R. N. Uma

Department of Mathematics & Computer Science
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AREAS OF RESEARCH EXPERTISE

Resource allocation in wireless and sensor networks, multimedia networking, scheduling theory and logistics planning.

EDUCATION

Ph. D. Computer Science
Polytechnic University, Brooklyn, NY. July 2000
Dissertation: *Theoretical and Experimental Perspectives on Hard Scheduling Problems.*
Advisor: Joel Wein, Associate Professor, Polytechnic University.

M. E. Computer Science
Indian Institute of Science, Bangalore, India. June 1994
Thesis: *Implementation of CAIR-IISc Prolog.*
Advisor: Vijaya Chandru, Professor, Indian Institute of Science.

B. Sc. Mathematics
University of Madras, Chennai (formerly Madras), India. May 1990

RESEARCH EXPERIENCE

Associate Professor, Department of Mathematics & Computer Science, North Carolina Central University. (August 2005 - present)

- Cross-layer approaches for wireless video networking.
- Transmission protocols for power-constrained wireless and sensor networks.
- Efficient algorithms for the Internet advertisement scheduling problem.

Assistant Professor, University of Texas at Dallas. (September 2000 - August 2005)

- Algorithms for hard scheduling problems: precedence-constrained scheduling problems, scheduling under transportation constraints, scheduling under machine non-availability.
- Algorithms for optimal placement and delivery of multimedia information.

- Cross-layer approaches for wireless video networking.
- Transmission protocols for power-constrained wireless and sensor networks.

Research Assistant, Polytechnic University, Brooklyn, NY.
Worked in several faculty and student teams on the following:

- Improved scheduling algorithms for maintenance and testing of the United States nuclear stockpile. (September 1999 - July 2000)
- Fast algorithms for mining approximate association rules. (August 1999 - July 2000)
- Simulation study of TCP traffic over Fujitsu's FACTR ATM switch. (June - December 1997)
- Evaluation of datamining tools and their distributed implementation. (June - August 1995)

Intern, Center for Artificial Intelligence & Robotics, Bangalore, India.

- Implemented a Prolog compiler ("CAIR-IISc Prolog") based on Warren's Abstract Machine (M. E. Final Year Project). (August 1993 - June 1994)
- Implemented a decision tree for industrial part identification by robots. (May - June 1992)

Intern, Kirloskar Computer Services Ltd., Bangalore, India.

- Developed a user-interface for UNIX text processing package nroff/troff. (June - July 1993)

REFEREED JOURNAL PUBLICATIONS
(Authors listed alphabetically in a majority of the papers)

1. "On the Relationship between Combinatorial and LP-Based Approaches to NP-hard Scheduling Problems", R. N. Uma, Joel Wein and David P. Williamson. *Theoretical Computer Science*, Volume 361, Issues 2-3 (2006): Special Issue on Approximation and Online Algorithms.
2. "Battery Power-Aware Encryption", R. Chandramouli, S. Bapatla, K. P. Subbalakshmi and R. N. Uma. *ACM Transactions on Information and System Security (TISSEC)*, Volume 9, Issue 2 (May 2006).
3. "An Experimental Study of LP-Based Approximation Algorithms for Scheduling Problems", Martin W.P. Savelsbergh, R. N. Uma and Joel Wein. *INFORMS Journal on Computing* **17**, 1 (Winter 2005). (Preliminary version appeared in *Proceedings of the 9th Annual ACM-SIAM Symposium on Discrete Algorithms*, 1998.)
4. "Techniques for Scheduling with Rejection", Daniel W. Engels, David R. Karger, Stavros G. Kolliopoulos, Sudipta Sengupta, R. N. Uma and Joel Wein. *Journal of Algorithms* **49** (2003). (A special issue devoted to papers selected from ESA'98.) (Preliminary version appeared in *Proceedings of the 6th Annual European Symposium on Algorithms*, August 1998. Gianfranco Bilardi, Giuseppe F. Italiano, Andrea Pietracaprina and Geppino Pucci (eds.): Algorithms - ESA '98, LNCS 1461, Springer: Berlin, 1998.)

5. “Dynamic Wavelength Assignment for Multicast in All-Optical WDM Networks to Maximize the Network Capacity”, Jianping Wang, Biao Chen and R. N. Uma. *IEEE Journal on Selected Areas in Communications (JSAC)* **21(8)** (October 2003).
6. “Clustering of Client-Sites in Three-Tier Database Architectures”, Je-Ho Park, Vinay Kanitkar, R. N. Uma and Alex Delis. *International Journal of Cooperative Information Systems*, **12(1)**, March 2003. (Preliminary version appeared in *Eleventh IEEE International Conference on Tools with Artificial Intelligence*, November 1999.)
7. “Off-line Admission Control for General Scheduling Problems”, Cynthia A. Phillips, R. N. Uma and Joel Wein. *Journal of Scheduling*, Volume 3, Number 6, November-December 2000: Special Issue on Approximation Algorithms (Part 2). (Preliminary version appeared in *Proceedings of the 11th Annual ACM-SIAM Symposium on Discrete Algorithms*, January 2000.)

REFEREED CONFERENCE PUBLICATIONS
(Authors listed alphabetically)

8. “MDC and Path Diversity in Video Streaming”, Siva Somasundaram, K. P. Subbalakshmi and R. N. Uma. *IEEE International Conference on Image Processing (ICIP)*, October 2004.
9. “Energy-Aware On-line Algorithms for Image Transmission over Wireless LAN”, R. Chandramouli, S. Sri Ganesh Veera Kumar and R. N. Uma. *IEEE International Conference on Communications (ICC)*, June 2004.
10. “On the Complexity and Hardness of the Steganography Embedding Problem”, R. Chandramouli, Shalin Trivedi and R. N. Uma. *SPIE’s 16th Annual Symposium Electronic Imaging Science and Technology*, January 2004.
11. “Task Planning with Transportation Constraints: Approximation Bounds, Implementation and Experiments”, Ovidiu Daescu, Derek Soeder and R. N. Uma. *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)*, September 2003.
12. “To Transmit or Not to Transmit: An Investigation Using Competitive Analysis”, R. Chandramouli and R. N. Uma. *Proceedings of the IEEE Wireless Communications and Networking Conference (WCNC)*, March 2003.
13. “On Deterministic Scheduling Approaches to Delivery of Scalable Streaming Media”, Derek Soeder, K. P. Subbalakshmi and R. N. Uma. *Proceedings of the 6th World Multi-Conference on Systemics, Cybernetics and Informatics (SCI)*, July 2002.
14. “On the Relationship between Combinatorial and LP-Based Approaches to NP-hard Scheduling Problems”, R. N. Uma and Joel Wein. *Proceedings of the 6th International IPCO Conference*, June 1998. R. E. Bixby, E. A. Boyd, and R. Z. Rios-Mercado (eds.): Integer Programming and Combinatorial Optimization, LNCS 1412, Springer: Berlin, 1998.
15. “Load-Sharing in Heterogeneous Systems via Weighted Factoring”, Susan Flynn Hummel, Jeanette Schmidt, R. N. Uma and Joel Wein. *Proceedings of the 8th Symposium on Parallel Algorithms and Architectures*, 1996.

MANUSCRIPTS UNDER REVIEW/IN PREPARATION
(Authors listed alphabetically)

1. "An Efficient Scheduling Algorithm for Low Bit Rate Video Streaming", Derek Soeder, Siva Somasundaram, K. P. Subbalakshmi and R. N. Uma. (In preparation.)
2. "On-Line Algorithms for Energy Efficient Wireless Transmission", Lichen Bao, R. Chandramouli, S. Sri Ganesh Veera Kumar and R. N. Uma. (In preparation.)
3. "Placement of Replicated Continuous Media Objects", Deeptichand Parvathaneni, B. Prabhakaran and R. N. Uma. (In preparation.)

TEACHING EXPERIENCE

Associate Professor, Department of Mathematics & Computer Science,
North Carolina Central University. (August 2005 - present)

- Introductory College Algebra
- College Algebra and Trigonometry I
- Programming II: C++
- Introduction to Data Structures and Algorithm Analysis (C++)
- Special Topics: Distributed Systems

Assistant Professor, Department of Computer Science,
University of Texas at Dallas, Richardson, TX. (September 2000 - August 2005)

- Discrete Structures
- Algorithm Analysis and Data Structures (C++) (including Honors)
- Advanced Data Structures and Algorithms
- Recent Advances in Scheduling Theory (research level course)

Teaching Assistant, Department of Computer & Information Science,
Polytechnic University, Brooklyn, NY. (September 1994 - May 1999)

- Introduction to Programming Methodology (Pascal & C++)
- Data Structures & Algorithms (Pascal & C++)
- Algorithms for Parallel & Distributed Systems

PRESENTATIONS (CONFERENCES/COLLOQUIUMS

- "Load-Sharing in Heterogeneous Systems via Weighted Factoring"
  - ACM Symposium on Parallel Algorithms and Architectures (SPAA), 1996.
- "On the Relationship between Combinatorial and LP-Based Approaches to NP-Hard Scheduling Problems"
  - ACM-SIAM Symposium on Discrete Algorithms (SODA), 1998.
  - Integer Programming and Combinatorial Optimization (IPCO), 1998.
  - Columbia University, Joint IEOR-MS Colloquium, 1998.
  - INFORMS National Meeting, Seattle, 1998.
- "Techniques for Scheduling with Rejection"
  - European Symposium on Algorithms (ESA), 1998.
  - Workshop on Models and Algorithms for Planning and Scheduling Problems (MAPSP), Renesse, The Netherlands, 1999.
- "Off-line Admission Control for General Scheduling Problems"
  - ACM-SIAM Symposium on Discrete Algorithms (SODA), 2000.
  - International Symposium on Mathematical Programming (ISMP), Atlanta, 2000.
- "On Deterministic Scheduling Approaches to Delivery of Scalable Streaming Media"
  - World Multi-Conference on Systemics, Cybernetics and Informatics (SCI), 2002.
  - Annual Conference of the Operational Research Society of Italy (AIRO): Integrating Operations Research and Information Technology to Support Decisions in Real World Systems, 2002.
- "Online Algorithms for Energy Efficient Wireless Transmission"
  - IEEE Wireless Communications and Networking Conference, New Orleans, 2003.
  - Polytechnic University, Brooklyn, 2003.
  - IEEE International Conference on Communications (ICC), Paris, 2004.
- "On the Complexity and Hardness of the Steganography Embedding Problem"
  - SPIE's 16th Annual Symposium Electronic Imaging Science and Technology, San Jose, 2004.

RESEARCH GRANTS

- **Sun Microsystems Inc. Academic Excellence Grant**
  "Efficient Adaptive Algorithms for Internet Advertisement Scheduling". *Amount: $32,035*. Duration: June 2006 - May 2009.
- **NCCU Faculty Senate Seed Grant**
  "Protocols Towards Improving QoS in Wireless Networks". *Amount: $2000.* Duration: January 2006 - October 2006.

- **Sun Microsystems Inc. Academic Equipment Grant**
  "Multi-layer approaches for reliable multimedia delivery over heterogeneous networks"; other PI: K. P. Subbalakshmi, Stevens Institute of Technology, New J ersey. *Amount: $52,000*. Duration: June 2001 - May 2003.
- **Clark Foundation Research Initiation Grant (Administered by Erik Jonsson School of Engineering and Computer Science at UT, Dallas.)**
  "Scheduling delivery of distributed multimedia information"; other PI: B. Prabhakaran, University of Texas at Dallas, Texas. *Amount: $48,000*. Duration January 2002 - December 2002.

STUDENT ADVISING & COMMITTEES

- **MS Thesis Advisor**
  - "Scheduling Under Machine Breakdowns: Approximation Bounds and Experimental Study", Anagha Kulkarni, MS Thesis, 2004.
  - "Combinatorial Scheduling Algorithms to Sequence Information Delivery", Sukumar Ramaraj, MS Thesis (co-advisor), 2003.
  - "Placement of Replicated Continuous Media Objects", Deepti Chand Parvathaneni, MS Thesis (co-advisor), 2003.
- **Undergraduate Honors Thesis Advisor**
  - "Geometric Algorithms for the Coverage Problem in Sensor Networks", Irfan Shahdad, Undergraduate Honors Thesis, 2004.
- **MS/PhD Thesis Committee Member**
  - "Sorting by Exchanging Elements at Bounded Distance", Sherry Fong, PhD Dissertation, 2005.
  - "Parallel Algorithms for High Performance Switching in Communication Networks ", Enyue Lu, PhD Dissertation, 2004.
  - "End-to-End QoS Guarantee in Heterogeneous Wired-Cum-Wireless Networks", Satish Satyamurthy, MS Thesis, 2003.
- **External MS/PhD Thesis Committee Member**
  - "Battery Power-Aware Encryption", Satish Bapatla, MS Thesis, Stevens Institute of Technology, 2004.

AWARDS AND SCHOLARSHIPS

- Leadership Award: Advisor of the Year 2002-2003, University of Texas at Dallas.
- Pearl Brownstein Doctoral Research Award (Polytechnic University), 1999, for doctoral research showing great promise in the field of Computer Science.
- Deborah Rosenthal, M.D. Award (Polytechnic University), 1996, for outstanding performance on the Computer Science Ph.D qualifying examination.
- GATE (Graduate Aptitude Test in Engineering) Scholarship (a national level scholarship), 1992-1994.
- Indian Institute of Science Merit Scholarship, 1990-1992.

COMPUTING SKILLS

- *Languages*: Java, C++, C, Pascal, FORTRAN, Prolog.
- *Others*: MPI, PVM.

PROFESSIONAL SERVICE

- Technical program committee member for IEEE Consumer Communications and Networking Conference (CCNC), 2007.
- Technical program committee member for IEEE International Workshop on Adaptive Wireless Networks (AWiN), 2004 & 2005 (GLOBECOM satellite workshop).
- Technical program committee member for IEEE International Symposium on Multimedia (ISM), 2005 & 2006. Additionally, co-organizer of a special track on Doctoral Dissertation in Multimedia.
- Technical program committee member for Multimedia Communication and Home Networking Symposium at IEEE International Conference on Communications (ICC), 2005.
- Technical program committee member for IEEE International Workshop on Networking Issues in Multimedia Entertainment (NIME) (GLOBECOM 2004 satellite workshop).
- Technical program committee member for Multimedia session at the "Global Services and Infrastructure for Next Generation Networking" Symposium at the International Conference on Communications (ICC), 2003.
- Panelist for NSF-ITR program.
- Reviewer for Acta Informatica, Computers & Industrial Engineering, European Symposium on Algorithms (ESA 2003), IEEE Consumer Communications and Networking Conference (CCNC 2007), IEEE International Conference on Communications (ICC 2003, 2004, 2005), IEEE International Symposium on Multimedia (ISM 2005, 2006), IEEE International Workshop on Adaptive Wireless Networks (AWiN (GLOBECOM) 2004, 2005), IEEE International Workshop on Networking Issues in Multimedia Entertainment (NIME (GLOBECOM) 2004), IEEE INFOCOM (2004), IEEE Transactions on Circuits and Systems for Videotechnology, IEEE Transactions on Control Systems Technology, IEEE Wireless Communications and Networking Conference (WCNC 2005), Information & Computation, INFORMS Journal on Computing, International Conference on Supercomputing (ICS'97), International Journal of Computers and Their Applications (a publication of ISCA), Journal of Algorithms, Journal of Scheduling, Journal of Universal Computer Science (Springer), SIAM Journal on Computing (SICOMP), Systemics, Cybernetics and Informatics (SCI 2004) and Theoretical Computer Science A.
- Member of the *Graduate Admissions Committee* (CS Department, UT Dallas, September 2000 - August 2002).
- Member of the *Core Committee for the Support of Women and Minorities*, that reports directly to the university president (UT Dallas, September 2001 - August 2003).
- Member of the *Computer Science Department Library Committee* (CS Department, UT Dallas, September 2003 - August 2005).

PROFESSIONAL MEMBERSHIPS

ACM, IEEE.