AKASH LAL

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Research Interests

My research interests span all aspects of programming languages and compilers, with particular emphasis on program verification. In my dissertation, I have developed tools and techniques for the verification of multi-threaded programs that use shared memory for communication.

Education

2003 - Present: **Ph.D. Candidate**, Computer Sciences Department, University of Wisconsin.
Advisor: Prof. Thomas Reps
Dissertation: *Interprocedural Analysis of Concurrent Programs*

May 2005:   **M.S.**, Computer Sciences Department, University of Wisconsin.
GPA 4.0

May 2003:   **B. Tech.**, Computer Science and Engineering, IIT-Delhi.
Department Rank 2/41, Institute Rank 3/400+
GPA 9.7/10, Major GPA 9.9/10

Awards and Honors

- Outstanding Graduate-Student Research Award, UW Computer Sciences Department, 2009.
- Microsoft Graduate Research Fellowship, 2007 – 2009.
- IBM Ph.D. Scholarship Award in recognition of academic excellence, 2006.

Work Experience

Research Assistant   *Fall 2004 – Spring 2009*
Computer Sciences Department, University of Wisconsin   *Advisor: Thomas Reps*
My research work has focused on model checking techniques for program verification. We built new and efficient program analyses using weighted pushdown systems. We have also developed a new technique for the verification of concurrent programs and are in the process of applying it to low-level machine code

Research Intern   *Fall 2007*
Microsoft Research, Bangalore, India   *Mentor: Ganesan Ramalingam*
I worked on techniques for verifying correctness of the Windows NTFS driver.

Research Intern   *Summer 2006*
Microsoft Research, Redmond, WA   *Mentor: Sumit Gulwani*
I worked on verification of concurrent programs. We developed a class of abstractions for concurrent programs and gave a refinement technique to tune the abstraction to a desired degree of precision and scalability.

Intern   *Summer 2004*
GrammaTech, Inc., Ithaca, NY   *Mentor: David Melski*
My work was on studying and implementing a scalable approach for verification of properties in programs using weighted pushdown systems. I also helped in writing a grant proposal for the company.

Intern   *Summer 2002*
INRIA, Rocquencourt, France   *Mentor: François Fages*
I worked on "Log-based reconciliation for nomadic applications". My work involved the study and implementation of an efficient constraint-programming approach for solving the cutset problem.

Journal Publications

- Akash Lal and Thomas Reps, **Reducing concurrent analysis under a context bound to sequential analysis**. To appear in: *Int. Journal on Formal Methods in System Design*. April 2009.

- François Fages and Akash Lal, **A constraint programming approach to cutset problems**. *Computers and Operations Research* 33, 10 (Oct. 2006), pp. 2852-2865.

Refereed Publications

- Junghee Lim, Akash Lal, and Thomas Reps, **Symbolic analysis via semantic reinterpretation**. To appear in *Proc. SPIN Workshop on Model Checking of Software (SPIN)*, 2009.

- Akash Lal and Thomas Reps. **Reducing concurrent analysis under a context bound to sequential snalysis**. In *Proc. Computer Aided Verification (CAV),* 2008. **(Invited for special submission to the Int. Journal on Formal Methods in System Design.)**

- Akash Lal and Thomas Reps. **Solving multiple dataflow queries using WPDSs**. In *Proc. Static Analysis Symposium (SAS),* 2008.

- Nicholas Kidd, Akash Lal, and Thomas Reps. **Language strength reduction**. In *Proc. Static Analysis Symposium (SAS),* 2008.

- Akash Lal, Tayssir Touili, Nicholas Kidd, and Thomas Reps. **Interprocedural analysis of concurrent programs under a context bound**. In *Proc. Tools and Algorithms for the Construction and Analysis of Systems (TACAS),* 2008.

- Akash Lal, Nicholas Kidd, Thomas Reps, and Tayssir Touili, **Abstract error projection**. In *Proc. Static Analysis Symposium (SAS)*, 2007.

- Akash Lal and Thomas Reps, **Improving pushdown system model checking**. In *Proc. Computer Aided Verification (CAV)*, 2006.

- Akash Lal, Junghee Lim, Marina Polishchuk, and Ben Liblit, **Path optimization in programs and its application to debugging**. In *Proc. European Symposium On Programming (ESOP)*, 2006. **(Nominated for the ETAPS best paper award.)**

- Akash Lal, Gogul Balakrishnan, and Thomas Reps. **Extended weighted pushdown systems**. In *Proc. Computer Aided Verification (CAV)*, 2005.

- Gogul Balakrishnan, Thomas W. Reps, Nicholas Kidd, Akash Lal, Junghee Lim, David Melski, Radu Gruian, Suan Hsi Yong, Chi-Hua Chen, Tim Teitelbaum, **Model checking x86 executables with**

CodeSurfer/x86 and WPDS++, (tool-demonstration paper). In *Proc. Computer Aided Verification (CAV)*, 2005.

- Deepak Garg, <u>Akash Lal</u>, and Sanjiva Prasad, **Effective chemistry for synchrony and asynchrony**. In *Proc. IFIP International Conference on Theoretical Computer Science (TCS),* 2004.

- François Fages and <u>Akash Lal</u>, **A global constraint for cutset problems**. *Fifth International Workshop on Integration of AI and OR techniques in constraint programming for combinatorial optimization problems (CPAIOR).* 2003.

Invited Papers

- Thomas Reps, <u>Akash Lal</u>, and Nicholas Kidd, **Program analysis using weighted pushdown systems** (invited paper). In *Proc. Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, 2007.

Pending Submissions

- <u>Akash Lal</u>, Junghee Lim, and Thomas Reps, **Verification of machine code**. Under preparation.

Technical Reports

- Nicholas Kidd, <u>Akash Lal</u>, and Thomas Reps, **Advanced queries for property checking**. Tech. report TR-1621, Computer Sciences Department, University of Wisconsin, Madison. October 2007.

- <u>Akash Lal</u>, Tayssir Touili, Nicholas Kidd, and Thomas Reps, **Weighted pushdown systems and weighted transducers**. Tech. report TR-1581, Computer Sciences Department, University of Wisconsin, Madison. October 2006.

- <u>Akash Lal</u> and Dieter van Melkebeek, **Graph isomorphism for colored graphs with color multiplicity bounded by three**. Tech. report TR-1523, Computer Sciences Department, University of Wisconsin, Madison. February 2005.

Lectures, Colloquia, and Conference Presentations

- Reducing concurrent analysis under a context bound to sequential analysis,
    - Conference on Computer Aided Verification (CAV), Princeton, NJ, USA, July 2008.
    - LIAFA, Université Paris Diderot – Paris 7, France, June 2008.

- Solving multiple dataflow queries using WPDSs,
    - Static Analysis Symposium (SAS), Valencia, Spain, July 2008.
    - LIAFA, Université Paris Diderot – Paris 7, France, June 2008.

- Interprocedural analysis of concurrent programs under a context bound,
    - École Normale Supérieure (ENS), Paris, France, June 2008.
    - Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS), Budapest, Hungary, April 2008.
    - Microsoft Research, Bangalore, India, October 2007.

- Abstract error projection,
    - Static Analysis Symposium (SAS), Kongens Lyngby, Denmark, August 2007.

- IBM Research, Hawthorne, USA, August 2007.
- Microsoft Research, Bangalore, India, January 2007.

- PC-based abstractions,
Microsoft Research, Redmond, Washington, August 2006.

- Improving pushdown system model checking,
Conference on Computer Aided Verification (CAV), Seattle, WA, USA, July 2006.

- Path optimization in programs and its application to debugging,
European Symposium on Programming (ESOP), Vienna, Austria, April 2006.

- Extended weighted pushdown systems,
  - Microsoft Research, Redmond, Washington, July 2005.
  - IBM, India Research Lab, January 2006.
  - IIT-Delhi, New Delhi, India, January 2006.
  - Conference on Computer Aided Verification (CAV), Edinburgh, Scotland, July 2005.

- Affine relation analysis in x86 code,
ONR MURI review meeting, Arlington, Virginia, February 2005.

Software

- Nicholas Kidd, Akash Lal, and Thomas Reps, WALi: The Weighted Automaton Library, 2007. http://www.cs.wisc.edu/wpis/wpds/download.php

- Nicholas Kidd, Thomas Reps, David Melski, and Akash Lal, WPDS++: A C++ implementation of weighted pushdown systems, 2005. http://www.cs.wisc.edu/wpis/wpds/download.php

Professional Activities

- External reviewer for Int. Journal on Formal Methods in System Design (FMSD) 2009, Computer Aided Verification (CAV) 2009, Programming Language Design and Implementation (PLDI) 2009, Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2009, CAV 2008, ASIAN Symposium on Programming Languages and Systems (APLAS) 2008, Foundations of Software Technology and Theoretical Computer Science (FSTTCS) 2008, Compiler Construction (CC) 2008, Static Analysis Symposium (SAS) 2007, TACAS 2007, Principles of Programming Languages (POPL) 2007, CAV 2006, APLAS 2006.
- Member of the Graduate Admissions Committee 2007, Computer Sciences Department, University of Wisconsin-Madison.
- Organized a programming competition in TRYST 2003, IIT-Delhi and took part in numerous programming and debugging competitions.

Other Academic Achievements

- IIT-Delhi Merit Award for academic excellence for semesters 1, 2, 3, 6 and 8.
- Obtained an all-India rank of 30 in the IIT Joint Entrance Exam 1999, which was taken by over 100,000 students.
- Vilas Travel Grant, University of Wisconsin-Madison, awarded to present paper at TACAS 2008.
- Team member, University of Wisconsin-Madison Programming Team, 2004,
  - First position in 2004 ACM North Central North America Programming Contest.
  - Competed in 2004 ACM-ICPC World Finals at Prague, Czech Republic.

- Travel and accomodation funding from the Indian Association for Research in Computer Science (IARCS) to attend TECS 2003, a school on program analysis.

Personal Information

- Country of Citizenship: India
- Visa Status: F1

References

References available upon request