Curriculum Vitae

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1 General Information

Date of Birth:	13 September 1977
Place of Birth:	Paola (CS)
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Current Position

I am a Ph.D. student advised by Madhusudan Parthasarathy (UIUC). My research interests are in applying formal methods for verification and testing of concurrent programs using static and dynamic program analyses. I am a member of (UPCRC Universal Parallel Computing Research Center at the University of Illinois); I am working on a project checking the correctness of concurrent programs reducing the space of the interleavings.

Software/tools

- Penelope: A testing tool for concurrent programs.
  http://www.cs.uiuc.edu/ sorrent1/penelope/index.html

Research Interests

- *Software analysis and verification*: automatic verification, abstraction based verification, dynamic verification, static analysis, model checking.
- *Concurrency*: atomicity, deadlocks, ordering violations, data-races, partial-order methods, testing.

Research Statement

My research focus lies in model checking both from an algorithmic prospective and in developing tools.

Recently, I am focusing on analyzing correctness of concurrency in the development of large system programs. Unfortunately, the interactions among communicating threads in the program can result in unexpected behaviors. These behaviors typically result in bugs that occur late in the software development cycle or even after the software is released. The use of concurrent multi-threaded systems necessitates the development of new methodologies to debug these programs. Traditional methods of testing, such as stress and random testing, often miss these bugs. Moreover, the verification of correctness of software is fundamentally challenged for concurrent programs because of the "*interleaving explosion problem*" the complexity of testing all the possible interleavings of a program under a single test input.

The approach that I am pursuing to tackle this problem is to choose (wisely) a subset of interleaved executions to test. Such a subset is the class of executions that violate "*atomicity*". In particular, for the case of atomicity violations involving only two threads and a single variable, which covers many of the atomicity errors reported in bug databases, we propose an efficient algorithm that works in linear time in the length of the runs, and quadratic time in the number of threads. A preliminary version of the tool called PENELOPE that implements our algorithm has shown promising results. It scales well for benchmark concurrent programs and is effective in predicting a large number of atomicity violations even from a single run.

This tool is divided in phases. In the first phase the Java classes of a concurrent program are automatically transformed to insert a monitor and monitoring messages. The second phase works on the information collected during the monitoring of the program. In this phase the events involved in atomicity violations are detected. Given the original schedule and the events generated previously this phase synthesizes schedules violating the atomicity. In the last phase we instrument the Java classes using bytecode transformations, so that the same events that were monitored now interact with a global scheduler. The scheduler looks at the schedule that it suppose to schedule, and directs the appropriate tread to perform a precise number of steps. When the re-scheduling phase terminates the output generated is checked against the test harness in order to verify if there were a real error in the program or not.

2 Formation

Education

- Currently pursuing PhD in Computer Science at the University of Illinois at Urbana Champaign. Advisor: Prof. Madhusudan Parthasarathy.
- Laurea degree in Computer Science (summa cum laude) at the Università degli Studi di Salerno. Thesis title: *Haplotyping su singolo individuo*. Advisor: Prof. Mimmo Parente.
- High School Diploma in Accounting, Business, And Computer Programming at the I.T.C.G. Pizzini, Paola (CS).

Schools attended

- *Dagstuhl Workshop on Design and Validation of Concurrent Systems*: Dagstuhl, Germany, Aug 30, 2009.
- 2^{nd} *International School on Software Engineering*, University of Salerno, 13 - 16 September, 2005.
- 17^{th} *International School for Computer Science Researchers*: *"Formal Methods: Theory And Practice"*, Lipari Island, 10 - 23 July, 2005.
- *BISS 2005: Bertinoro International Spring School in Computer Science*, University Residential Center, 07 - 18 March, 2005.

Talks

- *FSE'10* - 18^{th} *ACM SIGSOFT International Symposium on the Foundations of Software Engineering*: Santa Fe, New Mexico, Nov 9, 2010.
- *Software Engineering Seminar*: University of Illinois at Urbana Champaign, Nov 3, 2010.
- *Formal Method Seminar*: University of Illinois at Urbana Champaign, Oct 22, 2010.
- *Software Engineering Seminar*: University of Illinois at Urbana Champaign, Dec 2, 2009.
- *MVD'09 - Midwest Verification Day*: University of Iowa, IO, Sep 12, 2009.
- *Formal Hardware Verification Seminar*: University of Illinois at Urbana Champaign, Nov 19, 2008.

Grants and Awards

- *Nov 2010*: Student travel grant for attending the 18^{th} ACM SIGSOFT International Symposium on the Foundations of Software Engineering (FSE 2010), granted by ACM SIGSOFT based on academic merits.

Commitee Services

- *Organizing commitee*:
  GandALF 2010: First International Symposium on Games, Automata, Logics and Formal Verification. Minori, Italy - 17-18 June 2010.
- *Serving Reviews*:
  International Journal *Distributed Computing*, Springer.

3 Activities and Practical Knowledge

- Research Associate, University of Salerno, 2007-2008.
- Teaching assistant of courses of "Foundations of Computer Science", held at the University of Salerno, in the academic year 2007-2008.
- Teaching assistant of courses of "Programming Languages", held at the University of Salerno, in the academic year 2007-2008.
- Visiting student at the University of California, Los Angeles under the advises of Prof. Rupak Majumdar. 2006-2007.
- Teaching assistant of courses of "Programming Languages", held at the University of Salerno, in the academic year 2004-2005.
- Exhaustive knowledge of the most diffused applications and operating systems, and of several programming and scripting languages (e.g.: Matlab, HTML, PHP, JAVA, OCAML, BPEL, Bytecode, ObjectiveC, Lex and Yacc and especially C/C++).
- Comprehension and expertise of intermediate level in electronics.

4 Publications

Publications are available online at `http://www.cs.uiuc.edu/~sorrent1/`

Conferences and Journal articles

- "Logical Prediction of Atomicity Violations for Testing"
  (Under Submission).
  (*With A. Farzan, P. Madhusudan and N. Razavi*)
- "PENELOPE: Weaving Threads to Expose Atomicity Violations"
  In Proceedings of ACM SIGSOFT Int'l Symp. on the Foundations of Software Engineering **FSE**, Santa Fe, New Mexico, USA, November 2010.
  (*With A. Farzan and P. Madhusudan*)
- "PENELOPE: Weaving Threads to Atomicity"
  EC2 2010: Workshop on Exploiting Concurrency Efficiently and Correctly **EC2**, Edinburgh, UK, 2010.
  (*With A. Farzan and P. Madhusudan*)
- "A NuSmv Integration for Graded CTL Model Checking"
  In Proceedings of Computer Aided Verification, **CAV 2010**, Lecture Notes in Computer Science, volume: 6174, pages: 670 – 673.
  (*With A. Ferrante, M. Napoli, M. Memoli and M. Parente*)
- "Meta-analysis of Concurrent Program Runs with Nested Locking for Atomicity Violations", In Proceedings of Computer Aided Verification, **CAV 2009**, Lecture Notes in Computer Science, volume: 5643, pages: 248 – 262.
  (*With A. Farzan and P. Madhusudan*)
- "Fast Payment Schemes for Truthful Mechanisms with Verification", Theoretical Computer Science, **TCS** 410 (2009), pages 886-899.
  (*With A. Ferrante, G. Parlato and C. Ventre*)
- "The Consistency of Web Conversations", 23rd IEEE/ACM International Conference on Automated Software Engineering, **ASE 2008**, 15-19 September 2008, L'Aquila, Italy.
  (*With J. Fischer and R. Majumdar*)
- "Improvements for Truthful Mechanisms with Verifiable One–Parameter Agents", Third Workshop on Approximation and Online Algorithms, **WAOA'05**, Palma de Mallorca, Spain, 6-7 Oct 2005.
  (*With A. Ferrante, G. Parlato and C. Ventre*)

23 March, 2011

Francesco Sorrentino