

# PRADEEP RAMACHANDRAN

PhD candidate  
Department of Computer Science  
University of Illinois, Urbana Champaign  
*E-mail* – pramach2@uiuc.edu

201 N. Goodwin Avenue,  
Urbana, IL - 61801.  
*Tel* - 1-217-419-0693  
*http* : //rsim.cs.uiuc.edu/~ pramach2

---

---

## OBJECTIVE

- To understand and address issues related to hardware failures in modern processor reliability through micro-architectural research

## EDUCATIONAL BACKGROUND

- **PhD candidate, August 2005 - Present**,  
University of Illinois at Urbana Champaign (UIUC), Urbana, Illinois.  
PhD advisor: Prof. Sarita Adve, *GPA* : 3.94/4.0
- **Master of Science (MS) in Computer Science, May, 2007**,  
University of Illinois at Urbana Champaign (UIUC), Urbana, Illinois.  
Thesis Topic: Metrics for Architecture Level Lifetime Reliability Analysis  
Thesis Advisor: Prof. Sarita Adve, *GPA* : 3.92/4.0
- **Bachelor of Technology (B.Tech) in Computer Science, May, 2005**,  
Indian Institute of Technology (IIT), Madras.  
Final Project: Agile Algorithm Co-Processor Design  
Project Guide: Prof. V. Kamakoti, *GPA* : 8.53/10.0

## ACADEMIC ACHIEVEMENTS

- Intel PhD fellowship, 2009.
- IBM PhD Scholarship, 2009.
- Secured Rank 27 (out of over 1.7 lakh candidates) in IIT Joint Entrance Exam, 2001.
- Secured Rank 6 (out of over 1 lakh candidates) in Roorkee Entrance Exam, 2001.
- Amongst top 35 students at the Indian National Chemistry Olympiad, 2001.
- Aditya Birla Scholarship interview candidate, Mumbai, India, 2001.

## RESEARCH EXPERIENCE

- **Research Assistant**, August '05 - Current: RSIM group, UIUC, under Prof. Sarita Adve  
The focus of my research is to design architecture-level solutions to deal with hardware failures. I have been part of three projects at UIUC.
  1. **SWAT - SoftWare Anomaly Treatment**  
*June '06 - Present, University of Illinois, under Prof. S. Adve, Prof. V. Adve and Prof. Y. Zhou.*  
The aim of this project is to design and develop low-cost software-level symptoms to detect failures from both hardware faults and software bugs, and to use hardware/software co-designed techniques to diagnose, recover, and repair the system for continuous operation.
  2. **Automatic Generation of Hardware Assertions for Microprocessors**  
*February '08 - May '09, University of Illinois, under Prof. S. Adve, and Prof. S. Vasudevan.* This work interposes the hardware fault tolerance, software fault tolerance and hardware verification worlds. The goal is to use data mining techniques to automatically derive *assertions* and/or properties of the hardware from a microarchitecture-level description of the hardware (a C-level software simulator) to aid in both formal hardware verification, and fault tolerance.

### 3. Lifetime Reliability

August '05 - April '08, University of Illinois, under Prof. S. Adve, Pradip Bose and Jude Rivers.

This project, in collaboration with IBM, deals with developing tools and metrics to understand the impact of hard errors on lifetime reliability of modern processors.

- **Technical co-op**, June '07 - Nov '07: Systems and Technology group, IBM T.J. Watson Research Center  
Mentors: Prabhakar Kudva, Pia Sanda and Pradip Bose

This project focusses on understanding the microarchitectural effects of radiation-induced soft errors. For this, I assisted in developing the Statistical Fault Injection (SFI) tool that accurately models soft errors. Injections in microprocessor systems, such as the IBM POWER6, performed through whole-chip simulations on a hardware emulator, are performed to understand the effect of these soft errors.

## PUBLICATIONS

1. Siva Kumar Sastry Hari, Man-Lap Li, **Pradeep Ramachandran**, Byn Choi, and Sarita Adve, “mSWAT: Low-cost Hardware Fault Detection and Diagnosis for Multicore Systems” to appear in the *Proceedings of the International Symposium of Microarchitectre (MICRO)*, December, 2009.
2. Man-Lap Li, **Pradeep Ramachandran**, Rahmet Ulya Karpuzcu, Swarup Sahoo, Siva Kumar Sastry Hari, Sarita Adve, Vikram Adve and Yuanyuan Zhou, “Accurate Microarchitecture-level Fault Modeling for Studying Wear-out Faults” in the *Proceedings of the International Conference on High-Performance Computer Architecture (HPCA)*, February, 2009.
3. **Pradeep Ramachandran**, Prabhakar Kudva, Jeffrey Kellington, John Schumann, and Pia Sanda, “Statistical Fault Injection”. in the *Proceedings of the International Conference on Dependable Systems and Networks (DSN)*, June, 2008.
4. Man-Lap Li, **Pradeep Ramachandran**, Swarup Sahoo, Sarita Adve, Vikram Adve and Yuanyuan Zhou, “Trace-Based Diagnosis for Permanent Hardware Faults”. in the *Proceedings of the International Conference on Dependable Systems and Networks (DSN)*, June, 2008.
5. Swarup Sahoo, Man-Lap Li, **Pradeep Ramachandran**, Sarita Adve, Vikram Adve and Yuanyuan Zhou, “Using Likely Program Invariants to Detect Hardware Errors”. in the *Proceedings of the International Conference on Dependable Systems and Networks (DSN)*, June, 2008.
6. **Pradeep Ramachandran**, Sarita Adve, Pradip Bose, Jude Rivers and Jayanth Srinivasan, “Metrics for lifetime reliability”. in the *Proceedings of IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS)*, April, 2008.
7. Man-Lap Li, **Pradeep Ramachandran**, Swarup Kumar Sahoo, Sarita Adve, Vikram Adve and Yuanyuan Zhou, “SWAT: An Error Resilient System”. in the *Fourth Workshop on Silicon Errors in Logic - System Effects (SELSE - IV)*, March, 2008.
8. Man-Lap Li, **Pradeep Ramachandran**, Swarup Kumar Sahoo, Sarita Adve, Vikram Adve and Yuanyuan Zhou, “Understanding the propagation of hard faults to software and its implications on Resilient Systems Design”, in the *Proceedings of 13<sup>th</sup> International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, March, 2008.
9. Man-Lap Li, **Pradeep Ramachandran**, Sarita Adve, Vikram Adve and Yuanyuan Zhou, “Towards a Software-Hardware Co-designed Resilient System”. in the *Third Workshop on Silicon Errors in Logic - System Effects (SELSE - III)*, April, 2007.

## PATENTS

1. **Pradeep Ramachandran**, Prabhakar Kudva, Jeffrey Kellington, John Schumann, and Pia Sanda, “Design and Evaluation of Checkers in Micro-processors”, *IBM invention Disclosure Filed. Patent Pending, November, 2007.*

## TALKS

1. Invited talk, “SWAT: Designing Reliable Hardware through Treating Software Anomalies”, at *Intel, Hudson, MA*, October, 2009.
2. Invited talk, “SWAT: Designing Reliable Hardware through Treating Software Anomalies”, at *Department of Computer Science, Indian Institute of Technology, Madras*, December 2008.

3. Workshop talk, “SWAT: An Error Resilient System”, at *GSRC Annual Symposium*, September 2008.
4. Paper presentation, “Statistical Fault Injection”. in *International Conference on Dependable Systems and Networks (DSN)*, June, 2008.
5. Paper presentation, “Metrics for Architecture-Level Lifetime Reliability Analysis”. in *International Symposium on Performance Analysis of Systems and Software (ISPASS)*, April, 2008.
6. Workshop talk, “Metrics for Architecture-Level Lifetime Reliability Analysis”. *Talk in GSRC workshop on Fault Modeling and Resiliency Analysis*, December 2007.
7. Paper presentation, “Towards a Software-Hardware Co-designed Resilient System”. *Talk in the Third Workshop on Silicon Errors in Logic - System Effects (SELSE - III)*, University of Texas at Austin, March, 2007.
8. Invited talk, “Reliability Aware Micro-Processors (RAMP)”, *Department of Computer Science, Indian Institute of Technology, Madras*, July 2006.
9. Seminar, “System-on-Chip - An FPGA perspective”. in *Short Term Training Program for college professors, IIT Madras*, September 2004.

## POSTERS

1. **Pradeep Ramachandran**, Man-Lap Li, Siva Kumar Sastry Hari, Sarita Adve, Shobha Vasudevan, “Application-Aware SoftWare Anomaly Treatment (SWAT)”, *Poster in Giga-Scale Research Center (GSRC) Annual Symposium*, Sept, 2009.
2. Siva Kumar Sastry Hari, Man-Lap Li, **Pradeep Ramachandran**, Sarita Adve, “mSWAT: Low-Cost Hardware FAult Detection for Multicore Systems”, *Poster in Giga-Scale Research Center (GSRC) Annual Symposium*, Sept, 2009.
3. Man-Lap Li, **Pradeep Ramachandran**, Swarup Kumar Sahoo, Siva Kumar Sastry Hari, Sarita Adve, Vikram Adve, “SWAT: SoftWare Anomaly Treatment”, *Poster in Giga-Scale Research Center (GSRC) Annual Symposium*, Sept, 2008.
4. Man-Lap Li, **Pradeep Ramachandran**, Rahmet Ulya Karpuzcu, Siva Kumar Sastry Hari, Sarita Adve, “SWAT-Sim: Accurate Microarchitecture-Level Fault Models”, *Poster in Giga-Scale Research Center (GSRC) Annual Symposium*, Sept, 2008.
5. **Pradeep Ramachandran**, Prabhakar Kudva, John Schumann, Jeffrey Kellington, Pia Sanda, “Statistical Fault Injection (SFI): Characterizing the SER of today’s processors”. *Posters in IBM*, August 2007.
6. Man-Lap Li, **Pradeep Ramachandran**, Sarita Adve, Vikram Adve, Yuanyuan Zhou, “Co-designed System for Comprehensive Hardware Reliability”. *Poster in Giga-Scale Research Center (GSRC) Annual Symposium*, Sept, 2006.
7. Jayanth Srinivasan, **Pradeep Ramachandran**, Sarita Adve, Pradip Bose and Jude Rivers, “Lifetime Reliability awareness for Microprocessors”. *Poster in Affiliates Conference of the Department of Computer Science, UIUC*, April 2006.
8. **R. Pradeep**, S. Vinay, Sanjay Burman and V. Kamakoti, “FPGA based Agile Algorithm On-demand Coprocessor”. *Poster in the Design Automation and Test in Europe (DATE)*, March, 2005.

## TECHNICAL SKILLS

- **Simulators** – SIMICS, GEMS, Turandot, SimpleScalar, SESC
- **Programming Languages** – C, C++, JAVA, Verilog
- **CAD tools** – Synopsys Design-Compiler, Cadence NCVerilog.
- **Scripting Languages** – Perl, Python, BASH
- **Operating Systems** – Linux, Windows, Solaris, Mac OS

## SERVICE AND LEADERSHIP

- Paper reviewer for Micro, HPCA, Transactions on Computers, ACM Computing Surveys, ACM TACO

- Volunteer in fund-raising events for *ASHA for Education* to support education in India
- Finisher at the Chicago Distance Classic Half Marathon, part of Team-Asha-UC, 2008
- Executive council member of Indian Graduate Students Association (IGSA), UIUC, 2006-2007
- Captain, IIT Madras soccer team Inter-college Sports fest, 2004
- Team-member of IIT Madras soccer team for Inter college Sports fest, 2003
- Editor-in-chief of Alakananda hostel monthly magazine, IIT Madras, 2004
- Silver medalist in inter-hostel soccer tournament, IIT Madras, 2004
- South-Zone representative in inter-school volleyball tournament, 2001