Curriculum Vitae — Domagoj Babić

Contact Information

Phone:	+1 (510) 331-8993
Email:	babic@berkeley.edu, babic.domagoj@gmail.com
WWW:	http://www.domagoj.info/

Education

2008	Ph.D. in Computer Science, University of British Columbia, Canada
2003	M.Sc. in Computer Science, University of Zagreb, Croatia
2001	Dipl.Ing. in Electrical Engineering, University of Zagreb, Croatia

Citizenship

Citizen of Croatia and Canada, US Permanent Resident

Selected Honours and Awards

2011–2012	Lawrence Livermore National Lab research grant
2010–2012	Post-Doctoral Fellowship Research Award from the Canadian Natural Science and Engineering Research Council (NSERC)
2005–2007	Microsoft Research Graduate Fellowship
2007	1st place, International Satisfiability Modulo Theories competition, quantifier-free bit-vector arithmetic category
2004–2005	Fulbright Fellowship, declined in order to attend UBC
2004–2005	UBC University Graduate Fellowship
2000	University of Zagreb Rector Award

Selected Invited Talks

2013	NASA Jet Propulsion Lab, La Cañada Flintridge, CA, USA
2013	University of Dallas, Texas, Department of Computer Science
2013	University of Pennsylvania, Computer & Information Science Dep.
2013	Purdue University, Computer Science Department
2012	Princeton University, Computer Science Department
2012	University of Maryland, College Park, MD, USA
2012, 2009	NASA Ames, Moffett Field, USA
2011, 2010	Lawrence Livermore National Lab, Livermore, USA
2011, 2008	Microsoft Research Redmond, Redmond, USA
2013, 2011, 2007	Stanford Research Institute, Menlo Park, USA
2011, 2007	Intel, Strategic CAD Labs, Portland, USA
2013, 2009, 2007, 2005	Microsoft Research Cambridge, Cambridge, UK
2007	Stanford, Computer Science Department
2007	UC Berkeley, EECS
2007	Carnegie Mellon University, Department of Computer Science
2007	MIT, Computer Science and Artificial Intelligence Laboratory
2007	Schloss Dagstuhl, Wadern, Germany
2007	Max Planck Institute for Software Systems

Program Committee Service

2014 Program committee member, International Conference on Computer Aided Verification (CAV'14)
2014 Program committee member, NASA Formal Methods Symposium (NFM'14)
2013 Program committee member, First Botnet Fighting Conference (Botconf'13)
2013 Program committee member, International Conference on Computer Aided Verification (CAV'13)
2010 Program committee member, International Conference on Computer Aided Verification (CAV'10)
2010 Program committee member, International Symposium on Stabilization, Safety, and Security of Distributed Systems (SSS'10)
2009 Program committee member, Satisfiability Modulo Theories workshop (SMT'09)
2008 Co-chair and co-organizer of the Bit-Precise Reasoning workshop (affiliated with CAV 2008)

Research Experience

Google, Inc., Mountain View, CA, USA
Senior Research Scientist *Apr 2013 –*
Working on making open software ecosystems secure by innovations in program security analysis, distributed machine learning, and system security.

Facebook, Inc., Menlo Park, CA, USA
Research Scientist *Aug 2012 – Apr 2013*
Worked on inference of probabilistic stateful models for representing users, their actions, and for analysis of various distributed services employed at FB. Such models have a broad range of applications, from detection of fake accounts, feed- and ad-targeting, and speculative prefetching of data for latency minimization.

University of California at Berkeley, Computer Science Division, Berkeley, USA
Research Scientist *Feb 2010 – Aug 2012*
The focus of my research at UCB is on various aspects of software security, especially those that have a close connection to the world of software verification and decision procedures. More broadly, I was studying automated learning of grammars and automata for various applications in security and testing.

Synopsys, Mountain View, USA
Senior R&D Eng. *Jul 2009 – Feb 2010*
I was working on a guided random test case generation project, which includes symbolic simulation, constraint solving, and improving coverage.

Fujitsu Labs America, Sunnyvale, USA
Research Consultant *Feb 2009 – Jun 2009*
First, I worked on formalization of databases in decidable subsets of first-order logic and application of Satisfiability Modulo Theories to automatized test-case generation for checking various properties of databases. Later, I worked on verification of web applications, JavaScript in particular.

Cadence Research Laboratories, Berkeley, USA
Research Scientist *Jun 2008 – Jan 2009*
Did research on automated tools for software analysis, verification, and testing. Also, I was working on decision procedures that such automated tools use for reasoning.

Microsoft Research, Redmond, USA
Visiting Graduate Researcher *Apr 2005 – Jul 2005*
Worked on decision procedures for linear and non-linear modular arithmetic.

University of British Columbia, Vancouver, Canada
Research Assistant *Sep 2003 – Aug 2008*
Researched how structure of software can be exploited for improving scalability and precision of automated software verification tools.

University of Zagreb, Zagreb, Croatia
Research and Teaching Assistant *Sep 2001 – Aug 2003*
Did research on parallel signal processing algorithms for FPGAs. Microprocessors I – Led lab sessions, prepared and marked midterms and finals. Occasionally led tutorials and thought several lectures. Modeling and Simulation – Marker.

Teaching

2010	Advanced Topics in Computer Security (UCB CS294-50), guest lecturer
2004	Models of Computation (UBC CPSC 121), teaching assistant
2001–2003	Computer Architecture (at University of Zagreb), teaching assistant

Professional Service

Panels. NSF panelist in 2011, USA.

Reviewing. Reviewer for IEEE Transactions on Dependable and Secure Computing, Formal Methods in System Design (FMSD), International Journal on Software Tools for Technology Transfer (STTT), International Conference on Computer Aided Verification (CAV), Principles of Programming Languages (POPL), Static Analysis Symposium (SAS), Design Automation Conference (DAC), Tools and Algorithms for the Construction and Analysis of Systems (TACAS), Design and Test Europe (DATE), Automated Technology for Verification and Analysis (ATVA), Satisfiability Modulo Theories workshop (SMT), Haifa Verification Conference (HVC), Asia and South Pacific Design Automation Conference (ASP-DAC), International Conference on Computer-Aided Design (ICCAD), IEEE Transactions on Software Engineering.

Involvement in Creation of Standards. Participated in formulation of the Satisfiability Modulo Theories (SMT) standard for bit-vector arithmetic (QF_BV), which is now used as a standard SMT input format.

Creation of Benchmarks. Generated and delivered software verification benchmarks used in several SMT competitions, generated and made available malware system call dependency graphs for the benefit of other researchers.

Peer-Reviewed Journal Publications

1. **Domagoj Babić**, Byron Cook, Alan J. Hu, and Zvonimir Rakamarić. "Proving Termination of Non-Linear Command Sequences", *Formal Aspects of Computing*, pg. 1–15, Springer Verlag, 2012.
2. **Domagoj Babić**, Daniel Reynaud, and Dawn Song. "Recognizing Malicious Software Behaviors with Tree Automata Inference", *Formal Methods in System Design*, pg. 107–128, Springer Verlag, 2012.
3. **Domagoj Babić** and Alan J. Hu. "Approximating the Safely Reusable Set of Learned Facts". *International Journal on Software Tools for Technology Transfer (STTT)*, 11(4), pg. 325–338, Springer Verlag, 2009.
4. **Domagoj Babić**, Jesse Bingham, and Alan J. Hu. "B-Cubing: New Possibilities for Efficient SAT-Solving", *IEEE Transactions on Computers*, 55(11), pg. 1315–1324, IEEE Computer Society, 2006.

Peer-Reviewed Publications

1. Sirinda Palahan, **Domagoj Babić**, Swarat Chaudhuri, Daniel Kifer, "Extraction of Statistically Significant Malware Behaviors", *Proceedings of the* 29th *Computer Security Applications Conference (ACSAC'13)*, 2013.
2. **Domagoj Babić** and Zvonimir Rakamarić, "Asynchronously Communicating Visibly Pushdown Systems", *Proceedings of the 2013 IFIP Joint International Conference on Formal Techniques for Distributed Systems (FORTE13)*, pg. 225–242, LNCS vol. 7892, Springer, 2013.

3. Matko Botinčan and **Domagoj Babić**, "Sigma*: Symbolic Learning of Input-Output Specifications", *Proceedings of the* 40th *ACM SIGPLAN-SIGACT Symposium Principles of Programming Languages (POPL'13)*, pg. 443–456, ACM, 2013.
4. **Domagoj Babić**, Daniel Reynaud, and Dawn Song. "Malware Analysis with Tree Automata Inference", *Proceedings of the* 23rd *Int. Conference on Computer Aided Verification (CAV'11)*, pg. 116–131, LNCS vol. 6806, Springer, 2011.
5. **Domagoj Babić**, Lorenzo Martignoni, Stephen McCamant, and Dawn Song. "Statically-Directed Dynamic Automated Test Generation", *Proceedings of the International Symposium on Software Testing and Analysis (ISSTA'11)*, pg. 12–22, ACM Press, 2011.
6. Chia Yuan Cho, **Domagoj Babić**, Pongsin Poosankam, Kevin Chen, Edward XueJun Wu, and Dawn Song. "MACE: Model-inference-Assisted Concolic Exploration for Protocol and Vulnerability Discovery", *Proc. of the 2011 USENIX Security Symposium*, 2011.
7. Chia Yuan Cho, **Domagoj Babić**, Richard Shin, and Dawn Song. "Inference and Analysis of Formal Models of Botnet Command and Control Protocols", *Proc. of the 2010 ACM Conference on Computer and Communications Security (CCS'10)*, pg. 426–440, ACM Press, 2010.
8. Juan Caballero, Pongsin Poosankam, Stephen McCamant, **Domagoj Babić** and Dawn Song. "Input Generation via Decomposition and Re-Stitching: Finding Bugs in Malware", *Proc. of the 2010 ACM Conference on Computer and Communications Security (CCS'10)*, pg. 413–426, ACM Press, 2010.
9. **Domagoj Babić** and Alan J. Hu. "Calysto: Scalable and Precise Extended Static Checking", *Proc. of the* 30th *Int. Conference on Software Engineering (ICSE'08)*, pg. 211–220, ACM Press, 2008.
10. **Domagoj Babić** and Alan J. Hu. "Structural Abstraction of Software Verification Conditions", *Proc. of the* 19th *Int. Conference on Computer Aided Verification (CAV'07)*, pg. 371–383, LNCS vol 4590, Springer, 2007.
11. **Domagoj Babić**, Byron Cook, Alan J. Hu, and Zvonimir Rakamarić. "Proving Termination by Divergence", *Proc. of the* 19th *Int. Conference on Software Engineering and Formal Methods (SEFM'07)*, pg. 93–102, IEEE Computer Society, 2007.
12. **Domagoj Babić** and Alan J. Hu. "Exploiting Shared Structure in Software Verification Conditions", *Proc. of Haifa Verification Conference (HVC'07)*, pg. 169–184, LNCS vol 4899, Springer, 2007.
13. Frank Hutter, **Domagoj Babić**, Holger H. Hoos, and Alan J. Hu. "Boosting Verification by Automatic Tuning of Decision Procedures", *Proc. of Int. Conference on Formal Methods in Computer-Aided Design (FMCAD'07)*, pg. 27–37, IEEE Computer Society, 2007.
14. **Domagoj Babić**, Jesse Bingham, and Alan J. Hu. "B-Cubing Theory: New Possibilities for Efficient SAT-Solving", *Proc. of* 10th *IEEE International High-Level Design Validation and Test Workshop (HLDVT'07)*, pg. 192–199, IEEE Press, 2005.
15. **Domagoj Babić**, Jesse Bingham, and Alan J. Hu. "Efficient SAT Solving: Beyond Supercubes", *Proc. of the* 42nd *Design Automation Conference (DAC'05)*, pg. 744–749, ACM Press, 2005.
16. **Domagoj Babić** and Alan J. Hu. "Integration of Supercubing and Learning in a SAT Solver", *Proc. of the* 10th *Asia and South Pacific Design Automation Conference (ASPDAC'05)*, Vol 1, pg. 438–444, ACM Press, 2005.

17. **Domagoj Babić** and Mario Kovač. "Polynomial Transform Based DCT Implementation", *Student Contest Proc. of the 4th Electronic Circuits and Systems Conference (ESC'03)*, pg. 5–9, 2003.

Theses

1. **Domagoj Babić**. "Exploiting Structure for Scalable Software Verification", *Ph.D. thesis*, University of British Columbia, Computer Science Department, Vancouver, Canada, 2008.
2. **Domagoj Babić**. "Discrete Cosine Transform Algorithms for FPGA Devices", *M.Sc. thesis*, Faculty of Elec. Eng. and Computing, Zagreb University, Croatia, 2003.
3. **Domagoj Babić**. "Designing RISC processors in FPGAs", *Dipl.Ing. thesis*, Faculty of Elec. Eng. and Computing, University of Zagreb, Croatia, 2001. (in Croatian)

Technical Reports

1. **Domagoj Babić**, Matko Botinčan, and Dawn Song. "Symbolic Grey-Box Learning of Input-Output Relations", *UCB Technical Report UCB/EECS-2012-59*, EECS Department, University of California, Berkeley, 2012.
2. **Domagoj Babić** and Zvonimir Rakamarić. "Asynchronously Communicating Visibly Pushdown Systems", *UCB Technical Report UCB/EECS-2011-108*, EECS Department, University of California, Berkeley, 2011.
3. **Domagoj Babić** and Madanlal Musuvathi. "Modular Arithmetic Decision Procedure", *MSR Technical Report TR-2005-114*, Microsoft Research, 2005.

Tool Papers

1. **Domagoj Babić** and Frank Hutter. "Spear Theorem Prover", *In Proc. of the SAT 2008 Race*, Guangzhou, China, 2008.
2. **Domagoj Babić** and Frank Hutter. "Spear", *In Proc. of the SAT 2007 competition*, Berlin, Germany, Jan 2007.
3. **Domagoj Babić** and Alan J. Hu. "HyperSAT", *In Proc. of the SAT 2005 competition*, St. Andrews, Scotland, UK.

Books

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

Research Software

2011 Tree automata inference engine
2010 Static analysis engine for binary analysis in the BitBlaze project
2008 Calysto extended static checker
2007 Spear bit-vector arithmetic decision procedure
2005 HyperSAT boolean satisfiability solver

References

Available upon request.