

# Maria-Cristina V. Marinescu

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## Research Interests

Music Technology, Socio-technical Networks, Programming Languages and Semantics, Program Analysis, Compilation Techniques, Embedded Systems, Hardware/Software Codesign.

## Education

- **Massachusetts Institute of Technology** ..... Cambridge, MA  
PostDoctoral Fellow ..... April, 2002 - August, 2003
- **Massachusetts Institute of Technology** ..... Cambridge, MA  
Visiting Scholar ..... August, 1997 - March, 2002
- **University of California** ..... Santa Barbara, CA  
Ph.D. in Computer Science ..... December, 2002  
Thesis title: "Synthesis of Synchronous Pipelined Circuits from High-Level Modular Specifications".  
Advisor: Prof. Martin C. Rinard.
- **Politehnica University of Bucharest** ..... Bucharest, Romania  
B.S. in Computer Science ..... June, 1995

## Work Experience

- **IBM T.J. Watson Research Center** ..... Hawthorne, NY  
Research Staff Member ..... September, 2003 - Present
- **Reactors: a data-oriented synchronous/asynchronous programming model for distributed applications** (major contributor): The reactor model is a simple and uniform programming model suitable for building, evolving, and maintaining internet-scale applications. This model is unique in seamlessly combining the following features in a single language: (1) data rather than ports or channels as the interface to a component, (2) synchronous and asynchronous interaction in the same model, with the ability to generate processes dynamically, (3) expressive data query and transformation constructs, (4) the ability to specify constraints/assertions as a natural part of the core language, (5) distributed atomic transactions, and (6) declarative, compositional specifications of functionality in an "aspect-like" manner.
- **Emerging software governance** (project lead): This project lies at the intersection of software engineering and social networks. Given a set of agents, i.e., people and software components, a representation of the organization in which they operate, and a changing goal, the challenge is to discover what are the rules that the different components must follow to accomplish the goal. The rules may require a change in individual attributes of the people, their interaction patterns, or the structure of the organization. Any of these characteristics can also change independently of the goal, in which case the rules may also change to re-satisfy the goal. The rules must enable global behavior to emerge from the local behavior of the agents, who may not be aware of the global requirements and the goal of the organization, but can reason about local properties (in the case of people). Some examples of the issues that arise in this context are understanding: (1) how local decisions affect the organization globally, (2) how to measure some property of the organization (e.g. business value), and (3) how to detect leadership in an organization.

- **Y, a semantics foundation for textual use cases** (project lead): Use cases are an effective means for understanding the intended system behavior and specifying how to meet the application requirements. Although a very useful concept, UML use cases are informal; verifying that a use case is correctly covered by a piece of code, that it correctly embodies a requirement, and that it composes well with other use cases are all operations that are done manually, if at all. In contrast, **Y** focuses on using use cases as formal artifacts to enable their composition and refinement while supporting reuse. This approach embraces the fact that use cases are inherently incomplete, but requires that their semantics be formally defined. The development style is incremental, and supports stepwise refinement while guaranteeing correctness of the transformation steps. Associating a rigorous semantics with use cases enables checking and inference, the execution of partially specified applications, design via refinement with tool support, and code and test generation.
- **ESP\*: programming with events, states, and predicates for embedded systems** (major contributor): ESP\* is a unified language that reifies key concepts from Statecharts and treats them as first-class elements in a Java-like language. By lifting Statecharts concepts into Java, ESP\* improves on the standard approach in several key regards: (1) it avoids the standard out-of-synch between the model and the generated native code by enabling users to directly work on the model, (2) it provides features involving concurrency, object-orientation, and strong typing directly into the language, and (3) it makes modeling valuable beyond its role as a documentation tool since there is now a continuum between the models and the resulting implementation.
- **Massachusetts Institute of Technology, LCS** ..... Cambridge, MA  
Visiting Scholar and Research Assistant, Prof. Martin Rinard ..... August, 1997 - April, 2002
  - **Automatic synthesis of pipelined circuits:** I designed a specification language and a compiler with the goal of reducing the time, effort, and expertise required to design efficient digital circuits. This approach relies on novel compiler technology to synthesize highly concurrent, synchronous implementations of circuits, starting from modular, asynchronous specifications written in our language. The compiler takes a description written in our specification language and automatically generates a synchronous, fully pipelined implementation of it in synthesizable Verilog at the RTL level.
  - **Automatic pipelining of hardware descriptions:** I developed a new approach for automatically pipelining sequential circuits described in the same specification language that is used by the synthesis compiler described in the previous paragraph. The language facilitates the automated analysis and transformation of specifications. The pipelining algorithm is based on speculation and uses state retention and recovery to respond to incorrect speculations. To decrease the area and increase the throughput of the pipeline, the algorithm implements stalling and forwarding as extensions to the basic approach.
- **University of California, Computer Science Department** ..... Santa Barbara, CA  
Research Assistant, Prof. Martin Rinard ..... June, 1997 - September, 1997
  - **Multiplexor-driven speculative pipelining:** I developed an algorithm for the automatic pipelining of a restricted class of digital circuits based on multiplexor-driven speculative pipelining. This approach has several interesting properties. First, the registers in the pipelined circuit may not contain a correct value in every clock cycle. This is not a problem if the correct, unspeculated value has not been already generated in a past clock cycle. In this case, there is no time penalty for incorrect speculations relative to the unpipelined circuit. Finally, for deeply pipelined circuits, our approach allows multiple speculations in flight at the same time.
- **Politehnica University of Bucharest** ..... Bucharest, Romania
  - 1995, **B.S. Thesis:** I implemented a distributed shared memory model using PVM.

## Teaching Experience

- **University of California, Computer Science Department** ..... Santa Barbara, CA

Over the academic years 1995 and 1996, I was a Teaching Assistant for six classes, four of which were core undergraduate classes and one of which was a freshman class with over 100 students. I was responsible for holding discussion sections, helping the instructor create assignments and/or exams and grading the exams. The specific courses were: Operating Systems, Data Structures and Algorithms, Introduction to Computer Communication Networks, Theory of Computation, Programming Methods, and Parallel Scientific Computing.

## Publications

- Maria-Cristina Marinescu, Rafael Ramirez, “Expressive Performance in the Human Tenor Voice”, 5th Sound and Music Computing Conference SMC08, Berlin, Aug. 2008.
- John Field, Maria-Cristina Marinescu, and Christian Stefansen, “Reactors: A data-oriented synchronous/asynchronous programming model for distributed applications”, in review for Theory of Computer Science, 2008.
- John Field, Maria-Cristina Marinescu, and Christian Stefansen, “Reactors: A data-oriented synchronous/asynchronous programming model for distributed applications”, Coordination 2007, Paphos, Cyprus, June 2007.
- Vugranam Sreedhar and Maria-Cristina Marinescu, “From Statecharts to ESP\*: Programming with Events, States, and Predicates for Embedded Systems”, EMSOFT 2005, Jersey City, USA, Sept. 2005.
- Maria-Cristina Marinescu and Martin Rinard, “A Formal Framework for Modular Synchronous System Design”, Formal Methods Europe 2003, Pisa, Italy, Sept. 2003
- Maria-Cristina Marinescu, “Synthesis of Synchronous Pipelined Circuits from High-Level Modular Specifications”, PhD Thesis, Oct. 2002.
- Maria-Cristina Marinescu and Martin Rinard, “High-level Automatic Pipelining for Sequential Circuits”, Proceedings of the 14th International Symposium on System Synthesis, ISSS 2001, Montreal, Canada, Sept.-Oct. 2001.
- Maria-Cristina Marinescu and Martin Rinard, “High-level Synthesis of Pipelined Circuits from Modular Queue-Based Specifications”, IEICE Transactions, Special Issue on VLSI Design and CAD Algorithms, 2001.
- Maria-Cristina Marinescu and Martin Rinard, “High-level Specification and Efficient Implementation of Pipelined Circuits”, Proceedings of ASP-DAC Asia and South Pacific Design Automation Conference 2001, Yokohama, Japan, Jan.-Feb. 2001.
- Maria-Cristina Marinescu and Martin Rinard, “A Synthesis Algorithm for Modular Design of Pipelined Circuits”, Proceedings of the X IFIP International Conference on VLSI, Lisbon, Portugal, Dec. 1999.

## Invited Talks

- “Reactors: A data-oriented synchronous/asynchronous programming model for distributed applications”, Coordination 2007, Paphos, Cyprus, June 2007.
- “Reactors”, IBM Programming Languages Day, May 2007.
- “From Statecharts to ESP\*: Programming with Events, States, and Predicates for Embedded Systems”, EMSOFT 2005, Jersey City, USA, Sept. 2005.
- “High-level Automatic Pipelining for Sequential Circuits”, Proceedings of the 14th International Symposium on System Synthesis, ISSS 2001, Montreal, Canada, Sept.-Oct. 2001.
- “High-level Specification and Efficient Implementation of Pipelined Circuits”, Proceedings of ASP-DAC Asia and South Pacific Design Automation Conference 2001, Yokohama, Japan, Jan.-Feb. 2001.

- “A Synthesis Algorithm for Modular Design of Pipelined Circuits”, Proceedings of the X IFIP International Conference on VLSI, Lisbon, Portugal, Dec. 1999.
- Seminar talks at various institutions in the United States and Europe.

## Patents

- “Data-Oriented Programming Model for Loosely-coupled Applications”, John Field, Rafah Hosn, Bruce Lucas, Maria-Cristina Marinescu, Christian Stefansen, Mark Wegman, Charles Wiecha, June 2007.
- “System and Method for Managing Resources Using a Compositional Programming Model”, John Field, Rafah Hosn, Bruce Lucas, Maria-Cristina Marinescu, Mark Wegman, Charles Wiecha, June 2007.

## Awards and Memberships

- Tuition Fellowship from University of California at Santa Barbara between 1995 and 2002.
- Merit Fellowship from Politehnica University of Bucharest between 1990 and 1995.
- Second Prize in Best Thesis Student Contest at Politehnica University of Bucharest Workshop (graduating class size approx. 250 students), Romania, May, 1995.
- First Patent Disclosure Award, June 2007.
- Invention Achievement Award, June 2007.
- Member of the ACM.

## Other Skills

- Language Skills:
  - Fluent in English, Romanian.
  - Good knowledge of Spanish (Castellano).
  - Practical knowledge of Italian, French.
- As development training, I took courses in Presentation Skills, Teamwork and Leadership, and The Art of Influencing the Other.
- I am proud to have been the founder of my high school’s Women’s Soccer League. Through my persistence—despite skepticism and occasional laughter—over several years, I convinced enough girls to start a league—something unheard of in Romania at that time— and we eventually acquired an enthusiastic following.

## Personal Interests

- I am an avid climber and skier.
- I am interested in how the two sides of the brain perceive different components of music, and how the human voice works.

## References

- Martin Rinard (PhD Advisor), email: rinard@csail.mit.edu, phone: (617) 258-6922  
Professor, Department of EECS, Massachusetts Institute of Technology
- Srinivas Devadas, email: devadas@mit.edu, phone: (617) 253-0454  
Professor, Associate Department Head, EECS, Massachusetts Institute of Technology

- Mark Wegman, email: Wegman@us.ibm.com, phone: (914) 784-7809  
IBM Fellow, Head of Computer Science, IBM Research
- Additional references available on request.