

Zvonimir Rakamarić

CONTACT INFORMATION	<i>Phone:</i> +1 (740) 346-9866 <i>E-mail:</i> zvonimir.rakamaric@gmail.com <i>WWW:</i> www.zvonimir.info <i>Located in:</i> Bay Area, CA, USA
CITIZENSHIP	Permanent resident of Canada, citizen of Croatia
RESEARCH INTERESTS	My research area is formal methods for analysis and verification of complex systems. My emphasis is on practical, highly automatic, and scalable formal verification techniques for software, in particular for concurrent and heap-manipulating programs. I am interested in any technique that supports that goal, such as extended static checking, automated theorem proving, model checking, and runtime verification.
EDUCATION	University of British Columbia, Vancouver, BC, Canada Ph.D. in Computer Science, March 2011 <ul style="list-style-type: none">• Thesis Topic: Modular Verification of Shared-Memory Concurrent System Software• Supervisor: Alan J. Hu M.Sc. in Computer Science, August 2006 <ul style="list-style-type: none">• Thesis Topic: A Logic and Decision Procedure for Verification of Heap-Manipulating Programs• Supervisor: Alan J. Hu Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia Dipl. ing. (5-year degree) in Computer Science, June 2002 <ul style="list-style-type: none">• Thesis Topic: Java Assembler• Supervisor: Danko Basch
HONORS AND AWARDS	Silver Medal in the ACM Student Research Competition at the 32nd International Conference on Software Engineering (ICSE), 2010 Microsoft Research Graduate Fellowship, 2008/09 – 2009/10 UBC Four Year Doctoral Fellowship, 2009/10 ¹ Pacific Century Graduate Scholarship, 2008/09 ¹ UBC University Graduate Fellowship (4 times), 2005/06, 2006/07, 2007/08, 2008/09 ¹ Student travel award for the 5th Intl. Workshop on Satisfiability Modulo Theories (SMT), 2007 Outstanding Student Paper Award sponsored by Microsoft Research Cambridge, 13th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS), 2007 Croatian Ministry of Science and Education Grant for Study Abroad, 2004 Grant for The Calculemus Autumn School, 2002 University of Zagreb Rector Award, 2002 Croatian Ministry of Science and Education Scholarship, 1997/98 – 2001/02 Second Place in Croatian Competition in Informatics, 1997

¹Declined in order to accept the Microsoft Research Graduate Fellowship.

PROFESSIONAL
EXPERIENCE

Carnegie Mellon University, Silicon Valley Campus, NASA Ames Research Park, CA, USA

Postdoctoral Fellow

Mar 2011 — present

The goal of the project I've been working on is improving coverage of testing and checking of NASA's flight critical systems.

Dept. of Computer Science, University of British Columbia, Vancouver, BC, Canada

Research Assistant

Sep 2006 — Mar 2011

I have been researching how to automatically and effectively analyze and check shared-memory concurrent system software. I developed three main contributions: a scalable and precise memory model for low-level software verification, a technique for automatic inference of a class of specifications (frame axioms), and an approach to context-bounded analysis of concurrent system programs by translating them into sequential programs.

Software Reliability Research Group, Microsoft Research, Redmond, WA, USA

Research Intern

Jul 2006 — Oct 2006

During my first internship, I worked on practical techniques for verification of programs that use linked data structures. I developed the modular static checker *HAVOC* that translates C source and annotations into *BoogiePL* (Microsoft's intermediate language for verification). *HAVOC* remains active in Microsoft Research with many people contributing and using it.

Oct 2008 — Jan 2009

In a second internship, I started *STORM* — a tool for statically finding concurrency errors in systems code. The key idea was to extend recent theoretical ideas by improving scalability and precision, thereby making them applicable to real concurrent software. I applied *STORM* to Microsoft's code bases and found a bug in the driver development kit provided to their customers.

Nov 2009 — Feb 2010

Since *STORM* showed great promise, I was invited for a third internship, during which I interacted with product teams to improve *STORM* and make it a software developers' tool of choice for finding concurrency bugs in their code. *STORM* uncovered many more bugs, and my work on *STORM* has been incorporated into the ongoing *Poirot* project at Microsoft Research.

Dept. of Computer Science, University of British Columbia, Vancouver, BC, Canada

Research Assistant

May 2005 — Aug 2006

During my master's thesis, I invented with another student a novel logic for verification of heap-manipulating programs. I also developed the accompanying automatic decision procedure.

TIS.kis, Zagreb, Croatia

Software Engineer/Developer

Mar 2003 — Aug 2004

I was a member of the team that developed an application for buying and downloading content (e.g. pictures, melodies, movies, etc.) via SMS, MMS, and WAP to mobile phones. I also developed an application for sending WAP Push messages to mobile phones.

REFEREED
JOURNAL
PUBLICATIONS

D. Babić, B. Cook, A. J. Hu, Z. Rakamarić, "Proving Termination of Non-Linear Command Sequences", invited paper for a special issue of *Formal Aspects of Computing*. Submitted in June 2009.

S. Chatterjee, S. Lahiri, S. Qadeer, Z. Rakamarić, "A Low-Level Memory Model and an Accompanying Reachability Predicate", *International Journal on Software Tools for Technology Transfer (STTT)*, 11(2), Springer, February 2009, pp 105–116.

REFEREED
CONFERENCE
PUBLICATIONS

M. Emmi, S. Qadeer, Z. Rakamarić, "Delay-Bounded Scheduling", *Proceedings of the 38th ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL 2011)*, ACM, 2011,

pp 411–422. (Acceptance rate: 49/209, 24%)

N. Ghafari, A. J. Hu, Z. Rakamarić, “Context-Bounded Translations for Concurrent Software: An Empirical Evaluation”, *Proceedings of the 17th International SPIN Workshop on Model Checking Software (SPIN 2010)*, Lecture Notes in Computer Science, Springer, Vol. 6349, 2010, pp 227–244. (Acceptance rate: 13/29, 45%)

S. Lahiri, S. Qadeer, Z. Rakamarić, “Static and Precise Detection of Concurrency Errors in Systems Code Using SMT Solvers”, *Proceedings of the 21st International Conference on Computer Aided Verification (CAV 2009)*, Lecture Notes in Computer Science, Springer, Vol. 5643, 2009, pp 509–524. (Acceptance rate: 36/135, 27%)

Z. Rakamarić, A. J. Hu, “A Scalable Memory Model for Low-Level Code”, *Proceedings of the 10th International Conference on Verification, Model Checking and Abstract Interpretation (VMCAI 2009)*, Lecture Notes in Computer Science, Springer, Vol. 5403, 2009, pp 290–304. (Acceptance rate: 24/72, 33%)

Z. Rakamarić, A. J. Hu, “Automatic Inference of Frame Axioms Using Static Analysis”, *Proceedings of the 23rd IEEE/ACM International Conference on Automated Software Engineering (ASE 2008)*, IEEE, 2008, pp 89–98. (Acceptance rate: 34/280, 12%)

Z. Rakamarić, R. Bruttomesso, A. J. Hu, A. Cimatti, “Verifying Heap-Manipulating Programs in an SMT Framework”, *Proceedings of the 5th International Symposium on Automated Technology for Verification and Analysis (ATVA 2007)*, Lecture Notes in Computer Science, Springer, Vol. 4762, 2007, pp 237–252. (Acceptance rate: 36/88, 41%)

D. Babić, B. Cook, A. J. Hu, Z. Rakamarić, “Proving Termination by Divergence”, *Proceedings of the 5th IEEE International Conference on Software Engineering and Formal Methods (SEFM 2007)*, IEEE Computer Society, 2007, pp 93–102. (Acceptance rate unknown)

S. Chatterjee, S. Lahiri, S. Qadeer, Z. Rakamarić, “A Reachability Predicate for Analyzing Low-Level Software”, *Proceedings of the 13th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2007)*, Lecture Notes in Computer Science, Springer, Vol. 4424, 2007, pp 19–33. (Acceptance rate: 45/204, 22%)

Outstanding Student Paper Award. Invited for special section submission to the International Journal on Software Tools for Technology Transfer (STTT).

Z. Rakamarić, J. Bingham, A. J. Hu, “An Inference-Rule-Based Decision Procedure for Verification of Heap-Manipulating Programs with Mutable Data and Cyclic Data Structures”, *Proceedings of the 8th International Conference on Verification, Model Checking and Abstract Interpretation (VMCAI 2007)*, Lecture Notes in Computer Science, Springer, Vol. 4349, 2007, pp 106–121. (Acceptance rate: 21/85, 24%)

J. Bingham, Z. Rakamarić, “A Logic and Decision Procedure for Predicate Abstraction of Heap-Manipulating Programs”, *Proceedings of the 7th International Conference on Verification, Model Checking and Abstract Interpretation (VMCAI 2006)*, Lecture Notes in Computer Science, Springer, Vol. 3855, 2005, pp 207–221. (Acceptance rate: 27/58, 47%)

D. Babić, Z. Rakamarić, “Bytecode Optimization”, *Proceedings of the 24th International Conference on Information Technology Interfaces (ITI 2002)*, 2002, pp 377–382. (Acceptance rate unknown)

G. Jakovljević, Z. Rakamarić, D. Babić, “Java Simulator of Real-Time Scheduling Algorithms”, *Proceedings of the 24th International Conference on Information Technology Interfaces (ITI 2002)*, 2002, pp 411–417. (Acceptance rate unknown)

OTHER REFEREED PUBLICATIONS

Z. Rakamarić, “STORM: Static Unit Checking of Concurrent Programs”, *ACM Student Research Competition, Proceedings of the 32nd International Conference on Software Engineering (ICSE 2010)*, ACM, Vol. 2, 2010, pp 519–520.

Silver Medal Winner in the Competition.

Z. Rakamarić, R. Bruttomesso, A. J. Hu, A. Cimatti, "Deciding Unbounded Heaps in an SMT Framework", Presentation-only paper, *Proceedings of the 5th International Workshop on Satisfiability Modulo Theories (SMT 2007)*, 2007, page 60.

OTHER
PUBLICATIONS

D. Babić, Z. Rakamarić, "Asynchronously Communicating Visibly Pushdown Systems", *EECS Department, University of California, Berkeley Tech Report UCB/EECS-2011-108*, Oct 2011.

Z. Rakamarić, "Modular Verification of Shared-Memory Concurrent System Software", *Ph.D. Thesis*, Department of Computer Science, The University of British Columbia, Mar 2011.

M. Emmi, S. Qadeer, Z. Rakamarić, "Delay-Bounded Scheduling: A Canonical Characterization of Scheduler Nondeterminism", *Microsoft Research Tech Report MSR-TR-2010-123*, Sep 2010.

D. Babić, Z. Rakamarić, "Guidebook for Graduate Studies Abroad" (in Croatian), P.O.I.N.T., ISBN: 978-953-99805-1-9, Croatia, 2007.

S. Chatterjee, S. Lahiri, S. Qadeer, Z. Rakamarić, "A Reachability Predicate for Analyzing Low-Level Software", *Microsoft Research Tech Report MSR-TR-2006-154*, Nov 2006.

Z. Rakamarić, "A Logic and Decision Procedure for Verification of Heap-Manipulating Programs", *M.Sc. Thesis*, Department of Computer Science, The University of British Columbia, Aug 2006.

Z. Rakamarić, J. Bingham, A. J. Hu, "A Better Logic and Decision Procedure for Predicate Abstraction of Heap-Manipulating Programs", *UBC Department of Computer Science Tech Report TR-2006-02*, Jan 2006.

J. Bingham, Z. Rakamarić, "A Logic and Decision Procedure for Predicate Abstraction of Heap-Manipulating Programs", *UBC Department of Computer Science Tech Report TR-2005-19*, Sep 2005.

INVITED TALKS

"Static and Precise Detection of Concurrency Errors in Systems Code Using SMT Solvers", Oct 20, 2009, Institute of Science and Technology (IST) Austria, Klosterneuburg, Austria

"Static and Precise Detection of Concurrency Errors in Systems Code Using SMT Solvers", Oct 9, 2009, Schloss Dagstuhl Seminar (by-invitation-only international seminar) "Interaction versus Automation: The Two Faces of Deduction", Wadern, Germany

"Static and Precise Detection of Concurrency Errors in Systems Code Using SMT Solvers", Aug 5, 2009, Intel, Hillsboro, OR, USA

"Static and Precise Detection of Concurrency Errors in Systems Code Using SMT Solvers", Jun 25, 2009, Verimag, France

"Automatizing Modular Software Verification Using Static Analysis", Oct 2, 2008, Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia

CONFERENCE
TALKS

"Context-Bounded Translations for Concurrent Software: An Empirical Evaluation", SPIN, Sep 29, 2010, Enschede, The Netherlands

"STORM: Static Unit Checking of Concurrent Programs", ICSE, May 6, 2010, Cape Town, South Africa

"Static and Precise Detection of Concurrency Errors in Systems Code Using SMT Solvers", CAV, Jun 29, 2009, Grenoble, France

"A Scalable Memory Model for Low-Level Code", VMCAI, Jan 20, 2009, Savannah, GA, USA

"Automatic Inference of Frame Axioms Using Static Analysis", ASE, Sep 17, 2008, L'Aquila, Italy

"Verifying Heap-Manipulating Programs in an SMT Framework", ATVA, Oct 25, 2007, Tokyo,

Japan

“Deciding Unbounded Heaps in an SMT Framework”, SMT, Jul 1, 2007, Berlin, Germany

“A Reachability Predicate for Analyzing Low-Level Software”, TACAS, Mar 24, 2007, Braga, Portugal

“An Inference-Rule-Based Decision Procedure for Verification of Heap-Manipulating Programs with Mutable Data and Cyclic Data Structures”, VMCAI, Jan 14, 2007, Nice, France

PROFESSIONAL
SERVICE

Reviewer for journals:

- Formal Methods in System Design (FMSD) 2011
- ACM Transactions on Programming Languages and Systems (TOPLAS) 2009

Reviewer for conferences:

- International Conference on Formal Methods in Computer-Aided Design (FMCAD) 2011
- International Conference on Computer Aided Verification (CAV) 2010
- International Conference on Fundamental Approaches to Software Engineering (FASE) 2010
- International Conference on Computer Aided Verification (CAV) 2009
- International Symposium on Automated Technology for Verification and Analysis (ATVA) 2008
- International Conference on Computer Aided Verification (CAV) 2008
- Design, Automation and Test in Europe Conference and Exposition (DATE) 2008
- International Haifa Verification Conference (HVC) 2007
- International Symposium on Automated Technology for Verification and Analysis (ATVA) 2007
- International Conference on Computer Aided Verification (CAV) 2007
- Heap Analysis and Verification Workshop (HAV) 2007
- International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2007
- Workshop on Pragmatics of Decision Procedures in Automated Reasoning (PDPAR) 2006
- Design Automation Conference (DAC) 2006
- Design, Automation and Test in Europe Conference and Exposition (DATE) 2006

OTHER
EDUCATION

Seminars and Summer Schools

- Schloss Dagstuhl Seminar “Decision Procedures in Software, Hardware and Bioware”, 2010, Wadern, Germany²
- Schloss Dagstuhl Seminar “Interaction versus Automation: The Two Faces of Deduction”, 2009, Wadern, Germany
- The Calculemus Autumn School, 2002, Pisa, Italy

TEACHING
EXPERIENCE

University of British Columbia, Vancouver, BC, Canada

- CPSC 311 — Definition of Programming Languages, Fall 2004. Prepared and graded programming assignments and problem sets, graded midterm and final exams.
- CPSC 312 — Functional and Logic Programming, Spring 2005. Led review sessions, graded midterm and final exams, prepared and graded homework assignments, held office hours.

MEMBERSHIPS

ACM, IEEE, IEEE Computer Society

REFERENCES

Available upon request.

²Couldn't attend because volcanic ash from Iceland brought air traffic to a halt in Europe.