <i>11th Int. Conference on Verification, Model Checking, and Abstract Interpretation VMCAI 2010</i> , Madrid, Spain, January 17-19, 2010.
2008	Title: Hiding Information in Completeness Holes - New perspectives in code obfuscation and watermarking. <i>6th IEEE Int. Conferences on Software Engineering and Formal Methods, SEFM'08</i> , pages 7-20, IEEE Press. Cape Town (South Africa), 10-14 November 2008.
2008	Title: Transforming abstract interpretations by abstract interpretation. <i>15th Int. Static Analysis Symposium SAS'08</i> , Vol. 5079 of LNCS, pages 1-17, Springer-Verlag. Valencia, Spain, 16-18 July, 2008.
2002	Title: Systematic design of complete abstractions: from semantics to program analysis via model-checking. <i>18th Workshop on the Mathematical Foundations of Programming Semantics MFPS XVIII</i> , Tulane University, New Orleans, LA USA. March 23 - March 26, 2002.
1998	Invited tutorial: <i>Domain theory in abstract interpretation, Static Analysis Symposium, SAS'98</i> , Pisa, 14-16 September 1998. Volume 1503 Lecture Notes in Computer Science, pages 349-350.

PhD students and group leadership

Roberto Giacobazzi is the leader of the research group in *Static Analysis and Software Protection* at the Department of Computer Science of the University of Verona. The group now includes:

- Prof. Roberto Giacobazzi, Full Professor and scientific leader;
- Prof. Fausto Spoto, Associate Professor;
- Dr. Isabella Mastroeni, Assistant Professor;
- Dr. Mila Dalla Preda, Assistant Professor.

He has been advisor of more than 80 Master Thesis in computer science, notably in formal methods, abstract interpretation, and language-based security, at the University of Pisa and Verona. He has been advisor of 9 PhD thesis. Former co-tutored PhD students include: Dr. Maria Handjieva, with Dr. Radhia Cousot, D.E.A. at the Université de Paris VII. Dr. Francesca Scozzari, with Prof. Giorgio Levi, PhD at the University of Siena, now Assistant Professor at the University of Chieti-Pescara, Dr. Samir Genaim, with Prof. Michael Codish, PhD at the Ben-Gurion University (IL), now Assistant Professor in the CLIP (The Computational logic, Languages, Implementation, and Parallelism Laboratory) group at the Universidad Complutense de Madrid, and Prof. Francesco Ranzato, with Prof. Gilberto Filè, PhD at the University of Padova, now Associate Professor at the University of Padova. He has been advisor of the following PhD students at the University of Verona: Dr. Isabella Mastroeni, now Assistant Professor at the University of Verona, Dr. Damiano Zanardini, now Assistant Professor in the CLIP (The Computational logic, Languages, Implementation, and Parallelism Laboratory) at Universidad Politécnica de Madrid, Dr. Mila Dalla Preda, now Assistant Professor at the University of Verona, Dr. Giovanni Scardoni, now Post-Doc at the Department of Pathology of the University of Verona, Dr. Enrico Visentini, now employed at Power Reply (Milan), and Dr. Durica Nikolić, now Post-Doc at ETH Zürich.

In 2000 Roberto Giacobazzi founded the *SPYLab - Static Program analysis by Abstract Interpretation*. The *SPYLab* is located at the Department of Computer Science of the University of Verona and is a research lab for

master and graduate-level students making research and tool development in static program analysis, software protection, and security.

In 2012 Roberto Giacobazzi co-founded, together with Prof. Fausto Spoto, the JULIA s.r.l., a spin-off company of the University of Verona (originating from the *SPYLab*) and of the Université de La Reunion (FR), for the commercialization of a general purpose Java analyzer (<http://juliasoft.com>). JULIA is a complex software tool for static analysis based on Abstract Interpretation of Java and Android code. JULIA received the Unicredit Bank Award and the Telecom Italia [Working Capital Competition](#) Award for the innovative spin-offs in the ICT area. JULIA is now subcontractor in a project financed by the U.S. Air Force Research Laboratory/RITM Contract No. FA8750-12-C-0174, \$291,000.00, through the University of Washington on software verification techniques for information confinement in Java and Android applications. The last annual budget of JULIA for 2013 is: 288.000€.

Roberto Giacobazzi is co-founder of DAPA – Digital Asset Protection Association (www.d-a-p-a.org). DAPA, established in Tucson Arizona (US) in 2011, as a no-profit association dedicated to the advancement and successful deployment of technologies for protecting the privacy and integrity of digital assets including software, content, keys, and other valuable digital information. Founders: University of Virginia, University of Arizona, University of Verona, IRDETO and ARXAN. DAPA is the main sponsor of the *Int. Summer School of Information Security and Protection* ISSISP'10 - Beijing, ISSISP'11 - Gent, ISSISP'12 - Tucson, and *ACM SIGPLAN Software Security and Protection Workshop* SSP'11 and SSP'12 - Beijing.

Memberships, boards and committees

Roberto Giacobazzi is ACM member since 2002. Since 2009 he is life-time member of the *Accademia di Agricoltura Scienze e Lettere di Verona*, established in 1768 as a major cultural institution for science and arts in Verona. He is and has been chair and member of Steering Committees for the following international conferences and workshops in the field of static program analysis, programming languages, and security:

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| 2013 | Program Chair of the <i>14th Int. Conf. on Verification, Model Checking, and Abstract Interpretation (VMCAI'13)</i> . Roma January 20-22, 2013. |
| 2013 | General Chair of <i>POPL2013, the 40th ACM SIGACT-SIGPLAN Symposium on Principles of Programming Languages</i> . Roma January 23-25, 2013. 435 attendees and a total budget of \$364,752. |
| 2013 – | Member of the <i>Steering Committee</i> of the <i>ACM SIGPLAN Program Protection and reverse Engineering Workshop, PPREW</i> , joint with POPL. |
| 2012–2014 | Member of the <i>Steering Committee</i> of the <i>Symposium on Principles of Programming Languages (POPL)</i> . Currently he is Chair of the POPL Steering Committee. |
| 2010– | Member of the <i>Steering Committees</i> of the <i>ACM SIGPLAN Software Security and Protection Workshop, SSP</i> and of the <i>ACM annual Int. Summer School on Information Security and Protection, ISSISP</i> . |
| 2010– | Member of the Editorial Board of the <i>Central European Journal of Computer Science</i> , published by Springer-Verlag. |
| 2011 | Editor of the Special Issue of the <i>3rd Int. Workshop on Programming Language Interference and Dependence - PLID 2007</i> , in <i>Mathematical Structures in Computer Science</i> Vol. 61, Issue 6, 2011. |
| 2008 | Program Chair of the <i>30 Years of Abstract Interpretation (30YAI)</i> workshop in honor of Patrick Cousot, January 09, 2008, San Francisco USA. |
| 2007 | Editor of the Special Issue on the <i>11th Int. Static Analysis Symposium - SAS2004</i> in <i>Science of Computer Programming</i> Vol. 64, Issue 1, Pages 1-184 (January 1st, 2007). |
| 2004 | Program Chair of the <i>11th Int. Static Analysis Symposium (SAS'04)</i> Verona, Italy. August 2004. |

2004–2007	Member of the <i>Steering Committee</i> of the <i>Programming Language Interference and Dependence (PLID)</i> workshop.
2002–	Member of the <i>Steering Committee</i> of the <i>Static Analysis Symposium (SAS)</i> .

Roberto Giacobazzi has been in Program Committees and Editorial Boards in several international conferences and symposia on static program analysis, system verification, security and programming languages, in particular: *First International Workshop on Concurrent Constraint Programming, CCP'95; International Static Analysis Symposium, SAS 1996, 1997, 1999, 2000, 2002, 2005, 2006, 2007, 2009, and 2011; Joint Conference on Declarative Programming, APPIA-GULP-PRODE 1998 and 1999; ACM Principles and Practice of Declarative Programming, PPDP'01; Algebraic Methods in Language Processing, AMiLP-3; IEEE International Workshop on Source Code Analysis and Manipulation, SCAM 2004 and 2005; International Conference on Verification, Model Checking and Abstract Interpretation, VMCAI 2005, 2006, and 2007; 15th International Conferences on Logic for Programming, Artificial Intelligence and Reasoning, LPAR 2008; 37th ACM SIGPLAN Symposium on Principles of Programming Languages, POPL 2010; External Review Committee of the 32nd ACM SIGPLAN Conference on Programming Language Design and Implementation, PLDI 2011; IEEE International Conference on Intelligence and Security Informatics, ISI 2011, 2012, and 2013; 6th International Conference on Information Systems, technology and Management, ICISTM 2012; The Alan Turing Centenary: Turing-100, Manchester 2012; 6th International Symposium on Foundations & Practice of Security, FPS 2013; ACM Partial Evaluation and Program Transformation, PEPM 2013; International Symposium on Foundations of Open Source Intelligence and Security Informatics, FOSINT-SI 2013 and 2014; and 23rd European Symposium on Programming, ESOP2014.*

Visiting positions

The following includes visiting research and professorship appointed for periods longer than 1 month.

(February–April 2014) He has a full-time Visiting Professor position in Computer Science at the department of Computer Science of the University of Louisiana, USA.

(May–July 2011) He had a full-time Visiting Professor position in Computer Science at the Département d'Informatique (DI) of the École Normale Supérieure in Paris.

(December 2010) He had a full-time Visiting Professor position in Computer Science at the Département d'Informatique (DI) of the École Normale Supérieure in Paris.

(May & June 2009) He had a full-time Visiting Professor position in Computer Science at the Computer Science Department of the Universidad Complutense de Madrid (UCM).

(June–August 2008) He had a full-time Visiting Professor position in Computer Science at the Département d'Informatique (DI) of the École Normale Supérieure in Paris.

(September 2006) Visiting researcher at the Laboratoire d'Informatique (LIX), École Polytechnique, Paris.

(June & July 2002) Visiting researcher at the Laboratoire d'Informatique (LIX), École Polytechnique, Paris.

(June 2000) Visiting researcher at the Laboratoire d'Informatique (LIX), École Polytechnique, Paris.

(June 1999) Visiting Professor at the Department of Computer Science, KAIST – Korean Advanced Institute of Science and Technology, Taejon, South Korea.

(December 1997) Visiting researcher at the Department of Computer Science, The University of Melbourne.

(November & December 1997) Visiting Professor at the Department of Mathematics and Computer Science, Ben-Gurion University of Negev, Beer-Sheva, Israel.

(April & May 1994) Visiting researcher at the Dept. of Computer Science, Katholieke Universiteit Leuven.

(December 1992) Visiting researcher at the Department of Computer Science, The University of Arizona.

Research projects since Y2000

- (2011–2013) He is the scientific leader of a Joint-Project between the University of Verona and the SME EN-ERGYCAMENTE s.r.l., project named *MoreGain*, for the development of a SW assisted energy efficient infrastructure for controlling photovoltaic large plants in Piemonte (Italy), by means of combinatorial optimization. Total amount: 50.000€.
- (2009–2011) He is the scientific leader of a Joint-Project between the University of Verona and the VITA consortium of ICT SMEs in Verona, named *ShadowCode* for the development of a Java bytecode obfuscator based on abstract interpretation. Total amount: 150.000€.
- (2008–2010) He is scientific leader of a 2 years joint project funded by the Italian Minister of University and Research MIUR COFIN2007. The project, with a total budget of 160.000€, is entitled *AIDA2 - Abstract Interpretation design and Applications*, and includes as associate partners the following Italian Universities: University of Verona, University of Parma, and University of Padova (National Coordinator).
- (2006–2010) he is coordinator of a international cooperation project *InterAbstract - Verification and Security by Abstract Interpretation*, within the INTERLINK framework. The project involves the École Normale Supérieure, the University of Arizona, the CNRS IRISA in Rennes, the Max Plank Institute in Saarbrücken, and the École Polytechnique, Paris. Total amount: 53.000€.
- (2004–2006) He is national scientific leader of a 2 years joint project funded by the Italian Minister of University and Research MIUR COFIN2004. The project, with a total budget of 244.600€, is entitled *AIDA - Abstract Interpretation design and Applications*, and includes as associate partners the following Italian Universities: University of Verona (National Coordinator), University of Parma, University of Pisa, University of Udine, University of Venezia, and University of Bologna.
- (2003–05) He is scientific coordinator of the individual post-doc fellowship Marie Curie of Dr. Samir Genaim, code n. MCFI-2002-00183, on *Property driven design of static program analysis*. The project had a budget of 123.712€.
- (2002–05) He is local coordinator of the MIUR-FIRB project: *SPY-Mod Abstract Interpretation and model checking in the automatic verification of embedded systems (code RBAU018RCZ.003)*. The project, with a budget assigned to the site of Verona of 82.000€, is coordinated by Prof. Francesco Ranzato.
- (2002–03) He has been coordinator of a CRUI-VIGONI bilateral project between the University of Verona and the Max Plank Institute - Saarbrücken on *Abstract interpretation and predicate abstraction*. Total budget 6.000€.
- (2002–04) He has been local coordinator of a 2 years joint project funded by the Italian Minister of University and Research MIUR COFIN2002. The project, with a budget assigned to the site of Verona of 40.000€, was entitled *CoVer: Constraint-based Verification of Reactive systems*. National scientific leader Prof. Maurizio Gabbrielli.
- (2000–03) He is the scientific leader of an international co-tutored PhD course on *logic and formal methods in Computer Science*. The project includes the following universities: Université de Paris XII, Université de Rennes I, Universidade Federal de Pernambuco, Recife (Brasil), University of Havana (Cuba), University of London, Queen Mary and Westfield College, Université de Bordeaux. The project had a total budget of 124.983€.
- (2000–02) He has been local coordinator of a 2 years joint project funded by the Italian Minister of University and Research MIUR COFIN2000. The project, with a budget assigned to the site of Verona of 26.339€, was entitled *Abstract Interpretation, types, systems and control-flow analysis*. National Scientific leader Prof. Giorgio Levi.

(1999–2001) He has been scientific leader of a 2 years joint project funded by the Italian Minister of University and Research MIUR COFIN1999. The project, with a total budget of 200.385€, was entitled *Automatic Program certification by Abstract Interpretation*, included as partners the following Italian Universities: University of Verona (National Coordinator), University of Parma, University of Pisa, University of Udine, and University of Venezia.

Evaluation and hiring committees for public and private institutions

(2012–2014) He is chair of the National Evaluation Committee for Professorship (associate professors and full professors) in Computer Science. 898 candidates in 2013.

(2012–) He is member of the board of evaluation of the Italian Minister of Research and Education (MIUR) for Applied Technology Research - ICT area: PON R& C 2007-2013 for the south area (Campania, Puglia, Calabria, Sicilia), 150.000.000€ which are 50% from EU FESR and 50% national resources FdR MiUR.

(2008–) He is reviewer for research proposals for the University of Pisa, University of Padova, and University of Venezia Ca'Foscari.

(2006–) He is member of the advisory board for the selection of applied research joint-projects between public universities and SME for Sardegna Ricerche and PRRIITT (Programma regionale per la ricerca industriale, l'innovazione e il trasferimento tecnologico) Emilia Romagna.

(2005–) He is reviewer for the EPSRC – Engineering and Physical Sciences Research Council (UK), the Israel Science Foundation (IL), the United States-Israel Binational Science Foundation (IL), the Estonian Science Foundation (EE), and Georgian's Shota Rustaveli National Science Foundation.

(2004–) He served in the habilitation committee for professorship in France: for the Université Paris-Dauphine for Dr. Matthieu Martel (2006) and Dr. Laurent Mauborgne (2006); for the École Normale Supérieure de Cachan for David Cachera (2010), for the Université de Grenoble for David Monniaux (2009), and École Normale Supérieure in Paris for Dr. Xavier Rival (2011).

(2004–) He is reviewer and evaluator for European Projects under the FP6 for the Specific International Scientific Cooperation Activities (INCO) and FP7 for the FET and STREP measures.

(2004–2011) Member of the Hiring Committee for Associate Professors 2004 at the University of Verona for computer science, promotion of Prof. Andrea Fusiello and Prof. Michele Piana; Hiring/promotion Committee for Full Professors 2005 at the University of Verona for computer science, promotion of Prof. Carlo Combi and Prof. Roberto Segala; Hiring/promotion Committee for Associate Professors 2006 at the University of Padova for computer science, promotion of Prof. Massimo Marchiori and Prof. Paolo Baldan; Hiring Committee for Assistant Professors (tenured) 2006 at the University of Verona for computer science, hiring of Dr. Isabella Mastroeni and Dr. Barbara Oliboni; Hiring/promotion Committee for Associate Professors 2004 at the University of Catania for computer science, promotion of Prof. Sebastiano Battiato and Prof. Giampaolo Bella; Hiring Committee for Assistant Professors (tenured) 2011 at the University of Pisa for computer science, hiring of Dr. Paolo Milazzo. Hiring Committee for Assistant Professors (tenured) 2012 at the University of Cagliari for computer science. Hiring of Dr. Lucio Spano.

(2004–) He is in the advisory board for the selection of projects within the research and innovation activities of the Italian Ministry M.A.P. *Ministero delle Attività Produttive*, ICT area.

(2000–) He has been member of the evaluation committees in PhD defenses, notably: in the PhD programme in *Mathématique et Informatique* at École Polytechnique, for the defenses of: Franck Védrine (2000), Stanislav Tzolovski: *Raffinement d'analyses statiques par interprétation abstraite* (2002), Damien Massé: *Vérification de Propriétés Temporelles par interprétation abstraite* (2002), Antoine Minè: *Weakly Relational Numerical Abstract Domains* (2004); in the PhD programme in *Informatique* at IRISA, Univ. de

Rennes (FR), for the defense of Marc Eluard: *Analyse de sécurité pour la certification d'applications Java Card* (2001); in the PhD programme in *Informatique* at INRIA Sophia Antipolis (FR), for the defense of Felipe Luna Del Aguila: *Information Flow Security for Asynchronous, Distributed, and Mobile Applications* (2005); in the PhD Programme in *Informatique* at LORIA, Institut National Polytechnique de Lorraine, for the defense of Philippe Beaucamps: *Analyse de Programmes Malveillants par Abstraction de Comportements* (2011).

(2000–2004) He was member of the jury for the selection of the foreign students applying for the major in Computer Science at the École Normale Supérieure (ENS-Europe 00-01 and 01-02, Sélection International en Sciences 02-03 and 03-04).

(2000–) He is part of the Board of Experts of the Italian Ministry of Education and Research – MIUR, and reviewer for Italian National Strategic Research plans: PRIN and FIRB.

Teaching

Roberto Giacobazzi has more than 20 years of experience in university-level undergraduate and graduate teaching in Computer Science, with responsibility of courses in the fields of: Programming, Automata and Formal Languages, Computability, Algorithms and Complexity, Programming Languages, Program Verification, Compilers, Program Transformation and optimization, and Code Protection.

Undergraduate: From 1995 to 1998 Roberto Giacobazzi has been in charge of the TA and practical activities in *Programming Languages* (20h) and *Object Oriented Programming* (20h) courses in the undergraduate major in Computer Science of the University of Pisa. From 1998 Roberto Giacobazzi is professor of *Formal Languages, Automata, Computability and Complexity* (120h) at the University of Verona. From 1998 to 2002 he was professor of *Programming Languages* (50h) and *Introduction to imperative programming* (120h) in the undergraduate major in Computer Science of the University of Verona. He is currently professor in *Formal Languages and Computability* (70h) at the University of Verona. Average classroom size in the undergraduate program: 110 students.

Graduate: In 1992 he has been in charge of a graduate course on *Logic program analysis* (20h) at the D.E.A.–I.M.A. (Informatique, Mathématiques et Applications), a joint graduate program among École Polytechnique, École Normale Supérieure, and Univ. de Paris VI, VII & XI. In 1997 he has been in charge of a PhD course on *Abstract Interpretation and Program Analysis* (20h) at the Ben-Gurion University of Negev, Beer-Sheva. In May 2004 he was appointed for an introductory course on *Completeness and Computability* (20h) in the course of Philosophy of Science at the *Studio Teologico San Zeno* in Verona. From 2000 to 2008 Roberto Giacobazzi was professor of *Program Analysis and Verification* (50h) in the graduate school in Computer Science of the University of Verona. Since the fall of 2008 he is professor of *Program Analysis and Software Protection* (50h) at the graduate school in Computer Science and Engineering at the University of Verona. In May and June 2010, when appointed as visiting professor at UCM (Universidad Complutense de Madrid), he has been in charge of a graduate course on *Software Protection* (50h). He is currently professor of *Program Analysis and Code Protection* at the Graduate School in Computer Science and Engineering of the University of Verona. Average classroom size in the graduate program: 20 students.

Main publications [1990-2013]

The 20 most cited papers are: [18, 2, 59, 12, 55, 6, 9, 36, 7, 48, 16, 32, 13, 1, 45, 19, 8, 5, 24, 14].

Main publications in international journals

- [1] R. Barbuti, R. Giacobazzi. A Bottom-up Polymorphic Type Inference in Logic Programming. *Science of Computer Programming*, 19(3):281–313, Elsevier Science Pub., Amsterdam Dicembre 1992. ISSN 0167-6423.
- [2] R. Barbuti, R. Giacobazzi, and G. Levi. A General Framework for Semantics-based Bottom-up Abstract Interpretation of Logic Programs. *ACM Transactions on Programming Languages and Systems*, 15(1):133–181, ACM Press, New York Gennaio 1993. ISSN 0164-0925.
- [3] R. Barbuti, M. Codish, R. Giacobazzi, and G. Levi. Modelling Prolog Control. *Journal of Logic and Computation*, 3(6):579–603, Oxford University Press, Oxford Dicembre 1993. ISSN 0955-792X.
- [4] B.M. Chang, K.M. Choe, and R. Giacobazzi. Improving execution models of logic programs by two-phase abstract interpretation. *Journal of the Electronics and Telecommunications Research Institute (ETRI)*. 16(4):27-47, ETRI Taejon, Korea Gennaio 1995. ISSN 1225-6463.
- [5] R. Barbuti, M. Codish, R. Giacobazzi, and M. Maher. Oracle Semantics for PROLOG. *Information and Computation*, 122(2):178-200, Academic Press, Orlando FL Novembre 1995. ISSN 0890-5401.
- [6] R. Giacobazzi, S. Debray, and G. Levi. Generalized Semantics and Abstract Interpretation for Constraint Logic Programs. *Journal of Logic Programming*, 25(3):191-248, Elsevier North-Holland, New York Dicembre 1995. ISSN 0743-1066.
- [7] G. Filé, R. Giacobazzi, F. Ranzato. A Unifying View on Abstract Domain Design. C. Hankin, H.R. Nielson and P. Wegner editors, Computing Surveys Symposium on Models of Programming Languages and Computation. *ACM Computing Surveys*, 28(2):333-336, ACM Press, New York Giugno 1996. ISSN 0360-0300.
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- [9] A. Cortesi, G. Filé, R. Giacobazzi, C. Palamidessi, and F. Ranzato. Complementation in Abstract Interpretation. *ACM Transactions on Programming Languages and Systems*, 19(1):7-47, ACM Press, New York Gennaio 1997. ISSN 0164-0925.
- [10] E. Zaffanella, R. Giacobazzi, and G. Levi. Abstracting Synchronization in Concurrent Constraint Programming. *Journal of Functional and Logic Programming*, 1997(6), The MIT Press, Cambridge Mass. Novembre 1997. ISSN 1080-5230.
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- [12] R. Giacobazzi. Abductive analysis of modular logic programs. *Journal of Logic and Computation*, 8(4):457-484, Oxford University Press, Oxford Agosto 1998. ISSN 0955-792X.
- [13] R. Giacobazzi and F. Ranzato. Optimal domains for disjunctive abstract interpretation. *Science of Computer Programming*, 32(1-3):177-210, Elsevier Science Pub., Amsterdam Agosto 1998. ISSN 0167-6423.
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- [15] R. Giacobazzi and F. Ranzato. Some properties of complete congruence lattices. *Algebra Universalis*, 40(2):189-200, Birkhäuser, Basilea 1998. ISSN 0002-5240. (Classificazione matematica: 06B10 (06A15, 06A23 06D15)).
- [16] R. Giacobazzi and F. Scozzari. A logical model for relational abstract domains. *ACM Transactions on Programming Languages and Systems*, 20(5):1067-1109, ACM Press, New York Settembre 1998. ISSN 0164-0925.
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