

**VITA**  
**RAJIV GUPTA**

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## **RESEARCH INTERESTS**

Compiler and Architectural Support: Enhancing Performance, Reliability, and Security. Software Engineering: Tools for Profiling, Slicing, and Debugging; Program Analysis: Static and Dynamic.

## **EDUCATION**

**Ph.D.** in Computer Science, University of Pittsburgh, PA, August 1987.

**M.S.** in Computer Science, University of Pittsburgh, PA, April 1984.

**B.Tech.** in Electrical Engineering, Indian Institute of Technology, New Delhi, India, April 1982.

## **APPOINTMENTS**

**Professor**, Dept. of Computer Science & Engineering, UC Riverside, August 2007 - present.

**Professor**, Department of Computer Science, The University of Arizona, August 1999 - August 2007.

**Professor**, Department of Computer Science, University of Pittsburgh, Sept. 1998 - August 1999.

**Associate Professor**, Department of Computer Science, Univ. of Pittsburgh, Sept. 1994 - August 1998.

**Faculty Member**, Computer Engineering Program, University of Pittsburgh, Sept. 1997 - August 1999.

**Visiting Faculty**, Microprocessor Research Lab, Intel Corporation, Sept. 1996 - Dec. 1996.

**Assistant Professor**, Department of Computer Science, University of Pittsburgh, Sept. 1990 - Aug. 1994.

**Senior Member Research Staff**, Philips Laboratories, Briarcliff Manor, NY, Oct. 1987 - Aug. 1990.

## **AWARDS AND HONORS**

### **Technical Advisory Group**

- Member, *Technical Advisory Group* (TAG) on **Networking and Information Technology** for the **President's Council of Advisors in Science and Technology** (PCAST), May 2006 – Sept. 2007.

### **Research**

- **ACM Fellow** (2009) (Citation: *for contributions to program analysis and optimization and sustained professional service to the computer science research community*).
- **IEEE Fellow** (2008) (Citation: *for contributions to computer architecture and optimizing compilers*).
- **Faculty Impact Award**, CS Department, The University of Arizona, 2006 and 2007.
- **Distinguished Paper Award**: "Precise Dynamic Slicing Algorithms," *International Conference on Software Engineering*, Portland, Oregon, May 2003.

- **Most Original Paper Award:** “Enabling Partial Cache Line Prefetching Through Data Compression,” *International Conference on Parallel Processing*, Kaohsiung, Taiwan, October 2003.
- **Most Influential Papers of PLDI 1979-1999:** “Complete Removal of Redundant Computations,” *ACM SIGPLAN Conference on Programming Language Design and Implementation*, June 1998. Reprint and retrospective in *20 Years of PLDI (1979-1999): A Selection*, 2004.
- **Dissertation Adviser** of *ACM SIGPLAN Outstanding Doctoral Dissertation Award* winners:
  - Rastislav Bodik, *Path and Value Sensitive Code Optimizations*, 2001.
  - Xiangyu Zhang, *Fault Location Via Precise Dynamic Slicing*, 2006.
- **Outstanding Paper Award:** “Designing a Non-intrusive Monitoring Tool for Developing Complex Distributed Applications,” *Second IEEE International Conference on Engineering of Complex Computer Systems*, Montreal, Canada, October 1996.
- **Presidential Young Investigator Award**, National Science Foundation, 1991.
- **Making a Difference Award**, Philips Laboratories, Briarcliff Manor, New York, 1988.
- **Andrew Mellon Predoctoral Fellow**, FAS, University of Pittsburgh, Pittsburgh, PA, 1985.

**Teaching:** Obtained the highest student evaluation score among Computer Science faculty teaching:

- a graduate core course during academic year 1995-1996, University of Pittsburgh.
- an advanced graduate elective during academic year 1995-1996, University of Pittsburgh.
- a graduate core course during academic year 1994-1995, University of Pittsburgh.

### Service

- **ACM Recognition of Service Award** for serving as the General Chair for PLDI 2008.
- **ACM Recognition of Service Award** for serving as the Program Chair for LCTES 2005.
- **ACM Recognition of Service Award** for serving as the General Chair for CGO 2005.
- **ACM Recognition of Service Award** for serving as the Program Chair for PLDI 2003.
- Presented a plaque in **Recognition of Contributions and Leadership** at HiPC 2004.
- **ACM Recognition of Service Award** for serving as the Workshops Chair for ICS 2002.
- **IEEE Distinguished Visitor**, IEEE Computer Society, 2000-2002.

## PROFESSIONAL ACTIVITIES

### Associate Editor

- (TACO) *ACM Transactions on Architecture and Code Optimization*, 2003-present.
- (IEEE TC) *IEEE Transactions on Computers*, 2009-present.
- (COMLAN) *Computer Languages, Systems and Structures*, Elsevier, 2006-present.
- (JEC) *Journal of Embedded Computing*, 2003-present.
- (PARCO) *Parallel Computing*, North Holland, 1991-present.
- (IJPDSN) *IASTED Intl. Journal of Parallel and Distributed Systems and Networks*, 1996-2002.

### **Guest Editor**

- (TECS) *ACM Transactions on Embedded Computing Systems*, special issue of on Language, Compiler, and Tool Support for Embedded Systems, Vol. 6, No. 4, September 2007.

### **General Chair**

- (ASPLOS) *SIGPLAN/SIGOPS International Conference on Architectural Support for Programming Languages and Operating Systems*, March 2011.
- (PLDI) *SIGPLAN Conference on Programming Language Design and Implementation*, June 2008.
- (CGO) *IEEE/ACM International Symposium on Code Generation and Optimization*, March 2005 (Co-Chair with Jesse Z. Fang).

### **Steering Committee Chair**

- (LCTES June 2006-September 2009) *ACM SIGPLAN Conference on Language, Compiler, and Tool Support for Embedded Systems*.

### **Program Chair**

- (CC 2010) *International Conference on Compiler Construction*.
- (HiPEAC 2008) *International Conf. on High-Performance Embedded Architectures and Compilers*. (Co-Chair with Minolis Katevenis)
- (LCTES 2005) *ACM SIGPLAN Conference on Language, Compiler, and Tool Support for Embedded Systems*.
- (PLDI 2003) *SIGPLAN Conference on Programming Language Design and Implementation*.
- (HPCA 2003) *IEEE International Symposium on High Performance Computer Architecture*.
- (HiPC 2003) Program Vice-Chair, Computer Architecture Track, *International Conference on High Performance Computing*.
- (ADCOM 2000) *Advanced Computing and Communication*. (Co-Chair with B.P. Sinha).
- (Dagstuhl Seminar) *Code Optimisation: Trends, Challenges, and Perspectives*, Dagstuhl, Germany, 2000 (Co-Chair with Jens Knoop, Carole Dulong, and Robert Kennedy).
- *First Workshop on Profile and Feedback-Directed Compilation*, held in conjunction with PACT, 1998 (Co-Chair with Brad Calder and James Larus).
- (LCT-RTS 1997) *ACM SIGPLAN Workshop on Language, Compiler, and Tool Support for Real-Time Systems*, held in conjunction with PLDI, (Co-Chair with David Whalley).

### **Registration Chair**

- (PACT 2005) *International Conference on Parallel Architectures and Compilation Techniques*.

### **Workshops Chair**

- (ICS 2002) *ACM International Conference on Supercomputing*.

### **Steering Committee Member**

- (ETAPS 2010-present) *The European Joint Conferences on Theory and Practice of Software*.
- (PLDI 2003-2005,2007-present) *ACM SIGPLAN Conf. on Programming Language Design and Implementation*.
- (HiPEAC 2005-2009) *International Conf. on High-Performance Embedded Architectures and Compilers*.

- (HPCA 2003) *IEEE International Symposium on High Performance Computer Architecture.*
- (LCTES 2000-present) *ACM SIGPLAN Conference on Language, Compiler, and Tool Support for Embedded Systems* (Member-at-large 2003-2005).

#### **Selection Committee Member**

- (IEEE Fellows), Member of IEEE Fellows Evaluation Committee, 2008, 2009, and 2010.
- (Top Picks 2007) *IEEE Micro's Top Picks* from Computer Architecture Conferences.
- (Top Picks 2005) *IEEE Micro's Top Picks* from Computer Architecture Conferences.
- (Most Influential PLDI 1994 Paper Award), Member of the Selection Committee, 2004.

#### **Program Committee Member – Conferences**

- (PACT 2010) *International Conference on Parallel Architectures and Compilation Techniques.*
- (RV 2010) *First International Conference on Runtime Verification.*
- (ICISS 2010) *The Sixth IEEE International Conference on Embedded Software and Systems.*
- (SAMOS 2010) *International Conference on Embedded Computer Systems: Architectures, Modeling, and Simulation.*
- (CGO 2010) *IEEE/ACM International Symposium on Code Generation and Optimization.*
- (HiPEAC 2010) *International Conf. on High-Performance Embedded Architectures and Compilers.*
- (QSIC 2010) *10th International Conference on Quality Software.*
- (SAC 2010) *24th ACM Symposium on Applied Computing.*
- (FutureTech 2010) *5th International Conference on Future Information Technology.*
- (PACT 2009) *International Conference on Parallel Architectures and Compilation Techniques.*
- (RTCSA 2009) *IEEE International Conference on Embedded and Real-Time Computing Systems and Applications.*
- (ICISS 2009) *The Sixth IEEE International Conference on Embedded Software and Systems.*
- (APLAS 2008) *The Sixth ASIAN Symposium on Programming Languages and Systems.*
- (CASES 2008) *International Conf. on Compilers, Architectures and Synthesis for Embedded Systems.*
- (ISPASS 2008) *IEEE International Symposium on Performance Analysis of Systems and Software.*
- (HPCA 2008) *IEEE International Symposium on High Performance Computer Architecture.*
- (Compute 2008) *ACM Compute 2008 Conference.*
- (ISCA 2007) *International Symposium on Computer Architecture.*
- (DATE 2007) *Design, Automation and Test in Europe.*
- (CC 2007) *International Conference on Compiler Construction.*
- (HiPEAC 2007) *International Conf. on High-Performance Embedded Architectures and Compilers.*
- (MICRO 2006) *IEEE/ACM International Symposium on Microarchitecture.*
- (CASES 2006) *International Conf. on Compilers, Architectures and Synthesis for Embedded Systems.*
- (CGO 2006) *IEEE/ACM International Symposium on Code Generation and Optimization.*

- (ICSOFT 2006) *International Conference on Software and Data Technologies.*
- (HPCA 2006) *IEEE International Symposium on High Performance Computer Architecture.*
- (POPL 2006) *ACM SIGACT/SIGPLAN Conference on Principles of Programming Languages.*
- (PDCN 2006) *Parallel and Distributed Computing and Networks.*
- (MICRO 2005) *IEEE/ACM International Symposium on Microarchitecture.*
- (HiPEAC 2005) *International Conf. on High-Performance Embedded Architectures and Compilers.*
- (CASES 2005) *International Conf. on Compilers, Architectures and Synthesis for Embedded Systems.*
- (HPCA 2005) *IEEE International Symposium on High Performance Computer Architecture.*
- (MICRO 2004) *IEEE/ACM International Symposium on Microarchitecture.*
- (EUC) *International Conference on Embedded And Ubiquitous Computing, August 2004.*
- (CASES 2004) *International Conf. on Compilers, Architectures and Synthesis for Embedded Systems.*
- (LCTES 2004) *ACM SIGPLAN Conference on Languages, Compilers, and Tools for Embedded Systems.*
- (ICS 2004) *ACM International Conference on Supercomputing.*
- (CGO 2004) *IEEE/ACM International Symposium on Code Generation and Optimization.*
- (PDCN 2004) *Parallel and Distributed Computing and Networks.*
- (MICRO 2003) *IEEE/ACM International Symposium on Microarchitecture.*
- (ICPP 2003) *International Conference on Parallel Processing.*
- (ICS 2003) *ACM International Conference on Supercomputing.*
- (CGO 2003) *IEEE/ACM International Symposium on Code Generation and Optimization.*
- (ISPASS 2003) *IEEE International Symposium on Performance Analysis of Systems and Software.*
- (MICRO 2002) *IEEE/ACM International Symposium on Microarchitecture.*
- (CASES 2002) *International Conf. on Compilers, Architectures and Synthesis for Embedded Systems.*
- (PLDI 2002) *ACM SIGPLAN Conference on Programming Language Design and Implementation.*
- (LCTES/SCOPES 2002) *ACM SIGPLAN Joint Conference on Languages, Compilers, and Tools for Embedded Systems & Software and Compilers for Embedded Systems.*
- (MICRO 2001) *IEEE/ACM International Symposium on Microarchitecture.*
- (ICS 2001) *ACM International Conference on Supercomputing.*
- (MICRO 2000) *IEEE/ACM International Symposium on Microarchitecture.*
- (PDCS 2000) *International Conference on Parallel and Distributed Computing Systems.*
- (CASES 1998) *Compiler and Architecture Support for Embedded Computing System.*
- (PACT 1998) *International Conference on Parallel Architectures and Compilation Techniques.*
- (PDCS 1998) *International Conference on Parallel and Distributed Computing and Systems.*
- (ICCL 1998) *IEEE International Conference on Computer Languages.*
- (CC 1998) *International Conference on Compiler Construction.*

- (PACT 1997) *International Conference on Parallel Architectures and Compilation Techniques.*
- (PDCS 1997) *International Conference on Parallel and Distributed Computing and Systems.*
- (PACT 1996) *International Conference on Parallel Architectures and Compilation Techniques.*
- (CC 1996) *International Conference on Compiler Construction.*
- (MICRO 1995) *IEEE/ACM International Symposium on Microarchitecture.*
- (PACT 1994) *International Conference on Parallel Architectures and Compilation Techniques.*
- (PLDI 1994) *ACM SIGPLAN Conference on Programming Language Design and Implementation.*
- (CC 1994) *International Conf. on Compiler Construction.*
- (PDCS 1992) *International Conference on Parallel and Distributed Computing and Systems.*

### **Program Committee Member – Workshops**

- (PESPMA 2010) *Workshop on Parallel Execution of Sequential Programs on Multi-core Architectures (with ISCA).*
- (M2A2) *International Workshop on Multicore and Multithreaded Architectures and Algorithms.*
- (INTERACT 2010) *Workshop on Interaction Between Compilers and Computer Architectures.*
- (PESPMA 2009) *Workshop on Parallel Execution of Sequential Programs on Multi-core Architectures (with ISCA).*
- (SAMOS 2009) *International Workshop on Systems, Architectures, Modeling, and Simulation.*
- (PASTE 2008) *ACM SIGPLAN-SIGSOFT Workshop on Program Analysis for Software Tools and Engineering (with FSE).*
- (SAMOS 2008) *International Workshop on Systems, Architectures, Modeling, and Simulation.*
- (RAAW 2007) *Workshop on Reconfigurable and Adaptive Architectures (with MICRO).*
- (WESAPEC 2007) *International Workshop on Embedded System Architectures for Pervasive Devices and Computers (with IPC).*
- (RAAW 2006) *Workshop on Reconfigurable and Adaptive Architectures (with MICRO).*
- (SoC 2006) *International Workshop on SoC and MCSoc design (with MoMM).*
- (EC 2006) *International Workshop on Embedded Computing.*
- (CTCES 2005) *Workshop on Compilers and Tools for Constrained Embedded Systems (with CASES).*
- (CTCES 2004) *Workshop on Compilers and Tools for Constrained Embedded Systems (with CASES).*
- (SCOPE 2004) *International Workshop on Software and Compilers for Embedded Systems.*
- (ECS 2004) *International Workshop on Embedded Computing Systems (with ICDCS).*
- (COCV 2004) *International Workshop on Compiler Optimization Meets Compiler Verification (with ETAPS).*
- (eTX 2003) *eclipse Technology eXchange Workshop (with OOPSLA).*
- (CTCES 2003) *Workshop on Compilers and Tools for Constrained Embedded Systems (with CASES).*
- (COLP 2003) *Workshop on Compilers and Operating Systems for Low Power (with PACT).*

- (SCOPES 2003) *International Workshop on Software and Compilers for Embedded Systems*.
- (PEPM 2003) *ACM SIGPLAN Workshop on Partial Evaluation and Semantics based Program Manipulation* (with PLDI).
- (VPW 2003) *Value Prediction Workshop* (with ISCA).
- (SSRS 2003) *Workshop on Software Support for Reconfigurable Systems* (with HPCA).
- (LARTES 2002) *IEEE Workshop on large Scale Real-Time and Embedded Systems* (with RTSS).
- (COLP 2002) *Workshop on Compilers and Operating Systems for Low Power* (with PACT).
- (MSP 2002) *Workshop on Memory System Performance* (with PLDI).
- (COCV 2002) *International Workshop on Compiler Optimization Meets Compiler Verification* (with ETAPS).
- (LCTES 2001) *ACM SIGPLAN Workshop on Languages, Compilers, and Tools for Embedded Systems* (with PLDI).
- (COLP 2001) *Workshop on Compilers and Operating Systems for Low Power* (with PACT).
- (COLP 2000) *Workshop on Compilers and Operating Systems for Low Power* (with PACT).
- (PASTE 1998) *ACM SIGPLAN-SIGSOFT Workshop on Program Analysis for Software Tools and Engineering* (with PLDI).
- (LCTES 1998) *ACM SIGPLAN Workshop on Languages, Compilers, and Tools for Embedded Systems* (with PLDI).
- (LCT-RTS 1995) *ACM SIGPLAN Workshop on Language, Compiler, and Tool Support for Real-Time Systems* (with PLDI).

## Membership

- Member – SIGPLAN, SIGSOFT, SIGARCH and SIGMICRO.
- Fellow – ACM and IEEE.
- Associate Member – HiPEAC, <http://www.hipeac.net>.

## Refereeing and Reviewing

- NSF Panels (Expeditions in Computing, CCF, Compilers, Computer Architecture, ITR, CAREER), SIGPLAN Doctoral Dissertation Award Nominees, NSERC Canada, Univ. Grants Council of Hong Kong, Univ. Video Communications, IEEE Computer Society.
- ACM TOSEM, ACM TOPLAS, ACM TECS, ACM TACO, ACM TODAES, ACM LOPLAS, IEEE TPDS, IEEE TSE, IEEE TC, IEEE Computer, IEEE Software, IEEE Micro, IEEE PDT, CACM, SP&E, JPDC, IJPP, Parallel Computing, Journal of Supercomputing, JSTVR, and JPL.
- SIGPLAN PLDI, IEEE/ACM MICRO, SIGPLAN-SIGACT POPL, ACM ICS, ACM ASPLOS, IEEE ICCL, CC, PEPM, HPCA, CGO, ISPASS, PACT, FDDO, LCTES, CASES, SCOPES, LCPC, COLP, ISSRE, IEEE SRDS, IEEE IPPS, ICPP, HiPC, PARLE, DMCC, PDCS, Supercomputing, ICPADS, and IEEE SPDP.

## GRANTS

- National Science Foundation**, Software and Hardware Foundations, *SHF: Medium: Hardware/Software Partitioning for Hybrid Shared Memory Multiprocessors*, CCF-0905509, \$800,000, 9/2009-8/2012 (PI: L. Bhuyan; Co-PIs: R. Gupta, W. Najjar).
- National Science Foundation**, Computing Systems Research Program, *Scalable and Efficient Dynamic Information Flow Tracking in Multithreaded Programs*, CNS-0751961/0719791, UCR funds \$180,000, 9/2007-8/2010 (PI: R. Gupta; Co-PI: X. Zhang).
- National Science Foundation**, Computing Research Infrastructure Program, *An Advanced Infrastructure for Generation, Storage, and Analysis of Program Execution Traces*, CNS-0751949/0708199, UCR funds \$85,000, 9/2007-9/2010 (PI: R. Gupta; Co-PIs: N. Gupta, X. Zhang).
- National Science Foundation**, Computing Systems Research Program, *Expert: dynamic analysis based fault location via Execution Perturbations*, CNS-0810906/0614707, \$332,000, 9/2006-8/2010 (PI: R. Gupta; Co-PI: N. Gupta).
- Microsoft Research**, Redmond, Washington, *Integrating Dynamic Slicing into the coredbg Debugger*, \$48,000, 4/2006-3/2007 (PI: N. Gupta; Co-PI: R. Gupta).
- National Science Foundation**, Computing Processes and Artifacts Program, *Dynamic Unmasking of Compiler Optimizations and Obfuscations*, CCF-0753470/0541382, \$300,000, 2/2006-1/2010.
- National Science Foundation**, ITR Medium Grants Program, *Morphable Software Services: Self-Modifying Programs for Distributed Embedded Systems*, CCF-0324969, \$166,225, 10/2003-9/2007 (PI: K. Schwan; Co-PIs: T. Balch, G. Eisenhauer, R. Gupta, S. Pande, C. Pu, H-H. S. Lee).
- Microsoft Research**, Redmond, Washington, *Using Phoenix for Program Slicing and its Application to Defect Analysis*, \$121,000, 9/2003-8/2006. Matching funds from ACIST at Univ. of Arizona \$42,500.
- Intel Corporation**, MRL, Santa Clara, California, *Compiling for Processors with Fine-Grained Threading, Heterogenous Cores, and Sophisticated Data Management*, \$108,500, 9/2003-8/2006.
- IBM**, Eclipse Innovation Award, *An Eclipse Module for Matching Execution Histories of Program Versions*, \$27,000, 1/2005-12/2005 (Co-PI: N. Gupta).
- National Science Foundation**, Computer Systems Architecture Program, *Information Encoding for Energy Efficient Processor Design*, CCF-0208756, \$280,000, 9/2002-8/2006.
- National Science Foundation**, ITR Small Grants Program, *Code and Data Segment Optimizations for Mixed Width Instruction Set Embedded Processor*, CCF-0220334, \$149,112, 9/2002-8/2005 (Co-PI: S. Pande). Seed grant of \$10,000 provided by ACIST, Univ. of Arizona.
- National Science Foundation**, Compilers Program, *Data Compression Techniques for Improving Memory Hierarchy Performance*, CCF-0105355, \$270,000, 9/2001-8/2005.
- IBM**, Eclipse Innovation Award, *Protecting Software through Slicing and Obfuscation Transformations*, \$27,000, 1/2003-12/2003. Seed grant of \$14,000 provided by ACIST, Univ. of Arizona.
- DARPA**, PAC/C Program, *Power-Adaptive Microarchitecture and Compiler Design for Mobile Computing*, Award no. F29601-00-1-0183, \$572,396, 7/2000-11/2002 (Co-PIs: S. Onder and S. Pande).
- National Science Foundation**, CISE Research Infrastructure, *Optimization of Distributed and Networked Systems: A Spectrum of Techniques*, EIA-0080123, \$1,396,252, 9/2000-9/2005 (Co-PIs: G.R. Andrews, S. Debray, R. Gupta, S. Pink, and R.T. Snodgrass).
- Intel Corporation**, MRL, Santa Clara, California, *Exploiting Speculation and Predication for Branch and Load Optimizations*, \$96,000, 9/1999-6/2002.

**National Science Foundation**, Experimental Systems Program, *Experimental Evaluation of Scalable Optimization Techniques*, EIA-9806525, \$400,000, 9/1998-9/2001 (PI: M.L. Soffa; Co-PIs: R. Gupta, L.L. Pollock, and D. Whalley).

**National Science Foundation**, Compiler Program, *A Framework for Path and Resource Sensitive Optimizations*, CCR-0096122/CCR-9808590, \$360,000, 9/1998-9/2002 (PI: R. Gupta; Co-PI: M.L. Soffa).

**Intel Corporation**, MRL, Santa Clara, California, *Machine Dependent Analysis for Exploiting ILP in VLIW Architectures*, \$32,000, 1/1998-12/1998.

**Hewlett Packard Laboratories**, Chelmsford, Massachusetts, *Comparative Debugging of Optimized Code*, \$236,131, 5/1997-4/1998 (Co-PI: M.L. Soffa).

**Hewlett Packard Laboratories**, Palo Alto, California, *Optimizations Techniques for Superscalar and VLIW Architectures*, \$34,484, 5/1997-4/1998 (Co-PI: M.L. Soffa).

**National Science Foundation**, Operating Systems Program, *On-line Avoidance of Monitoring Intrusion in Distributed Systems*, CCR-9996362/CCR-9704350, \$156,012, 6/1997-8/2000.

**Intel Corporation**, Santa Clara, California, *Machine Dependent Analysis for Exploiting ILP in VLIW Architectures*, \$72,038, 1/1997-12/1997.

**National Science Foundation**, Compiler Program, *Research Experience with Undergraduates*, supplement to *Loop Transformations and Scheduling Strategies for Parallelizing Software*, CCR-9157371, \$4,950, 8/1996-7/1997.

**Hewlett Packard Laboratories**, Palo Alto, California, *Optimizations Techniques for Superscalar/VLIW Architectures*, \$68,550, 1/1996-4/1997 (Co-PI: M.L. Soffa).

**Hewlett Packard Laboratories**, Chelmsford, Massachusetts, *Debugging of Optimized Code*, \$102,290, 1/1996-4/1997 (Co-PI: M.L. Soffa).

**Intel Corporation**, Santa Clara, California, *Static Analysis and Optimization Techniques for Exploiting ILP in Superscalar/VLIW Architectures*, \$20,000, 1/1996-12/1996.

**National Science Foundation**, Software Engineering Program, *Demand Driven Computation of Partial Data Flow and its Application in Software Engineering*, CCR-9402226, \$240,000, 9/1995-8/1998 (Co-PI: M.L. Soffa).

**Hewlett Packard Laboratories**, Palo Alto, California, *Data Flow Analysis and Optimization Techniques for Superscalar/VLIW Architectures*, \$57,022, 3/1995-4/1996.

**Intel Corporation**, Santa Clara, California, *Optimizations to Facilitate ILP for Superscalar/VLIW Architectures*, \$21,116, 1/1995-12/1995.

**National Science Foundation**, Compiler Program, *Loop Transformations and Scheduling Strategies for Parallelizing Software*, Presidential Young Investigator Award CCR-9157371, \$271,109, 8/1991-12/1997.

**Digital Equipment Corporation**, Pittsburgh, Pennsylvania, *Equipment Support for Studying the Interaction between Transformations and Scheduling Strategies in Compilers*, \$14,661, 2/1993.

**Siemens Corporate Research, Inc.**, Princeton, New Jersey, *Research Assistantships*, \$25,000, 6/1992.

**Honeywell Inc.**, Minneapolis, Minnesota, *PORTAL Compiler and Fine-Grained Adaptation of Real-Time Schedules*, \$5,000, 4/1992-8/1992.

**Philips Laboratories**, Briarcliff Manor, New York, *POOMA Multiprocessor Prototype*, \$35,000, 8/1992.

## PATENTS

- Pending - US Patent:** *Software Flow Tracking Using Multiple Threads*, Jan. 2008. **Inventors:** V. Nagarajan, H-S. Kim, Y. Wu, and R. Gupta.
- US Patent 6,848,100:** *Hierarchical Software Path Profiling*, Jan. 2005. **Inventors:** Y. Wu, A. Adl-Tabatabai, D. Berson, J.Z. Fang, and R. Gupta. **Assignee:** Intel Corporation.
- US Patent 6,044,221:** *Optimizing Code Based On Resource Sensitive Hoisting and Sinking*, March 2000. **Inventors:** R. Gupta, D. Berson, and J.Z. Fang. **Assignee:** Intel Corporation.
- US Patent 5,999,736:** *Optimizing Code by Exploiting Speculation and Predication with a Cost-Benefit Data Flow Analysis Based on Path Profiling Information*, December 1999. **Inventors:** R. Gupta, D. Berson, and J.Z. Fang. **Assignee:** Intel Corporation.
- US Patent 5,802,374:** *Synchronizing Parallel Processors using Barriers Extending Over Specific Multiple-Instruction Regions in Each Instruction Stream*, September 1998. **Inventors:** R. Gupta and M. Epstein. **Assignee:** Philips Electronics.
- US Patent 5,787,272:** *Method and Apparatus for Improving Synchronization Time in a Parallel Processing System*, July 1998. **Inventors:** R. Gupta and M. Epstein. **Assignee:** Philips Electronics.
- US Patent 5,317,734:** *Method of Synchronizing Parallel Processors Employing Channels and Compiling Method Minimizing Cross-Processor Data Dependencies*, May 1994. **Inventor:** R. Gupta. **Assignee:** Philips Electronics.
- US Patent 5,303,377:** *Method for Compiling Computer Instructions for Increasing Instruction Cache Efficiency*, April 1994. **Inventors:** R. Gupta and C-H. Chi. **Assignee:** Philips Electronics.
- US Patent 5,127,092:** *Apparatus and Method for Collective Branching in a Multiple Instruction Stream Multiprocessor where any of the Parallel Processors is Scheduled to Evaluate the Branching Condition*, June 1992. **Inventors:** R. Gupta and M. Epstein. **Assignee:** Philips Electronics.

## SELECTED PUBLICATIONS

### Scalable Program Analysis: Dynamic, Profile-Guided, and Static

- ISSTA S. Tallam, C. Tian, X. Zhang, and R. Gupta, "Enabling Tracing of Long-Running Multithreaded Programs via Dynamic Execution Reduction," *International Symposium on Software Testing and Analysis*, pages 207-218, London, July 2007.
- ACM TACO S. Tallam and R. Gupta, "Unified Control Flow and Dependence Traces," *ACM Transactions on Architecture and Code Optimization*, Vol. 4, No. 3, 31 pages, September 2007.
- ACM TACO X. Zhang and R. Gupta, "Whole Execution Traces and their Applications," *ACM Transactions on Architecture and Code Optimization*, Vol. 2, No. 3, pages 301-334, September 2005.
- MICRO X. Zhang and R. Gupta, "Whole Execution Traces," *IEEE/ACM 37th International Symposium on Microarchitecture*, pages 105-116, Portland, Oregon, December 2004.
- PLDI Y. Zhang and R. Gupta, "Timestamped Whole Program Path Representation and its Applications," *ACM SIGPLAN Conference on Programming Language Design and Implementation*, pages 180-190, Snowbird, Utah, June 2001.
- MICRO R. Gupta, D. Berson, and J.Z. Fang, "Resource-Sensitive Profile-Directed Data Flow Analysis for Code Optimization," *IEEE/ACM 30th International Symposium on Microarchitecture*, pages 358-368, Research Triangle Park, North Carolina, December 1997.

- ACM TOPLAS E. Duesterwald, R. Gupta, and M.L. Soffa, "A Practical Framework for Demand-Driven Interprocedural Data Flow Analysis," *ACM Transactions on Programming Languages and Systems*, Vol. 19, No. 6, pages 992-1030, November 1997.
- ESEC-FSE R. Bodik, R. Gupta, and M.L. Soffa, "Refining Data Flow Information using Infeasible Paths," *Joint 6th European Software Engineering Conference and ACM SIGSOFT 5th Symposium on Foundations of Software Engineering, LNCS 1301, Springer Verlag*, pages 361-377, Zurich, Switzerland, Sept. 1997.
- POPL E. Duesterwald, R. Gupta, and M.L. Soffa, "Demand-driven Computation of Interprocedural Data Flow," *22nd Annual ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages*, pages 37-48, San Francisco, California, January 1995.
- PLDI E. Duesterwald, R. Gupta, and M.L. Soffa, "A Practical Data Flow Framework for Array Reference Analysis and its Application in Optimizations," *ACM SIGPLAN Conference on Programming Language Design and Implementation*, pages 68-77, Albuquerque, New Mexico, June 1993.
- POPL R. Gupta, "Generalized Dominators and Post-Dominators," *18th Annual ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages*, pages 246-257, Albuquerque, New Mexico, January 1992.

## Software Debugging and Testing

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- EuroPar S. Onder and R. Gupta, "Instruction Wake-Up in Wide Issue Superscalars," *7th European Conference on Parallel Computing, LNCS 2150, Springer Verlag*, pages 418-427, Manchester, UK, August 2001.
- ISLPED J. Yang and R. Gupta, "FV Encoding for Low-Power Data I/O," *ACM/IEEE International Symposium on Low Power Electronics and Design*, pages 84-87, Huntington Beach, CA, August 2001.
- ISLPED J. Yang and R. Gupta, "Energy-Efficient Load and Store Reuse," *ACM/IEEE International Symposium on Low Power Electronics and Design*, pages 72-75, Huntington Beach, CA, August 2001.
- ICPP J. Yang and R. Gupta, "Load Redundancy Removal through Instruction Reuse," *International Conference on Parallel Processing*, pages 61-68, Toronto, Canada, August 2000.

- SAS C. Jaramillo, R. Gupta, and M.L. Soffa, "FULLDOC: A Full Reporting Debugger for Optimized Code," *International Static Analysis Symposium, LNCS 1824, Springer Verlag*, pages 240-259, Santa Barbara, CA, June-July 2000.
- PACT S. Onder, J. Xu, and R. Gupta, "Caching and Predicting Branch Sequences for Improved Fetch Effectiveness," *International Conference on Parallel Architectures and Compilation Techniques*, pages 294-302, Newport Beach, California, October 1999.
- IPPS/  
SPDP X. Yuan, R. Gupta and R. Melhem "Compiler Analysis to Support Compiled Communication for HPF-like Programs," *13th International Parallel Processing Symposium and 10th Symposium on Parallel and Distributed Processing*, pages 603-608, San Juan, Puerto Rico, April 1999.
- CC R. Gupta and R. Bodik, "Register Pressure Sensitive Redundancy Elimination," *International Conference on Compiler Construction, LNCS 1575, Springer Verlag*, pages 107-121, Amsterdam, Netherlands, March 1999.
- PACT C. Jaramillo, R. Gupta, and M.L. Soffa, "Capturing the Effects of Code Improving Transformations," *International Conference on Parallel Architectures and Compilation Techniques*, pages 118-123, Paris, France, October 1998.
- PACT S. Onder and R. Gupta, "Superscalar Execution with Direct Data Forwarding," *International Conference on Parallel Architectures and Compilation Techniques*, pages 130-135, Paris, France, October 1998.
- IC3N X. Yuan, R. Melhem and R. Gupta, "Performance of Multihop Communications Using Logical Topologies on Optical Torus Networks," *7th International Conference on Computer Communications and Networks*, pages 494-501, Lafayette, Louisiana, October 1998.
- SPDT W. Wu, R. Gupta, and M. Spezialetti, "Experimental Evaluation of On-line Techniques for Removing Monitoring Intrusion," *SIGMETRICS 2nd Symposium on Parallel and Distributed Tools*, pages 30-39, Oregon, August 1998.
- LCPC D. Berson, R. Gupta, and M.L. Soffa, "An Evaluation of Integrated Scheduling and Register Allocation Techniques," *11th International Workshop on Languages and Compilers for Parallel Computing, LNCS 1239, Springer Verlag*, pages 207-221, North Carolina, Chapel Hill, August 1998.
- LCR J. Tims, R. Gupta, and M.L. Soffa, "Dataflow Analysis Driven Dynamic Data Partitioning," *4th Workshop on Languages, Compilers, and Run-time Systems for Scalable Computers, LNCS 1511, Springer Verlag*, pages 75-90, Pittsburgh, PA, May 1998.
- ICDCS W. Wu, M. Spezialetti, and R. Gupta, "A Protocol for Removing Communication Intrusion in Monitored Distributed Systems," *IEEE-CS 18th International Conference on Distributed Computing Systems*, pages 120-129, Tilburg, The Netherlands, May 1998.
- CC R. Gupta, "A Code Motion Framework for Global Instruction Scheduling," *International Conference on Compiler Construction, LNCS 1383, Springer Verlag*, pages 219-233, Lisbon, Portugal, March 1998.
- HiPC R. Gupta, "Code Optimization as a Side Effect of Instruction Scheduling," *International Conference on High Performance Computing*, pages 370-377, Bangalore, India, December 1997 (invited paper).
- PACT R. Gupta, D. Berson, and J.Z. Fang, "Path Profile Guided Partial Dead Code Elimination Using Predication," *International Conference on Parallel Architectures and Compilation Techniques*, pages 102-115, San Francisco, California, November 1997.

- PDCS W. Wu, M. Spezialetti, and R. Gupta, "On-line Avoidance of Communication Intrusion in Token Ring Networks," *IASTED 9th International Conference on Parallel and Distributed Computing and Systems*, pages 429-436, Washington, D.C., October 1997.
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- SC X. Yuan, R. Melhem, and R. Gupta, "Compiled Communication for All-Optical TDM Networks," *Supercomputing*, Pittsburgh, Pennsylvania, November 1996.
- SPS X. Yuan, R. Gupta, and R. Melhem, "Demand-Driven Data Flow Analysis for Communication Optimization," *Workshop on Challenges in Compiling for Scalable Parallel Systems*, New Orleans, Louisiana, October 1996 (invited paper).
- SPDP W. Wu, M. Spezialetti, and R. Gupta, "Guaranteed Intrusion Removal from Monitored Distributed Applications," *IEEE 8th Symposium on Parallel and Distributed Processing*, pages 422-425, New Orleans, Louisiana, October 1996.
- ICECCS W. Wu, M. Spezialetti, and R. Gupta, "Designing a Non-intrusive Monitoring Tool for Developing Complex Distributed Applications," *IEEE 2nd International Conference on Engineering of Complex Computer Systems*, pages 450-457, Montreal, Canada, October 1996  
*Recipient of Outstanding Paper Award.*
- MC X. Yuan, R. Gupta, and R. Melhem, "Distributed Control in Optical WDM Networks," *IEEE Conference on Military Communication*, pages 100-104, McLean, VA, October 1996.
- LCPC D. Berson, P. Chang, R. Gupta and M.L. Soffa, "Integrating Program Optimizations and Transformations with the Scheduling of Instruction Level Parallelism," *9th Annual Workshop on Languages and Compilers for Parallel Computing, LNCS 1239, Springer Verlag*, pages 207-221, Santa Clara, California, August 1996.
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- ICDCS W. Wu, M. Spezialetti, and R. Gupta, "On-line Avoidance of the Intrusive Effects of Monitoring on Runtime Scheduling Decisions," *IEEE-CS 16th International Conference on Distributed Computing Systems*, pages 216-223, Hong Kong, May 1996.
- ICDCS R. Gupta, D. Mossé, and R. Suchoza, "Real-Time Scheduling using Compact Task Graphs," *IEEE-CS 16th International Conference on Distributed Computing Systems*, pages 55-63, Hong Kong, May 1996.
- HiPC S. Onder and R. Gupta, "SINAN - A Forwarding Multithreaded Architecture," *International Conference on High Performance Computing*, pages 347-354, New Delhi, India, December 1995.
- ICSM R. Gupta and M.L. Soffa, "Priority Based Data Flow Testing," *IEEE-CS International Conference on Software Maintenance*, pages 348-357, Nice, France, October 1995.
- SPDP R. Gupta and R. Bodik, "Adaptive Loop Transformations for Scientific Programs," *IEEE Symposium on Parallel and Distributed Processing*, pages 368-375, San Antonio, Texas, October 1995.
- LCPC R. Bodik and R. Gupta, "Array Data-Flow Analysis for Load-Store Optimizations in Superscalar Architectures," *8th Annual Workshop on Languages and Compilers for Parallel Computing, LNCS 1033 Springer Verlag*, pages 1-15, Columbus, Ohio, August 1995.

- ICDCS R. Gupta and M. Spezialetti, "Dynamic Techniques for Minimizing the Intrusive Affects of Monitoring Actions," *IEEE-CS 15th International Conference on Distributed Computing Systems*, pages 368-376, Vancouver, Canada, June 1995.
- IR D. Berson, R. Gupta, and M.L. Soffa, "GURRR: A Global Unified Resource Requirements Representation," *ACM SIGPLAN Workshop on Intermediate Representations*, pages 23-34, San Francisco, California, January 1995.
- RTSS R. Gupta and M. Spezialetti, "Busy-Idle Profiles and Compact Task Graphs: Compile-time Support for Interleaved and Overlapped Scheduling of Real-Time Tasks," *IEEE 15th Real-Time Systems Symposium*, pages 86-96, San Juan, Puerto Rico, December 1994.
- SRDS M. Spezialetti and R. Gupta, "Exploiting Program Semantics for Efficient Instrumentation of Distributed Event Recognitions," *IEEE 13th Symposium on Reliable Distributed Systems (SRDS)*, pages 181-191, Dana Point, California, October 1994.
- ICSM R. Gupta and M.L. Soffa, "A Framework for Partial Data Flow Analysis," *IEEE-CS International Conference on Software Maintenance*, pages 4-13, Victoria, British Columbia, September 1994.
- PACT D. Berson, R. Gupta, and M.L. Soffa, "Resource Spackling: A Framework for Integrating Register Allocation in Local and Global Schedulers," *International Conference on Parallel Architectures and Compilation Techniques, IFIP Transactions A-50*, pages 135-146, Montreal, Canada, August 1994.
- ICPP M. Spezialetti and R. Gupta, "Perturbation Analysis: A Static Analysis Approach for the Non-Intrusive Monitoring of Parallel Programs," *International Conference on Parallel Processing*, Vol. II, pages 81-88, St. Charles, Illinois, August 1994.
- LCT-RTS M. Spezialetti and R. Gupta, "Timed Perturbation Analysis: An Approach for Non-Intrusive Monitoring of Real Time Computations," *ACM SIGPLAN Workshop on Language, Compiler, and Tool Support for Real-Time Systems*, pages 1-11, Orlando, Florida, June 1994.
- ICDCS M. Spezialetti and R. Gupta, "Debugging Distributed Programs through the Detection of Simultaneous Events," *IEEE-CS 14th International Conference on Distributed Computing Systems*, pages 634-641, Poznan, Poland, June 1994.
- FTPDS C. Gong, R. Melhem, and R. Gupta, "Replicating Statement Execution for Fault Detection on Distributed Memory Multiprocessors," *IEEE Fault-Tolerant Parallel and Distributed Systems Workshop*, pages 132-141, College Station, Texas, June 1994.
- SHPCC C. Gong, R. Melhem, and R. Gupta, "Compiler Assisted Fault Detection for Distributed-Memory Systems," *IEEE Scalable High Performance Computing Conference*, pages 373-380, Knoxville, Tennessee, May 1994.
- RTOSS R. Gupta and P. Gopinath, "Correlation Analysis Techniques for Refining Execution Time Estimates of Real-Time Applications," *IEEE 11th Workshop on Real-Time Operating Systems and Software*, pages 54-58, Seattle, Washington, May 1994.
- CC E. Duesterwald, R. Gupta, and M.L. Soffa, "Reducing the Cost of Data Flow Analysis By Congruence Partitioning," *International Conference on Compiler Construction, LNCS 786 Springer Verlag*, pages 357-373, Edinburgh, Great Britain, April 1994.
- ICPP C. Gong, R. Gupta, and R. Melhem, "Compilation Techniques for Communication Optimizations on Distributed Memory Systems," *International Conference on Parallel Processing*, Vol. II, pages 39-46, St. Charles, Illinois, August 1993.
- LCPC R. Gupta and M. Spezialetti, "Towards a Non-Intrusive Approach for Monitoring Distributed Computations through Perturbation Analysis," *6th Annual Workshop on Languages and Compilers for Parallel Computing, LNCS 768 Springer Verlag*, pages 586-601, Portland, Oregon, August 1993.

- PACT D. Berson, R. Gupta, and M.L. Soffa, "URSA: A Unified ReSource Allocator for Registers and Functional Units in VLIW Architectures," *Conference on Architectures and Compilation Techniques for Fine and Medium Grain Parallelism, IFIP Transactions A-23*, pages 243-254, Orlando, Florida, January 1993.
- IAC P. Gopinath, T. Bihari, and R. Gupta, "Supporting Real-Time Software Integrated Circuits," *IEEE Workshop on Imprecise and Approximate Computation*, pages 55-61, Phoenix, Arizona, December 1992.
- ICSM R. Gupta, M.J. Harrold, and M.L. Soffa, "An Approach to Regression Testing using Slicing," *IEEE-CS International Conference on Software Maintenance*, pages 299-308, Orlando, Florida, November 1992.
- SC T. Watts, M.L. Soffa, and R. Gupta, "Techniques for Integrating Parallelizing Transformations and Compiler Based Scheduling Methods," *Supercomputing*, pages 830-839, Minneapolis, Minnesota, November 1992.
- CC E. Duesterwald, R. Gupta, and M.L. Soffa, "Register Pipelining: An Integrated Approach to Register Allocation for Scalar and Subscripted Variables," *International Workshop on Compiler Construction, LNCS 641 Springer Verlag*, pages 192-206, Paderborn, Germany, October 1992.
- IFIP R. Gupta and M.L. Soffa, "Automatic Generation of a Compact Test Suite," *12th IFIP World Computer Congress, Vol. I*, pages 237-243, Madrid, Spain, September 1992.
- LCPC E. Duesterwald, R. Gupta, and M.L. Soffa, "Distributed Slicing and Partial Re-execution for Distributed Programs," *5th Workshop on Languages and Compilers for Parallel Computing, LNCS 757 Springer Verlag*, pages 497-511, Yale University, New Haven, Connecticut, August 1992.
- RTOS P. Gopinath, T. Bihari, and R. Gupta, "Compiler Techniques for Generating Predictable Object-Oriented Real-Time Software," *IEEE 9th Workshop on Real-Time Operating Systems and Software*, Pittsburgh, May 1992.
- SHPPCC R. Gupta, "Compiler Optimizations for Distributed-Memory Programs," *Scalable High Performance Computing Conference*, pages 178-181, Williamsburg, Virginia, April 1992.
- ISS E. Duesterwald, R. Gupta, and M.L. Soffa, "Rigorous Data Flow Testing through Output Influences," *2nd Irvine Software Symposium*, pages 131-145, Univ. of California, Irvine, CA, March 1992.
- IPPS R. Kramer, R. Gupta, and M.L. Soffa, "The Combining DAG: A Technique for Parallel Data Flow Analysis," *6th International Parallel Processing Symposium*, pages 652-655, Beverly Hills, California, March 1992.
- TAVS R. Gupta and M. Spezialetti, "Loop Monotonic Computations: An Approach for the Efficient Run-time Detection of Races," *SIGSOFT Symposium on Testing, Analysis, and Verification*, pages 98-111, Victoria, Canada, October 1991.
- SEDMS P. Gopinath and R. Gupta, "A Hybrid Approach to Load Balancing in Distributed Systems," *Symposium on Experiences with Distributed and Multiprocessor Systems*, pages 133-147, Atlanta, March 1991.
- RTSS P. Gopinath and R. Gupta, "Applying Compiler Techniques to Scheduling in Real Time Systems," *IEEE 11th Real-Time Systems Symposium*, pages 247-256, Orlando, Florida, December 1990.
- SC R. Gupta and Chi-Hung Chi, "Improving Instruction Cache Performance by Reducing Cache Pollution," *Supercomputing*, pages 82-91, New York, November 1990.
- SC R. Gupta, "Loop Displacement: An Approach for Transforming and Scheduling Loops for Parallel Execution," *Supercomputing*, pages 388-397, New York, November 1990.

- ICSM M.J. Harrold, R. Gupta, and M.L. Soffa, "A Methodology for Controlling the Size of a Test Suite," *IEEE-CS International Conference on Software Maintenance*, pages 302-310, San Diego, CA, November 1990.
- TCS M.J. Harrold, R. Gupta, and M.L. Soffa, "TBM: A Testbed Management Tool," *7th International Conference on Testing Computer Software*, pages 47-56, San Francisco, California, June 1990.
- PC R. Gupta, L. Pollock, and M.L. Soffa, "Parallelizing Data Flow Analysis," *Workshop on Parallel Compilation*, Kingston, Ontario, May 1990.
- ICDCS P. Gopinath and R. Gupta, "Opportunistic Evaluation of Communication Link Loads," *IEEE-CS 10th International Conference on Distributed Computing Systems*, pages 406-413, Paris, France, May 1990.
- RTOS P. Gopinath and R. Gupta, "Compiler Assisted Adaptive Scheduling in Real-time Systems," *IEEE 7th Workshop on Real-Time Operating Systems and Software, Real-Time Systems Newsletter*, Vol. 6, No. 2, pages 62-69, University of Virginia, Charlottesville, Virginia, May 1990.
- DMCC R. Gupta and P. Gopinath, "A Hierarchical Approach to Load Balancing in Distributed Systems," *5th Distributed Memory Computing Conference (DMCC)*, pages 1000-1005, Vol. II, Charleston, South Carolina, April 1990.
- ICPP R. Gupta, "Synchronization and Communication Costs of Loop Partitioning on Shared-Memory Multiprocessor Systems," *International Conference on Parallel Processing*, Vol. II, pages 23-30, St. Charles, Illinois, August 1989.
- PARLE R. Gupta and M. Epstein, "Achieving Low Cost Synchronization in a Multiprocessor System," *Conference on Parallel Architectures and Languages Europe*, Vol. I, pages 70-84, Eindhoven, The Netherlands, June 1989.
- IMACS T.S. Anand and R. Gupta, "A Knowledge-based Tool for Parallelization of Scientific Programs," *IMACS Conference on Expert Systems in Numerical Computation*, Purdue University, Indiana, December 1988.
- ICS R. Gupta, "Debugging Code Reorganized by a Trace Scheduling Compiler," *3rd International Conference on Supercomputing*, Boston, Vol. III, pages 422-430, May 1988.
- HICSS R. Gupta and M.L. Soffa, "A Matching Approach to Utilizing Fine-Grained Parallelism," *21st Annual Hawaii International Conference on System Sciences*, Vol. I, pages 148-156, Kona, Hawaii, January 1988.
- ICPP R. Gupta and M.L. Soffa, "A Reconfigurable LIW Architecture," *International Conference on Parallel Processing*, pages 893-900, St. Charles, Illinois, August 1987.
- ICS R. Gupta and M.L. Soffa, "Region Scheduling," *2nd International Conference on Supercomputing*, Vol. III, pages 141-148, Santa Clara, May 1987.
- CSC R. Gupta and M.L. Soffa, "SHAPE: A Highly Adaptable and Parallel System," *Computer Science Conference*, pages 107-114, Cincinnati, February 1986.
- ADA R. Gupta and M.L. Soffa, "The Efficiency of Storage Management Schemes for Ada Programs," *Ada International Conference*, pages 164-172, Paris, May 1985. Also published in *Sigplan Notices*, Vol. 20, No. 11, pages 30-38, November 1985.

## BOOK CONTRIBUTIONS

- CRC Press X. Zhang, N. Gupta, and R. Gupta, "Whole Execution Profiles and their Use in Debugging," *The Compiler Design Handbook: Optimizations and Machine Code Generation*, Second Edition, Chapter 4, CRC Press, pages 4-1-4-17, Edited by Y.N. Srikant and P. Shankar, Dec. 2007.

- John Wiley Y. Zhang and R. Gupta, "Enabling Partial Cache Line Prefetching Through Data Compression," *High Performance Computing: Paradigm and Infrastructure*, pages 183-200, John Wiley & Sons, Edited by L.T. Yang and M. Guo, October 2005.
- CRC Press N. Gupta and R. Gupta, "Data Flow Testing," *The Compiler Design Handbook: Optimizations and Machine Code Generation*, First Edition, Chapter 7, pages 247-267, CRC Press, Edited by Y.N. Srikant and P. Shankar, September 2002.
- CRC Press R. Gupta, E. Mehofer, and Y. Zhang, "Profile Guided Compiler Optimizations," *The Compiler Design Handbook: Optimizations and Machine Code Generation*, First Edition, Chapter 4, pages 143-174, CRC Press, Edited by Y.N. Srikant and P. Shankar, September 2002.
- Springer Verlag R. Gupta, "SPMD Execution in Presence of Dynamic Data Structures," *Compiler Optimizations for Scalable Parallel Systems: Languages, Compilation Techniques and Run Time Systems, LNCS 1808*, Springer Verlag, pages 683-706, Edited by S. Pande and D.P. Agrawal, 2001.
- North Holland T.S. Anand and R. Gupta, "A Tool for Evaluating Compiler-based Parallelization Strategies," *Intelligent Mathematical Software Systems*, pages 103-110, Edited by E.N. Houstis, J.R. Rice, and R. Vichnevetsky, North Holland, 1990.

## INVITED PRESENTATIONS

- 4th Compiler Assisted SoC Assembly Workshop (CASA'08 - held at ESWEEK)*, "Speculative Parallelization of Applications on Multicores," October 2008.
- Google, Mountain View, CA, "Speculative Parallelization of Applications on Multicores," October 2008.
- Keynote, Workshop on Dynamic Analysis (WODA'07 - held at ICSE)*, "Scalable Dynamic Analysis for Automated Fault Location and Avoidance," May 2007.
- University of California, Davis, "Delivering Processor Performance with Limited Energy and Memory Resources," April 2007.
- Microsoft Research, Redmond, "Scalable Dynamic Analysis for Automated Fault Location," March 2007.
- University of Colorado, Boulder, "Reliable and Optimized Embedded Systems," March 2007.
- The College of William and Mary, Williamsburg, VA, "Safety and Optimization of Embedded Systems," Jan. 2007.
- University of California, Riverside, "Safety and Optimization of Embedded Systems," Dec. 2006.
- Massachusetts Institute of Technology, "Safety and Optimization of Embedded Systems," Joint EECS and Aeronautics & Astronautics Seminar, May 2006.
- Taught a course on "Compiling for Embedded Processors," First HiPEAC Summer School on *Advanced Computer Architectures and Compilation for Embedded Systems (ACACES)*, L'Aquila, Italy, July 2005.
- Microsoft Research Faculty Summit, "Using Phoenix for Exploring Whole Execution Traces," Redmond, Washington, July 2005.
- University of California, San Diego, "Dynamic Execution Histories and their Applications," May 2005.
- Arizona State University, Tempe, Arizona, "Whole Execution Trace and its Applications," December 2004.
- The College of William and Mary, Williamsburg, VA, *Distinguished Lecture Series Speaker*, "Enabling the Design of Compilers and Architectures for Emerging Applications," October 2004.
- Microsoft Research Faculty Summit, "Using Phoenix for Profiling Research," Redmond, August 2004.

*Infrastructure 2004: NSF CISE/EIA RI and MII PI's Workshop, Panelist:* "Research Challenges in Programming Languages: From Agendas To Impact," Snowbird, Utah, July 2004.

*University of Maryland,* College Park, "Enabling the Design of Compilers and Architectures for Emerging Applications," June 2004.

*University of California,* Irvine, Center for Embedded Computer Systems, "Frequent Value Locality and its Applications," May 2004.

*Arizona State University,* Tempe, Arizona, *CEINT Distinguished Seminar Series Speaker,* "Frequent Value Locality and its Applications," April 2004.

*Florida State University,* Tallahassee, Florida, "Precise Dynamic Program Slicing Algorithms," April 2004.

*Intel Corporation,* Microcomputer Research Lab, Santa Clara, California, "Compiler and Architectural Support for Embedded Processors," March 2003.

*Penn State University,* State College, Pennsylvania, "Supporting Bit Section Addressing for Embedded Applications," December 2002.

*Purdue University,* West Lafayette, Indiana, "Supporting Bit Section Addressing for Embedded Applications," December 2002.

*Georgia Tech,* Atlanta, Georgia, "Architectural and Compiler Support for Performance Optimization Under Limited Power and Memory Resources," November 2002.

*University of Texas at Austin,* Texas, "Frequent Value Locality and its Applications," February 2002.

*Intel Corporation,* Microcomputer Research Lab, Santa Clara, California, "Frequent Values and their Applications," August 2001.

*Intel Corporation,* Microcomputer Research Lab, Santa Clara, California, "Optimizing Static Power Dissipation by Functional Units," August 2001.

*University of Alberta,* Edmonton, Canada, *Distinguished Lecture Series,* "Frequent Value Locality and its Applications," June 2001.

*University of Nevada at Reno,* Reno, Nevada, *IEEE Distinguished Speaker,* "Frequent Value Locality and its Applications," April 2001.

*Compaq,* Marlborough, MA, "Frequent Value Locality and its Applications," November 2000.

*Lucent Technologies,* Allentown, Pennsylvania, "Path Sensitive Code Optimizations," June 1999.

*Georgia Tech,* Atlanta, Georgia, "Path Sensitive Code Optimizations," May 1999.

*University of Maryland,* College Park, Maryland, "Path Sensitive Code Optimizations," April 1999.

*The University of Arizona,* Tucson, Arizona, "Path Sensitive Code Optimizations," March 1999.

*University of California,* Los Angeles, California, "Path Sensitive Code Optimizations," January 1999.

*Florida State University,* Tallahassee, FL, "Path Sensitive Code Optimizations," January 1999.

*IBM T.J. Watson Research Center,* Hawthorne, NY, "Profile Guided Redundancy and Dead Code Elimination," October 1998.

*Hewlett-Packard Labs,* Palo Alto, CA, "Path Profile Guided PRE and PDE," July 1997.

*Intel Seminar,* Santa Clara, CA, "A Demand-driven Framework for Interprocedural Data Flow Analysis," December 1996.

*Intel University Research Forum,* Santa Clara, CA, "Analysis and Optimization in an ILP Environment," November 1996.

*Hewlett-Packard Laboratories*, Palo Alto, CA, “Array Data Flow Analysis for Load-Store Optimizations in Superscalar Architectures,” July 1995.

*Intel Corporation*, Santa Clara, CA, “Array Data Flow Analysis for Load-Store Optimizations in Superscalar Architectures,” July 1995.

*Tartan, Inc.*, Pittsburgh, PA, “Demand-Driven Computation of Interprocedural Data Flow,” June 1995.

*Tartan, Inc.*, Pittsburgh, PA, “Array Data Flow Analysis for Load-Store Optimizations in Superscalar Architectures,” April 1995.

*Panelist*: “Program Transformations and Analysis for Real-Time Systems,” *ACM SIGPLAN Workshop on Language, Compiler, and Tool Support for Real-Time Systems*, Orlando, Florida, June 1994.

*Clemson University*, Clemson, South Carolina, “SPMD Execution of Programs on Distributed-Memory Machines,” October 1993.

*Carnegie Mellon University*, Pittsburgh, PA, “A Practical Data Flow Framework for Array Reference Analysis and its Use in Optimizations,” May 1993.

*University of Delaware*, Newark, Delaware, “SPMD Execution of Programs on Distributed-Memory Machines,” December 1992.

*West Virginia University*, Morgantown, WV, “SPMD Execution of Programs on Distributed-Memory Machines,” December 1992.

*NASA Ames Research Center*, Moffett Field, CA, “SPMD Execution of Programs on Distributed-Memory Machines,” April 1992.

*IBM T.J. Watson Research Center*, Hawthorne, NY, “Fine-Grained Parallel Processing,” April 1990.

## Ph.D. STUDENTS

(*In Progress*) Chen Tian (expected Summer 2010), Min Feng (expected Summer 2011), and Changhui Lin (expected Summer 2012).

Vijayanand Nagarajan, *IMPRESS: Improving Multicore Performance and Reliability via Efficient Support for Software Monitoring*, completed August 2009.  
*Assistant Professor, University of Edinburgh, Edinburgh, UK* (Current).

Dennis Jeffrey, *Dynamic State Alteration Techniques for Automatically Locating Software Errors*, completed August 2009. *Google, Mountain View, CA* (Current).

Sriraman Tallam, *Fault Location and Avoidance in Long-Running Multithreaded Applications*, completed October 2007. *Google, Mountain View, CA* (Current).

Xiangyu Zhang, *Fault Location Via Precise Dynamic Slicing*, completed September 2006.  
**Recipient of SIGPLAN Outstanding Doctoral Dissertation Award**, 2006.  
*NSF CAREER Award*, 2009. *Assistant Professor, Purdue University* (Current).

Bengu Li, *Efficient Handling of Narrow Width and Streaming Data in Embedded Applications*, completed May 2006. *Synopsys, Portland* (Current).

Arvind Krishnaswamy, *Microarchitectural and Compiler Techniques for Dual-Width ISA Processors*, completed May 2006. *HP Labs, Cupertino, CA* (Current).

Jun Yang, *Frequent Value Locality and its Application to Energy Efficient Memory Design*, completed September 2002.  
*NSF CAREER Award*, 2008. *Associate Professor, Univ. of Pittsburgh* (Current).

Youtao Zhang, *The Design and Implementation of Compression Techniques for Profile Guided Compilation*, completed August 2002.  
*NSF CAREER Award*, 2005. *Assistant Professor, Univ. of Pittsburgh* (Current).

Clara Jaramillo, *Source Level Debugging Techniques and Tools for Optimized Code*, completed August 2000.  
*Chatam College, Pittsburgh, PA* (First Employment).

Ras Bodik, *Path and Value Sensitive Code Optimizations*, completed Nov. 1999.  
**Recipient of SIGPLAN Outstanding Doctoral Dissertation Award**, 2001.  
*NSF CAREER Award*, 2001. *Associate Professor, UC Berkeley* (Current).

Soner Onder, *Scalable Superscalar Processor Design*, completed July 1999.  
*NSF CAREER Award*, 2004. *Associate Professor, Michigan Tech. University* (Current).

Xin Yuan, *Dynamic and Compiled Communication in Optical Time-Division-Multiplexed Point-to-Point Networks*, completed August 1998. *Full Professor, Florida State University* (Current).

Jodi Tims, *Integrating Automatic Data Distribution and Communication Optimization*, completed July 1998. *Associate Professor, Baldwin Wallace College, PA* (Current).

Wanqing Wu, *On-line Avoidance of the Intrusive Effects of Monitoring of Distributed Applications*, completed July 1998. *Oracle Corporation, CA* (First Employment).

Tia Watts, *MIST: An Approach to Integrating Restructuring Transformations and Multiple Scheduling Techniques*, completed December 1997. *Associate Professor, Sonoma State University* (Current).

David Berson, *Unification of Register Allocation and Instruction Scheduling in Compilers for Fine-Grain Parallel Architectures*, completed November 1996. *Synopsys, Portland* (Current).

Evelyn Duesterwald, *A Demand Driven Approach for Efficient Interprocedural Data Flow Analysis*, completed July 1996. *IBM Research* (Current).

Chun Gong, *Fault Tolerant Computing on Distributed-Memory Systems: A Compiler Assisted Approach*, completed September 1995. *Microsoft Corporation, WA* (First Employment).

## M.S. STUDENT PROJECTS

Anton Jouline, *Dynamic Dispatching in Java Programs*, December 1999.

Jun Xu, *Implementation of Branch Sequence Prediction Techniques*, December 1998.

Aston AuYeung, *Extending UPFAST to Support VLIW Architectures*, August 1998.

Vishal Jain, *An Approach for Monitoring Intrusion Removal in Real-Time Systems*, April 1997.

Philip Kamp, *Language and Compile-time Analysis Support for Dynamic Data Structures*, December 1995.

Xin Yuan, *Timestamp-based Selective Invalidation Scheme for Multiprocessor Cache Coherence*, Aug. 1995.

Meena Krishnan, *Implementation of Array Data Flow Analysis in the PDGCC Compiler*, Dec. 1994.

Wanqing Wu, *A Simulator for the PDGCC Compiler*, December 1994.

Ed Kuzemchak, *Automatic Test Generation for Testing Ada Compilers*, December 1994.

Ras Bodik, *Optimal Placement of Load-Store Operations for Array Accesses in Loops*, Dec. 1994.

Kishore Karnam, *Automatic Distribution of Data on Distributed Memory Machines*, April 1994.

Radha Sivaramakrishnan, *Static Analysis of Distributed Memory Programs*, December 1993.

Michael Bigrigg, *An Integrated Database Programming Environment for Parallel Applications*, August 1993.

Padmavathi Vallabhaneni, *Analysis and Transformation of Programs for SPMD execution on Distributed-Memory Multiprocessors*, December 1992.

Sunah Lee, *Executing Loops on a Fine-Grained MIMD Architecture*, August 1991.

Robert Kramer, *The Combining DAG: A Technique for Parallel Data Flow Analysis*, April 1991.

## **DISSERTATION COMMITTEES**

Min Wan, CSE Dept., UC Riverside, 2008.

Xiaotong Zhuang, College of Computing, Georgia Tech., 2004-2006.

Haibo Wang, ECE Dept., University of Arizona, 2000-2002.

Daler Rakhmatov, ECE Dept., University of Arizona, 2000-2002.

Atif Memon, Dept. of Computer Science, University of Pittsburgh, 1999-2001.

Chuck Salisbury, Dept. of Computer Science, University of Pittsburgh, 1997-1998.

Chris Newburn, Dept. of Electrical and Computer Engineering, Carnegie Mellon University, 1993-1997.

Mohamed Younis, Dept. of Computer Science, New Jersey Institute of Technology, NJ, 1995-1996.

Herman Schmit, Dept. of Electrical and Computer Engineering, Carnegie Mellon University, 1993-1995.

Chyi-Ren Dow, Dept. of Computer Science, University of Pittsburgh, 1992-1994.

## **TEACHING EXPERIENCE**

### **Univ. of California, Riverside**

CS 203A: *Advanced Computer Architecture*, Winter'09.

CS 206: *Testing and Verification Techniques in Software Engineering*, Fall'09.

CS 201: *Compiler Construction*, Winter'08, Spring'09.

CS 260: Seminar on *Advanced Execution Systems for Reliable High-Performance Computing*, Spring'08.

CS 152: *Compiler Design*, Fall'08, Winter'10.

### **The University of Arizona**

CSc 453: *Compilers and System Software*, Fall'99, Fall'03.

CSc 553: *Principles of Compilation*, Spring'01, Spring'02, Spring'05, Spring'07.

CSc 576: *Computer Architecture*, Fall'00, Fall'01, Fall'02, Fall'03, Fall'04.

CSc 620: *Microarchitecture and Compiler Support for Instruction Level Parallelism*, Spring'00.

CSc 620: *Embedded Systems*, Fall'02.

CSc 620: *Advanced Execution Systems for Reliable Computing*, Fall'06.

### **University of Pittsburgh**

CS2210: *Compiler Design*, Fall'91-95, Fall'97.

CS2212: *Advanced Compiler Design*, Winter'93-95.

CS2230: *Compiling Techniques for Parallel Systems*, Fall'93, Winter'96.  
CS3210: *Advanced Topics in Programming Languages*, Winter'98-99.  
CS3220: *Seminar on Fine-Grained Parallel Processing Systems*, Winter'91.  
CS1622: *Compiler Design*, Winter'91-96, Winter'98-99.  
CS1621: *Structure of Programming Languages*, Fall'90.  
CS1520: *Programming Languages*, Fall'98.  
CS0441: *Discrete Structures for Computer Science*, Winter'92.

## DEPARTMENTAL ADMINISTRATIVE ACTIVITIES

### University of California, Riverside

Chair, Research Committee, Bourns College of Engineering Retreat, 2008.  
Retreat Oversight Committee, Bourns College of Engineering, 2008-present.  
University and Department Level AdHoc Committees for Peer Evaluations.  
Research Committee, 2007-2008.  
Resource/Publicity Committee, 2008-2009.  
Star Search Committee, 2007-present.  
Recruiting Committee, 2008-2009.  
Executive Committee, CSE Dept., 2007-present.

### The University of Arizona

(Strategic Plan) Proposed the concept of *Research Clusters* and formulated these clusters to capture both the current interests of computer science faculty and areas of interest in which future growth is planned. These clusters are central to the new *Strategic Vision* developed by the department.

(Academic Program Review) Self-Study Team for the Departmental Review, *Member*, 2006-2007

- This committee prepared the self-study report for the external evaluation committee that will visit in Jan. 2007.

Advisory Committee, *Member Elected by the Faculty*, 2006-2007

- This committee addresses any/all concerns of the faculty and communicates them to the department head.

Five Year Review Committee of Department Head, *Member Appointed by the Dean*, 2003

- This committee carried out the evaluation of the department head and made a case for his reappointment for another term to the Dean of the College of Science.

Steering Committee, Research Infrastructure Grant:

- *Chair*, 2003-2005; and
- *Member*, 2001-2002.

Graduate Admissions Committee:

- *Chair*, 2000-05/2005, 09/2006-2007; and
- *Member*, 1999.

Graduate Affairs Committee, *Member*, 2006-2007.

Space Planning Committee, *Member*, 2004

- The Computer Science Department received an entire floor of space; the committee developed plan for its use and renovation.

Colloquium Czar, 2001-2002.

Human Subjects Review Committee, *Chair*, 2003-2005.

Promotion and Tenure Committee, *Member*, 1999-2001 and 2002-2005.

PhD Qualifiers Committee, 2001-2002.

## **University of Pittsburgh**

Computer Engineering Program Proposal Committee, *Member*, 1995

- This committee wrote a detailed successful proposal for launching the Computer Engineering Program that is jointly run by the Electrical Engineering and the Computer Science Departments.

Committee on the University of Pittsburgh's Presentation on the Internet, 1995

- This University level committee formulated a plan for developing University's webpages.

Faculty of Arts and Sciences Tenure Review Committees, 1998 and 1999

- Served as both *Chair* and *Member* of committees convened to evaluate and make recommendations to the Dean of FAS on specific tenure and promotion cases.

Faculty of Arts and Sciences Tenure Council, *Member*, 1994, 1995 and 1998

- The tenure council planned handling of tenure & promotion cases in the Faculty of Arts & Sciences.

Faculty Recruiting Committee, *Member*, 1990-1991.

Graduate Programs and Exams Committee, *Member*, 1991-1993.

Graduate Admissions and Financial Aid Committee, *Member*, 1992-1993 and 1998-1999.

TA/TF Training and Evaluation Committee, *Member*, 1994-1995.

Computing and Communications Committee, *Member*, 1994-1999.

Web Administrator for the Computer Science Department, 1994-1999

- My main task was to maintain the research and publications webpages for the CS Department.