Leading the Tech Revolution

The future of engineering will be very different. The way we educate engineers and computer scientists will change. The disciplines necessary to the future of engineering are going to look very different from those we have today and they will be intricately interconnected.

There are no models.

Fearless engineering prepares for what is not yet invented. Or imagined. It anticipates what could be and builds the infrastructure to support it. It leads change. It leads the revolution in engineering.

Since its founding in 1986, the Jonsson School has been committed to world-class education and breakthrough research. In twenty short years, the school has had some remarkable achievements:

- For the second year in a row, UTD confers the most computer science degrees in the nation—at the B.S., M.S., and Ph.D. levels combined, according to the *American Society of Engineering Education* data.
- UTD ranks fourth in the nation when you combine all degrees awarded in electrical engineering and computer science.
- UTD also ranks first in the total number of computer science degrees awarded to women and second in the number of female tenured/tenure track computer science faculty members within an engineering school.
- Incoming UTD students have the highest SAT scores of any public university in Texas.
- The Jonsson School offers degree programs in electrical engineering, computer science, computer engineering, software engineering, materials science & engineering, and telecommunications engineering—the nation's first ABET-accredited telecom engineering degree program.
- And, from nanotechnology and human language technology to micro-electrical-mechanical systems and cybersecurity, researchers are addressing the hottest—and coolest—challenges of our time.

Impressive achievements for a twenty-year old school, by any standards. And the best is yet to come.

To help ensure the future economic life of North Texas, the State of Texas, Texas Instruments, The University of Texas System and private sources are funding a $300 million research initiative to make the Jonsson School even stronger by building a new $85 million Natural Science & Engineering Research Laboratory, adding endowed chairs, and significantly increasing graduate fellowships to attract even more top talent.

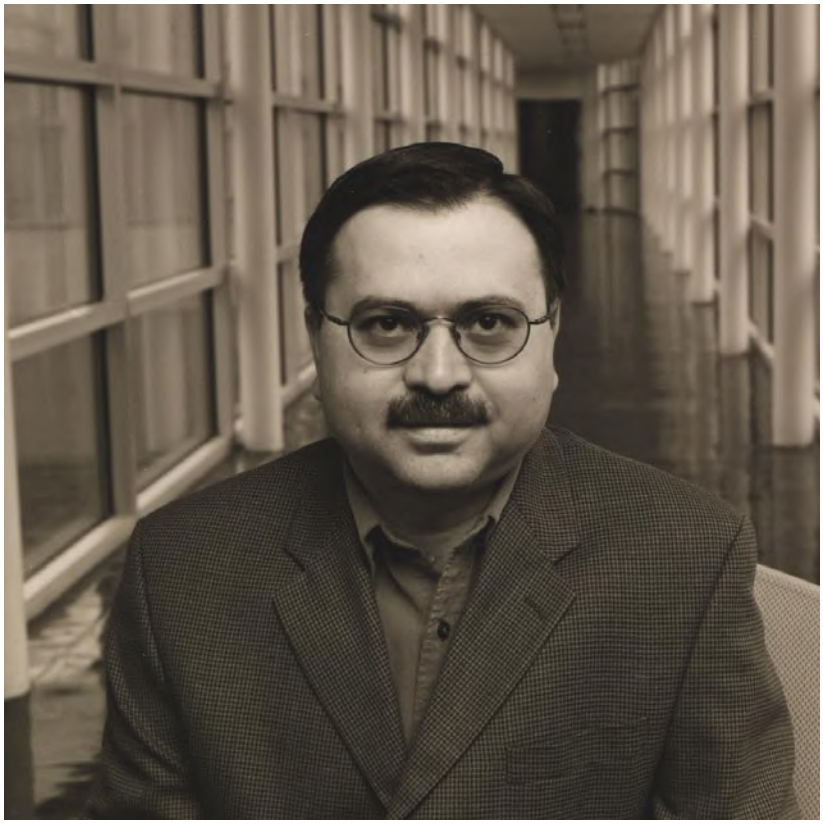
The research of the Jonsson School faculty and their students is a fundamental part of creating the world-class engineering school crucial to the future of Texas and the nation. In the following pages you'll see how UTD's Jonsson School faculty, along with their students, are tackling some of the most interesting challenges of tomorrow and you'll see how engineering and computer science are evolving.

The Jonsson School is proving itself a leader in the tech revolution. Join us.

Dr. Bob Helms
Dean of Engineering and Computer Science

Natural Science & Engineering Research Building

UTD's new 192,000-square foot interdisciplinary research laboratory will house world-class laboratories and support facilities for research in electrical engineering, materials science, behavioral and brain sciences, chemistry, biology, and physics. The $85 million building is designed to enhance collaborative, interdisciplinary research and will open in late 2006.



Naofal Al-Dhahir

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Research Interests

- Design of Physical-Layer Algorithms for Broadband Transmission
- Signal Processing under Practical Complexity Constraints

Education

- Ph.D., Electrical Engineering, Stanford University (1994)
- M.Sc., Electrical Engineering, Stanford University (1990)
- B.Sc., Electrical Engineering, Kuwait University (1989)

"The most rewarding part of my job as a professor at UTD is daily interaction with students as a teacher in the classroom and as a research supervisor in the lab. I get tremendous satisfaction from the feeling that I'm making a positive impact on their lives by teaching them to be creative thinkers and fearless researchers. Day by day, as they uncover and understand more, they learn to tell a coherent, logical story of what they learned, where it came from, how it connects to other things, and what it is good for in the simplest possible language. I believe these skills are critical for their future careers."

Professional Highlights

Dr. Al-Dhahir is an Associate Professor in the Department of Electrical Engineering. Prior to joining UTD, he gained more than 10 years of industry experience at the research and design laboratories of General Electric and AT&T. Among his areas of research focus are low-complexity receiver algorithms, space-time coding, cross-layer design, beamforming algorithms for anti-jam Global Positioning System (GPS) receivers, and multi-carrier Discrete Multitone Modulation/Orthogonal Frequency-Division Multiplexing (DMT/OFDM) transceiver design for both wireline (DSL modems) and wireless (802.11, 802.16,802.15.3, and Digital Video Broadcasting systems). He holds 16 issued U.S. Patents and has authored over 145 journal and conference publications on these and related topics. Dr. Al-Dhahir is an editor for the *IEEE Transactions on Wireless Communications*. Dr. Al-Dhahir's research awards include the IEEE 2006 Donald G. Fink Best Journal Paper award, the IEEE 2005 Signal Processing Society Young Author Best Journal Paper award, the IEEE Fall 2005 Vehicular Technology Conference Best Paper award, and General Electric R&D Center Research Achievements awards in 1995, 1996, and 1999.

ENHANCING THROUGHPUT AND RELIABILITY OF BROADBAND WIRELESS TRANSMISSIONS

Dr. Al-Dhahir applies multiple-antenna (or so-called "space-time") techniques to enhance the throughput and reliability of broadband wireless transmissions both for outdoor environments such as cellular, and digital television broadcasts, and indoor environments such as wireless local area and personal area networks.

HIGH-PERFORMANCE RECEIVER DIGITAL SIGNAL PROCESSING ALGORITHMS

Dr. Al-Dhahir's research focuses on the design of computationally efficient high-performance receiver digital signal processing algorithms—such as equalization, interference cancellation, and decoding—under severe multipath conditions. He investigates both coherent techniques where the channel is estimated at the receiver, and non-coherent techniques (differential) where no channel knowledge is available. Both of these techniques are especially attractive under high-mobility conditions.

Poras Balsara

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Associate Chairman for Graduate Studies, Electrical Engineering

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Research Interests

- Very Large-Scale Integration (VLSI) Design Techniques
- Circuits and Systems for Digital Signal Processing (DSP) and Communications
- Reconfigurable Circuits and Systems for Field Programmable Gate Arrays (FPGA)
- Power Aware Architectures and 3D Circuits

Education

- Ph.D., Electrical Engineering, Penn State University (1989)
- M.S., Electrical Engineering, Penn State University (1985)
- B.E. (Distinction), University of Bombay, India (1983)
- L.E.E. (Distinction), Victoria Jubilee Technical Institute, Bombay, India (1980)

"I enjoy teaching and conducting research. Being a university professor gives me opportunity to teach, interact with students at different levels, investigate interesting and challenging research problems and collaborate with other colleagues in academia and industry."

Professional Highlights

Dr. Poras T. Balsara is a Professor in the Department of Electrical Engineering and the Director of UTD's Center for Integrated Circuits and Systems (CICS). His research interests include VLSI design, the design of energy efficient digital circuits and systems, VLSI architectures and algorithms for signal processing and communications, computer arithmetic, reconfigurable computing, and application-specific systems design. Dr. Balsara has published many journal and conference papers in these areas. He is a Senior Member of the IEEE and consults and conducts research in the integrated circuit (IC) design industry.

CIRCUITS AND SYSTEMS FOR SIGNAL PROCESSING AND COMMUNICATIONS

Dr. Balsara's work involves developing digitally intensive techniques for design of circuits and architectures for wireless communications. This investigation began with the development of a high-speed all-digital frequency synthesizer operating in GHz range. In this work, digital techniques were used to tune an LC oscillator to create a synthesizer around a digitally controlled oscillator. Currently under investigation are circuits for high-speed interpolators, filters, modulation, equalization and coding and digital techniques to calibrate, monitor and tune mixed-signal circuits to alleviate problems related to process, temperature and voltage variations.

ENERGY EFFICIENT DIGITAL SYSTEMS

Dr. Balsara is performing an ongoing investigation in which techniques are being developed for lowering power dissipation in digital systems without drastically affecting performance. Taking into account the growing demand for battery-powered and portable applications, this research is being carried out to lower the dynamic and leakage power dissipation in both custom and reconfigurable circuits and systems.

RECONFIGURABLE DIGITAL SYSTEMS

This investigation involves design and development of reconfigurable hardware that is suitable for DSP and multimedia applications. The rapid prototyping of wireless communication systems and sensor network platforms is also being investigated. Dr. Balsara is developing several building blocks for power aware digital filters and communication algorithms. Work is also being done to develop new energy-efficient FPGA architectures.

NETWORK-ON-CHIP (NoC) ARCHITECTURES FOR FUTURE GENERATION INTERCONNECTS

The NoC architecture is a solution for providing on-chip communication for System-on-Chip (SoC) applications. It is a packet switched network that separates communication from computation and facilitates parallel communication between the processing cores on the chip. The NoC overcomes the limitations of current bus-based networks by providing scalable bandwidth, parallel communication, and pipelined high speed short node-to-node links. It also facilitates integration and synchronization of various IP cores, error checking protocols, and dynamic reconfiguration of the processing elements. Currently, Dr. Balsara's research is looking into implementing system level applications on this network to evaluate the network performance and also dynamically reconfigure applications on this communication network.

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Research Interests

- AI-Based Automated Software Synthesis and Testing
- Embedded Real-Time Process-Control and Telecommunications Systems
- Formal Methods and Automated Program Transformation
- High-Assurance Autonomous Decentralized Systems
- High-Confidence Software Reliability, Safety, and Security Assurance
- Inherently Fault-Tolerant and Self-Stabilizing Distributed Systems
- Modular Parallel Programs
- Tele-Collaborative Systems

Education

- Ph.D., Computer Science, University of California, Berkeley (1980)
- M.S., Computer Science, University of California, Berkeley (1978)
- B.Tech., Electrical Engineering, Indian Institute of Technology, Bombay, India (1977)

"Perfectioneering, or the relentless quest for perfection, is desirable in many disciplines but absolutely indispensable for critical systems. We are developing tools and techniques to enable software engineers to fearlessly conceive and rapidly create and deploy perfect software for critical modern applications."

Professional Highlights

Dr. Bastani has been a Professor in the Department of Computer Science at UTD since 1997. He is Director of the UTD Embedded Software Center that he established in 2000 with funding from Alcatel USA and Texas Instruments. His current research interests are in the areas of automated software synthesis and testing, highly dependable real-time network-centric systems, high-assurance systems engineering, and inherently fault-tolerant and self-stabilizing distributed systems. Dr. Bastani has received funding from several agencies, including the National Science Foundation (NSF), the Army Research Laboratory, the Space and Missile Defense Command (SMDC), the US Nuclear Regulatory Commission, the US Air Force, and the Texas Advanced Research Program. He has also received funding and equipment donations from industry, including Alcatel USA, IBM, QuEST Forum, Texas Instruments, and Windriver. Dr Bastani's research is currently supported by NASA — via IA/Tech, Inc. — and the Department of Defense's Space and Naval Warfare Systems Command (SPAWAR)/National Institute for Systems Test and Productivity (NISTP) via Independent Engineering, Inc.

Dr. Bastani has published over 150 refereed papers and has graduated 12 Ph.D. students and over 60 M.S. students. Dr. Bastani has been on the program committees of numerous conferences and workshops and on the editorial board of the *IEEE Transactions on Software Engineering* and the *High Integrity Systems Journal*. He is currently an emeritus Editor-in-Chief of the *IEEE Transactions on Knowledge and Data Engineering*, serves on the editorial boards of the *International Journal of Artificial Intelligence Tools* and the *Journal of Knowledge and Information Systems (KAIS)*, and on the Steering Committees of the *IEEE International Conference on Tools with Artificial Intelligence* and the *IEEE Symposium on Service-Oriented Systems Engineering*.

THE INTEGRATION OF EMBEDDED MULTI-SYSTEMS

Embedded multi-systems are used in a variety of applications ranging from telecommunications systems to sensor networks, emergency response systems, defense systems, and systems of autonomous mobile entities. These systems must be highly reliable since they are often used for critical applications. They must also be very secure since the network can be susceptible to intrusions and other types of cyber attacks. With initial funding from Alcatel USA, Texas Instruments, and the National Science Foundation, Dr. Bastani's team has explored methods of rapidly integrating embedded software systems from existing commercial-off-the-shelf (COTS) components. They are currently investigating a two-pronged strategy toward automatically generating the software, namely, aspect-oriented decomposition coupled with automated glue code synthesis. Dr. Bastani's team has developed a method of decomposing embedded frameworks into microservices that can be automatically customized and composed together to build application-specific frameworks.

TEMPORAL LOGIC OF ACTION (TLA)

Dr. Bastani and his team have developed a method of decomposing functional requirements expressed in Temporal Logic of Action (TLA) notation into orthogonal aspects of embedded multi-systems and have designed an integrated programming environment for supporting the automated decomposition of these types of specifications. Dr. Bastani is also developing models and tools for certifying critical embedded systems, especially with respect to their reliability and security. This approach uses a novel combination of formal, statistical, and AI reasoning techniques to achieve high-confidence certification of embedded software systems.

MULTI-MODAL USER FRIENDLY INTERFACES FOR EMBEDDED SYSTEMS

With initial funding from Alcatel USA, Dr. Bastani's research team has investigated methods of supporting the development of multi-modal user-friendly interfaces for embedded systems. This includes methods of rapidly building user-friendly systems using commercial speech recognition engines coupled with advanced graphics and computer vision systems. Dr. Bastani has also investigated advanced network support for rich presence systems, a powerful platform for building real-time, robust communication frameworks for embedded multi-systems. This project is leading to research into innovative rich presence query specification, processing, and presentation methods with applications to tele-collaborative and telematic systems.

EMBEDDED SYSTEM SECURITY

Using sophisticated techniques for tolerating faults without compromising performance, including self-stabilizing and inherent tolerance methods, Dr. Bastani's team is exploring hardware/software techniques for enabling embedded systems to fully withstand entire classes of security attacks, including attack-tolerant methods that guarantee that critical information will not be compromised and that enable critical services to be provided even under successful attacks. Plans are in place to develop a comprehensive integrated environment to support the code synthesis process.

Sergey Bereg

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Research Interests

- Computational Biology and Bioinformatics
- Computational Geometry and Geometric Optimization
- Networks and Communications
- Geographic Information Systems
- Facility Location
- Pattern Matching

Education

- Ph.D., Minsk Institute of Mathematics, Belarus (1992)

Professional Highlights

Dr. Bereg is an Associate Professor in the Department of Computer Science, where he has taught and conducted research since September 2002. His primary research areas are computational geometry and computational biology. Among his specific research projects are the study of computer graphics and mesh generation with applications to medicine, shape matching, and Geographic Information Systems (GIS) and map labeling.

MULTIPLE SEQUENCE ALIGNMENT

Many problems in multiple sequence alignment are NP-hard (non-deterministic polynomial-time hard) and there is a scientific need for efficient approximation algorithms. Recently, Dr. Bereg's team has studied RNA multiple structural alignments based upon the longest common subsequences.

PROTEIN STRUCTURE ANALYSIS

Dr. Bereg's team has studied the 3D structures of proteins using tools from computational geometry. This research considers the alignment of the 3D structures—polylines and surfaces, surface complementarily, and modeling proteins with cylinders. Recently, Dr. Bereg began research concerning combinatorial rigidity and its applications to protein structure analysis.

PHYLOGENETIC NETWORKS

Phylogeny reflects the history of transmission of life's genetic information and is an important part of biological investigations. One of the major endeavors in biology is reconstructing the complete "Tree of Life" - the phylogeny of all living organisms on Earth. Dr. Bereg's team is developing new methods for inferring such phylogenetic networks.

MOBILE COMPUTING

Dr. Bereg's team has designed efficient algorithms for mobile devices using methods from facility location.

COMPUTATIONAL TOPOLOGY

Focusing on problems in the interdisciplinary area of computer science and topology, Dr. Bereg is researching the shortest homotopic paths and encoding homotopy of paths. Another topic under consideration is that of equipartitions to discover a balanced partition of several masses distributed in a space. His team's recent work involves partitioning two sets in a polygon by geodesic paths.

Dinesh Bhatia

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Program Head, Computer Engineering

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Research Interests

- Reconfigurable and Adaptive Computing
- Architecture and CAD for Field Programmable Gate Arrays
- Design Automation for VLSI Systems
- Ultra Low Power Sensor Networks and Applications
- Energy Scavenging and Power Management for Wireless Networks
- Graph Theory and Applications in VLSI

Education

- Ph.D., Computer Science, The University of Texas at Dallas (1990)
- M.S., Computer Science, The University of Texas at Dallas (1987)
- B.S., Electrical Engineering, Regional Engineering College, Suratkal, India (1985)

"As an engineering professor and as a researcher who builds systems as artifacts, I see education has a role much larger than just creating a trained work force. Understanding fundamentals and using sound design principles makes engineers who are cautious in their creativity yet open to endless innovation. We should open the minds of the students to different facets of learning, and being able to contribute to such an environment is what I am most passionate about."

Professional Highlights

Dr. Dinesh Bhatia an Associate Professor in the Department of Electrical Engineering and is also the program head for Computer Engineering. He directs research activities within the Embedded and Adaptive Computing group and is also a member of UTD's Center for Integrated Circuits and Systems. His research interests include all aspects of reconfigurable and adaptive computing, architecture, and Computer-Aided Design (CAD) for Field Programmable Gate Arrays (FPGAs), physical design automation of Very Large-Scale Integration (VLSI) systems, power-aware programmable architectures, Network-on-Chip (NoC) solutions for Systems-on-Chip (SoCs) applications of wireless sensor networks. He has extensive experience in building large scale embedded and reconfigurable systems. Some of these activities include being principal designer and investigator for the RACE and NEBULA systems at the US Air Force's Wright Laboratories, a Principal Investigator (PI) for the DARPA-funded REACT program, a Co-PI on the Air Force Research Laboratory (AFRL) funded Scalable Processor Architecture (SPARCs) program and several others. Dr. Bhatia has collaborated on phase 1 and phase 2 Small Business Innovation Research (SBIR) programs to build product prototypes. He has published extensively in leading journals and conferences and continues to serve on program committees of several conferences. Dr. Bhatia is a senior member of the IEEE, the Computer Society, the Circuits and Systems Society, Eta Kappa Nu, and recently he served on the editorial board of *IEEE Transactions on Computers*.

RECONFIGURABLE AND ADAPTIVE COMPUTING

Dr. Bhatia's teams have built several large scale architectures and supporting software environments for signal processing and related applications. These include statically reconfigurable RACE architecture and dynamically reconfigurable NEBULA and REACT architectures. The current design focus is on NoC based system-level solutions that will help alleviate the interconnection design problems for current and future generation integrated systems.

ARCHITECTURE AND CAD FOR FIELD PROGRAMMABLE GATE ARRAYS

Dr. Bhatia has investigated the design of ultra low power programmable architectures (FPGA type) and supporting CAD for mapping large applications on programmable fabrics. The CAD tools include algorithms for a-priori prediction of design feasibility, floor-planning, placement, and routing. Dr. Bhatia's teams have evolved CAD/CAE tools to exploit available resources for overall power reduction in future deep sub-micron designs. His current investigations are focusing on architecture design, techniques for clustering, and mapping (place and floorplan) designs on power-aware programmable architectures.

ULTRA LOW POWER WIRELESS SENSOR NETWORKS AND APPLICATIONS

Wireless sensor networks have the potential to impact many aspects of human life by ubiquitously sensing, processing, and transmitting information. Medical care is one such area, where Dr. Bhatia's research group is exploring many applications in support of health monitoring and telemedicine. By outfitting patients with wireless and wearable vital sign sensors, real time data is collected for determining the physiological status of a patient. Dr. Bhatia's current research focus is on designing physical layer wireless nodes, network protocols, and security issues in managing patient health data.

ENERGY SCAVENGING AND POWER MANAGEMENT FOR WIRELESS NETWORKS

As embedded systems become more and more pervasive, managing their powering requirements will become an important and challenging problem. Dr. Bhatia's research group is solving many problems related to scavenging energy from natural resources. These include light (solar), air-flow, vibrations (piezo-electric), and more. Current solutions include a fully operational wireless sensor network that operates in batteryless environments. The current research focus includes designing circuits for power management, regulation, and delivery of energy for ultra low power operations. Power management for data processing is also addressed by using extreme design techniques like asynchronous designs.

3D INTEGRATED CIRCUIT (IC) DESIGN

Dr. Bhatia has investigated the design of interconnect-dominated 3D IC architectures (such as FPGAs). A successful evolution of 3D integrated circuits would require synergistic activities in the areas of circuit processing technology and development of CAD tools. Dr. Bhatia's team is developing a 3D CAD framework that addresses physical mapping in the presence of performance, thermal and electrical constraints.

Andrew J. Blanchard

Professor, Electrical Engineering

Senior Associate Dean, Director Operations and Finance

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Research Interests

- Mathematical Modeling of Electromagnetic Phenomena; Microwave Theory and Design; Radar System and Antenna Analysis
- Radar Cross-Section Measurements; Tomographic Imaging (Microwave and Acoustic)
- Electro-Optical System Design and Modeling

Education

- Ph.D., Electrical Engineering, Texas A&M University (1977)
- M.S., Electrical Engineering, Colorado State University (1974)
- B.S. Electrical Engineering, University of Southwestern Louisiana (1972)

"Fearless Engineering places you at the heart of an engineering solution. It allows failure, creativity, sharing, and innovation in the solution space. It lets you deliver the best value to the customer."

Professional Highlights

Andrew J. Blanchard received the B.S. degree from the University of Southwestern Louisiana, in 1972, the M.S. degree from Colorado State University in 1974, and the Ph.D. degree from Texas A&M University, College Station, in 1977, all in electrical engineering.

Prior to joining UTD, Dr. Blanchard was employed in academia, worked in industry, and served as a consultant to government and industry where he managed multi-million dollar programs. He has held full professorships with the Department of Electrical Engineering at The University of Texas at Dallas, the University of Missouri-Columbia, and The University of Texas at Arlington. He was a Research Engineer and recognized as a Research Fellow for outstanding research performance for three years with the Texas Engineering Experiment Station. From 1977 to 1979 he was Group Supervisor of the Remote Sensing Group in the Exploration Research Division of Conoco, Inc., Ponca City, OK. From 1989 to 1995 he worked with the Houston Advanced Research Center (HARC), serving as the Director of the Strategic Technology and Research Center. From 1995 to 2000 he was employed as the Director of Research and Budget for the College of Engineering at the University of Missouri-Columbia. Recently he served as Vice President –Technology, Clean Earth Technologies, where he was responsible for building programs in RF and optical sensor systems, imaging and network technologies, and weapons/sensor datalinks. His areas of technical specialization include mathematical modeling of electromagnetic phenomena; RF systems theory and design, radar system and antenna analysis; radar cross section theory and measurements, tomographic imaging (microwave, optical and acoustic), and electro-optical system design and modeling.

Dr. Blanchard is a member of the Electromagnetics Society, URSI Commission F, IEEE Geoscience Remote Sensing Society (GRSS), and the GRSS Fellow Evaluation Committee. He is affiliated with AGU, Phi Kappa Phi, Eta Kappa Nu, ASEE and Tau Beta Pi. In 1986 he received the Eta Kappa Nu MacDonald Award as the "Outstanding Electrical Engineering Professor in the United States of America." He is a registered professional engineer in the State of Texas, No. 48445, and an Institute of Electrical and Electronics Engineers (IEEE) Fellow. His contributions to the IEEE GRSS AdCom since becoming a member in 1986 include Newsletter Editor, Chairman of the Constitution and Bylaws Committee, Treasurer, Vice President, President and Chair of Strategic Planning for the Society. Dr Blanchard was the 1996 Recipient of the IEEE GRSS Outstanding Service Award, and the IEEE Third Millennium Medal.

Dale Byrne

Associate Professor, Electrical Engineering & Physics

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Research Interests

- Conception, Design, and Analysis of New Ellipsometric and Scatterometric Instrumentation and Analysis of Acquired Data
- Conception, Design, and Analysis of Diffractive Structures that Perform Specialized Spectral Filtering and/or Diffractive Functions
- Incorporation of Chiral Materials into Optical Devices to Perform Unique Spectral and/or Diffractive Functions

Education

- Ph.D., Optical Sciences, The University of Arizona (1978)
- M.S., Optical Sciences, The University of Arizona (1975)
- M.S., Physics, Florida Institute of Technology (1970)
- B.S., Physics, Florida Institute of Technology (1968)

"I most enjoy inverse problems… that is, problems in which the "answer is known" so to speak – meaning that measurements have been made – and the problem is to determine what caused the measurements. This generic type of problem can be one that is "diagnostic," and hence has applications in the medical field."

Professional Highlights

Dr. Byrne is an Associate Professor in the Departments of Electrical Engineering and Physics. He couples his theoretical interests with experimental work as much as possible and is upgrading the capabilities of his laboratories in both spectral measurements and optical testing. Dr. Byrne's area of expertise is in the general area of applied optics, with special emphasis on electromagnetic wave propagation, diffraction and scattering, and optical instrument design and analysis. His interests center around the propagation of electromagnetic waves and their interaction with materials, surfaces, and structures. Dr. Byrne worked in industrial research for nine years prior to joining UTD. From 1978 to 1980, he worked on real-time phase detection and correction of high-energy laser beams and associated imaging systems with United Technologies Research Center in West Palm Beach, Florida. This activity occurred during the United States' push for a "Star Wars" satellite defense system. For LTV Missiles and Advanced Electronics in Dallas, Dr. Byrne worked on optical countermeasures that prevent the disabling of optical and infrared detectors. This work involved the use of a switchable filter material (vanadium dioxide) that could change states from a semiconductor to a metal upon the application of heat. Dr. Byrne is currently investigating new polarization and spectral properties associated with metal mesh filters, commonly called frequency selective surfaces (FSSs).

FREQUENCY SELECTIVE SURFACE (STRUCTURE)

These surfaces are most easily described as two dimensional amplitude diffraction gratings whose spatial period is less than the wavelength of the incident radiation. Mesh can act as a filter to reflect radiation at microwave frequencies, while transmitting radiation at optical frequencies. Dr. Byrne's team is working to develop narrowband spectral filters, some of which are spectrally tunable. He is also working on metal grids that act in a manner similar to "optically active" materials, in that they respond to right and left circularly polarized waves differently.

ELLIPSOMETRY

Dr. Byrne's work in ellipsometry centers around the development of ellipsometric instrumentation. One of the instruments that his team has developed is an angular scanning ellipsometer, with the requisite software to control its operation and analyze the acquired data. Dr. Byrne and his students are currently calibrating and testing the optical assembly. Dr. Byrne has conceptualized analytical tasks that are related to system modeling of the ellipsometer, in its original configuration, and to its operation as a scatterometer and to the analysis of data collected by the instrument.

SCATTEROMETRY

Dr. Byrne's work in scatterometry began several years ago with the idea that he could devise a method for data analysis that would circumvent the need to generate a large database, which was successful. More recently, he concentrated on the general aspects of "inversion problems," specifically as they apply to analysis of scatterometric data.

João W. Cangussu

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Research Interests

- Software Process Control
- Software Testing
- Adaptive Systems
- Software Metrics

Education

- Ph.D., Computer Science, Purdue University, Indiana (2002)
- M.S., University of São Paulo, São Carlos, Brazil (1993)
- B.S., Federal University of Mato Grosso do Sul, Brazil (1990)

"I believe that UTD can fulfill its goal of achieving tier one status and become an internationally recognized research center.To be part of and have influence on this process is a challenging but enjoyable task."

Professional Highlights

Dr. Cangussu is an Assistant Professor of Computer Science at UTD. He received his Ph.D. in Computer Science from Purdue University in 2002. Dr. Cangussu's research interests are primary in the software engineering arena, specifically on software process monitoring, control, and management. He is interested in software testing and the application of control theory aspects to computer-related problems.

STRESS TESTING

Dr. Cangussu's research studies the automatic stress and load testing technique based on the concepts of feedback control theory. By automatically driving the resource usage to its limit, load sensitive faults can be detected and performance issues can be verified under stress conditions.

SOFTWARE PROCESS CONTROL

Dr. Cangussu's approach enables software development managers to exercise improved control over the cost, schedule, and quality of the Software Development Process (SDP). Dr. Cangussu's team believes that a formal theory of SDP control—based on an adaptation of the theory of automatic control—will likely help elevate the state of the SDP nearer to that of traditional manufacturing processes such as aircraft and automobile assembly.

Among Dr. Cangussu's many published works are:

- **A Software Test Process Stochastic Control Model based on CMM Characterization**, from *Software Process: Improvement and Practice,* Wiley Interscience, Volume 9, Issue 2, 2004
- **Using Sensitivity Analysis to Validate a State Variable Model of the Software Test Process**, with R. A. DeCarlo and A. P. Mathur, from the *IEEE Transactions on Software Engineering*, Volume 29, No. 5. 2003
- **Monitoring the Software Test Process Using Statistical Process Control: A Logarithmic Approach**, with R. A. DeCarlo and A. P. Mathur, from the *European Software Engineering Conference and ACM SIGSOFT Symposium on the Foundations of Software Engineering* (ESEC/FSE 2003), Helsinki, Finland, September 2003
- **A Formal Model for the Software Test Process**, with R. A. DeCarlo and A. P. Mathur, from *IEEE Transactions on Software Engineering*, Volume 28, No. 8, August 2002

Cyrus D. Cantrell

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Research Interests

- Photonics, including Raman Amplification in Fibers, Nonlinear Fiber Optics, Optical Switching and Routing
- Computational Electromagnetics with Applications to Very High Speed Deep Submicron Very Large-Scale Integration (VLSI) Circuits

Education

- Ph.D., Physics, Princeton University (1968)
- M.S., Physics, Princeton University (1964)
- B.S. (cum laude), Physics, Harvard University (1962)

"I had to be fearless – some said foolish – to believe that I could unravel the secrets of the infrared spectrum of UF_6 for laser isotope separation, when I knew no molecular spectroscopy and others had spent 20 years in the field. I did it in 3 weeks."

Professional Highlights

After earning his Bachelor's degree from Harvard and both Master's and Ph.D. degrees from Princeton University, Dr. Cantrell's first academic position was at Swarthmore. He received tenure there and subsequently joined the staff of the Los Alamos National Laboratory. Dr. Cantrell has worked in a wide variety of research areas. His current research topics include computational and theoretical nonlinear optics and the experimental study of polarization-mode dispersion in optical fibers. He has also performed research into bifurcation and hysteresis effects in lasers, multiphoton molecular excitation and dissociation, infrared spectroscopy of SF_6 and other polyatomic molecules, photoelectron counting statistics, intensity statistics of laser light, laser isotope separation, laser-light interactions with carriers in semiconductors, laser damage mechanisms in semiconductors, swept-beam-pumped lasers, and free-electron lasers. In 1985, Dr. Cantrell was elected a Fellow of the IEEE in recognition of his work at Los Alamos, and in 2000 he was awarded an IEEE Third Millennium Medal. He is a Fellow of the Optical Society of America and the American Physical Society. Dr. Cantrell has published more than 100 journal, conference, and book-chapter publications, and obtained three U.S. patents.

PHOTONICS AND OPTICAL COMMUNICATION SYSTEMS

Dr. Cantrell has recently worked and published on Raman amplification in optical fibers, performance monitoring in transparent optical metropolitan area networks, and novel numerical methods for simulating interacting, oppositely propagating pulses and pulse trains in optical fibers. He has received one of four Lockheed-Martin university grants in the United States for research on signal propagation in multimode fiberoptic communication systems such as those employed in tactical aircraft.

NONLINEAR OPTICS IN GLASS OR LIQUID DIELECTRIC SPHERES

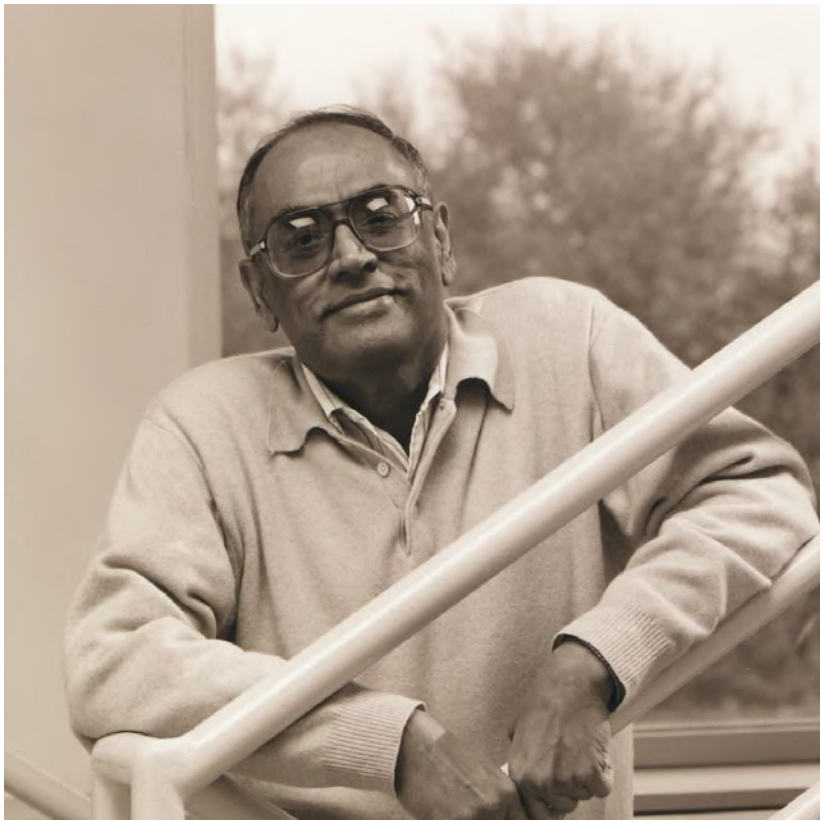
With a view towards applications to defend against high-power laser weapons, Dr. Cantrell's research in this area used group theory and the Racah-Wigner angular-momentum calculus to take maximum advantage of the exceptionally high symmetry of the sphere for simulating nonlinear interactions of electromagnetic fields. Resulting from this approach has been a computational method that is more accurate, and several orders of magnitude faster, than conventional finite-difference time-domain techniques.

QUANTUM COMPUTING

Stimulated by the arrival of an extremely capable doctoral student with a well-formed plan and 25 years of experience at Texas Instruments, Dr. Cantrell began a research thrust in quantum computing. They researched the creation of tools that will be needed in order to design quantum computers with thousands or millions of gates. The student, Dr. Matzke, successfully defended his dissertation, *Quantum Computation using Geometric Algebra*, in January 2002.

OPTIMIZING DIGITAL SIGNAL PROCESSOR ARCHITECTURES FOR ALGORITHMS

In 2000, Dr. Cantrell undertook the supervision of doctoral research in computer architecture, specifically in the area of optimizing digital signal processor architectures for algorithms other than multiply-accumulate and the Fast Fourier Transform.



Ramaswamy Chandrasekaran

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Research Interests

- Fault Tolerant Network Design
- On-line Algorithms for Parallel Machine Scheduling
- Special Multi-commodity Flow Problems
- Defensive Flows in Networks
- Minimum Cost System Reliability with Discrete Choice Sets for Components
- Combinatorial Algorithms and Integer Programming
- Computational Geometry
- Game Theory and Applications

Education

- Ph.D., Operations Research, University of California, Berkeley (1967)
- B.Tech (Honors), Mech. Engineering, Indian Institute of Technology, Bombay, 1964

Professional Highlights

Dr. Chandrasekaran is a UT System Ashbel Smith Professor. He holds a Ph.D. in Operations Research from the University of California at Berkeley and has taught courses in Advanced Data Structures, Algorithms, Combinatorics and Graph Algorithms, Optimization, Scheduling, Linear Programming and Combinatorial Optimization. Among many recent published works are:

- **Multi-Path Multi-terminal Flow Synthesis**, with K.P.K. Nair, Y.P. Aneja, and S.N. Kabadi, *Discrete Applied Mathematics*, 143, 2004
- **Prognosis Using an Isotonic Prediction Technique**, with Y. Ryu, and V. Jacob, *Management Science*, 50, #6, June 2004
- **Minimum Cost System Reliability with Discrete Choice Sets for Components**, with Y.P. Aneja and K.P.K. Nair, *IEEE Transactions on Reliability*, 2004
- **Scheduling Multiple Parts in a Robotic Cell Served by a Dual Gripper Robot**, with C. Sriskandarajah, I. Drobouchevitch, and S.P. Sethi, *Operations Research*, 2004
- **Improved Bounds for the On-line Scheduling Problem**, with John Rudin, *SIAM Journal on Computing*, 2003
- **Parametric Overall Min-Cut Trees**, with Y.P. Aneja and K.P.K. Nair, *Information Processing Letters*, 2003
- **Parametric Min-Cuts Analysis in a Network**, with Y.P. Aneja and K.P.K. Nair, *Discrete Applied Mathematics*, 2003
- **Using Linear Programming in a Business-to-Business Auction Mechanism**, with Milind Dawande and J. Kalagnanam, *The Review of Marketing Science*, #4, 2002
- **Maximizing Residual Flow under Arc Destruction**, with Y.P. Aneja and K.P.K. Nair, *NETWORKS*, 38, #4, 2001
- **Computational Complexity of Integrated Models of Network Design and Facility Location**, with J. Bhadury and L. Gewali, *Southwest Journal of Pure and Applied Mathematics*, 2000
- **Filtering Objectionable Internet Content**, with V. Jacob, R. Krishnan, Y.U. Ryu, and S. Hong in *Proceedings (Refereed) of the 20th International Conference on Information Systems*, 1999
- **Identifying Alternate Optimal Solutions to the Design Approximation Problem in Stock Cutting**, with J. Bhadury, *Engineering Optimization*, 1999
- **Geometric Problems in Automated Manufacturing**, with S.N. Kabadi, *OPSEARCH*, 36, #1, March 1999

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Research Interests

- Requirements Engineering
- System and Software Architecture

Education

- Ph.D., Computer Science, University of Toronto, Canada (1993)
- M.Sc., Computer Science, University of Toronto, Canada (1984)
- B.Sc., Computer Science, University of Toronto, Canada (1981)

"One of my favorite quotes is by Robert Pirsig: 'What the Metaphysics of Quality would do is take this separate category, Quality, and show how it contains within itself both subjects and objects. The Metaphysics of Quality would show how things become enormously more coherent--fabulously more coherent--when you start with an assumption that Quality is the primary empirical reality of the world.'"

Professional Highlights

Dr. Lawrence Chung joined UTD in 1994 and currently is an Associate Professor of Computer Science. He received his Ph.D. in Computer Science in 1993 from the University of Toronto, where he had previously received the B.Sc. and M.Sc. degrees. Dr. Chung is the principal author of *Non-Functional Requirements in Software Engineering*. His work on non-functional requirements has been used in Requirements Engineering and Software Architecture, applied by other researchers to performance engineering, project risk management and organizational modeling, and led to his earlier participation in a Business Process Reengineering (BPR) project at Andersen Consulting, Chicago. This work is the basis of his ongoing research, namely, from object-oriented (OO) to goal-oriented (GO) analysis. His research and work experience include developing a framework and a tool for mapping OO functional requirements into OO designs and compiling an OO design language into a database programming language.

NON-FUNCTIONAL REQUIREMENTS: MODELING AND REASONING

A software system has to meet not only its functional requirements but also its non-functional requirements, such as interoperability, security, performance, safety, adaptability, reliability, and the like. Although non-functional requirements are considered "soft" relative to functional requirements, "soft" is increasingly being recognized as harder to deal with than "hard" in System/Software Engineering. At the same time, these "soft" non-functional requirements are often more important, since it's typically only through them that we achieve the whole being much greater than the sum of its parts. Treating non-functional requirements as "softgoals" to be addressed, Dr. Chung's project explores a powerful method to model and reason about non-functional requirements, their tradeoffs and their metrifications.

SOFTWARE INTEROPERABILITY

Software is now used in nearly all walks of life, and people and organizations are increasingly interdependent. A lack of interoperability between software-based systems has become a major obstacle to everyday activities in business, government and in personal lives. Currently, data can be shared through weak standards and ad hoc methods that do not scale well, an example being applications developed in one environment that are usually not usable in other contexts. Dr. Chung's research aim is the investigation of techniques to maximize cooperation among software systems, while detecting, reconciling, and accommodating syntactic, semantic, and quality incompatibilities.

COMPONENT-AWARE TECHNOLOGY (CAT)

The reuse of software components is perceived to reduce the software development time and cost while improving software quality, by orders of magnitude. This clearly is a new software development paradigm, but with its own risks and benefits. Dr. Chung's research project investigates techniques to assemble a software system by considering the functional and non-functional capabilities of the software components, at the level of requirements (and architecture) in relation to the needs of the stakeholders of the system. Three main tasks being carried out in this project are modeling the component capabilities, evaluating component capabilities, and building a knowledge-based tool.

HOME NETWORKING/HOME APPLIANCE CONTROL SYSTEM

A networked Home Appliance Control System (HACS) enables home owners to remotely control home appliances such as garage doors, stoves, refrigerators, and air conditioners using the Internet and wireless access technologies. This is considered one of the most innovative technologies that is sure to change the way we live. Dr. Chung's project explores the desirable characteristics of such a system, builds the reference architecture, and provides the testbed for simulation and experimentation.

SECURITY ENGINEERING

Security has become a critical type of non-functional concern in cyberspace, the military, government, and the commercial sectors as well as at home. Analyses of security flaws often find that a significant portion of such flaws have to do with inadequate requirements or specifications. Dr. Chung is investigating methods for modeling and analyzing security goals on the one hand and policies at the level of requirements—along with security design components, connectors, and constraints at the architecture level—on the other.

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Research Interests

- Computer Networking
- Quality of Service (QoS) Scheduling in Computer Networks
- Mobile Computing
- Interdomain Routing (eBGP and iBGP)
- Stabilizing Systems

Education

- Ph.D., Computer Science, The University of Texas at Austin (1996)
- M.S., Computer Science, The University of Texas at Austin (1989)
- B.S., Computer Science, The University of Texas at El Paso (1987)

"Fearless Engineering is the embodiment of the ever-present human desire of achieving the impossible."

Professional Highlights

Dr. Cobb is an Associate Professor in the Department of Computer Science at UTD, where he has performed research in computer networking and taught undergraduate and graduate courses in this area. His main research focus is providing effective and efficient quality of service scheduling and signaling protocols for real-time and delay-sensitive applications for the future Internet. In addition, he investigates multiple issues in mobile computing, distributed computing, and fault tolerance. In particular, he focuses on the application of self-stabilization techniques to networking protocols in order to ensure their convergence to a normal operating state irrespective of their initial state or their state after the occurrence of transient faults. Dr. Cobb has served as a technical program committee member for numerous conferences, symposiums, and workshops, most notably the IEEE International Conference on Network Protocols. He has published more than 50 papers in prestigious journals and conferences.

PROVIDING QUALITY OF SERVICE (QoS) TO APPLICATIONS

Currently, the Internet is moving towards providing QoS to applications. The two main approaches involved in this are Integrated Services (IntServ) and Differentiated Services (DiffServ). Dr. Cobb's team is investigating scheduling/signaling techniques that provide the same QoS guarantees provided by the state-full IntServ approach, while simultaneously minimizing the amount of state and signaling required in the routers, as in the DiffServ approach.

INTERDOMAIN ROUTING (eBGP AND iBGP)

Interdomain routing suffers from instabilities and oscillating behavior, caused by allowing each autonomous system in the Internet to freely choose its routing policy, independently of its neighboring autonomous systems. Dr. Cobb is currently investigating techniques that prevent this oscillating behavior while maintaining the freedom of each autonomous system to choose its routing policies and minimizing the overhead on the system.

MOBILE COMPUTING

Dr. Cobb's research team has developed an acknowledgment strategy for the efficient transfer of data over transport sessions that involve noisy wireless networks of mobile computers. With minimal additional support from the router of the wireless network, the transport source is able to distinguish between losses due to congestion and losses due to corruption. Having this distinction allows the source to reduce its throughput—such as window size—when congestion occurs, and then quickly re-transmit when corruption occurs. Without this distinction, throughput over a path with a large bandwidth-delay product terminating in a noisy wireless network is significantly reduced. Dr. Cobb is also investigating the impact of unidirectional links in wireless networks.

STABILIZING SYSTEMS

A system is said to be stabilizing if it converges to a normal operating state from any state of its variables. Stabilization is a strong notion of fault-tolerance, since most faults can be modeled as perturbing the state of variables in the system. After a fault, the system will naturally converge to a normal operating state, regardless of the system state after the fault. Stabilization is a fruitful area in distributed systems, and has had an impact on network protocols because they must operate continuously and without human intervention. Dr. Cobb's research team is currently developing stabilizing protocols for various areas in networking, such as loop-free routing and inter-domain routing.

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Research Interests

- Component-Based Software and System Engineering Methodologies
- Requirements Engineering
- Software and System Architecture

Education

- Ph.D., Electrical and Computer Engineering, University of British Columbia, Canada (2001)
- M.A.Sc., Electrical and Computer Engineering, University of British Columbia, Canada (1995)
- B.A.Sc., Electrical and Computer Engineering, University of British Columbia, Canada (1993)

"The biggest challenge in my research field is component-based engineering – a key element in rapidly developing high quality, large scale software intensive systems"

Professional Highlights

Dr. Cooper is an Assistant Professor in the Department of Computer Science at UTD. She received her Ph.D. in Electrical and Computer Engineering in 2001 from the University of British Columbia and has more than 60 publications in journals, conferences, symposia, and workshops. Dr. Cooper has worked in the early phases of the software development lifecycle for more than 10 years in industrial and academic settings. In industry, she has worked on defining and maintaining the requirements and architecture for a variety of complex, large-scale systems including project management, air traffic control, and the core network for a wireless General Packet Radio Service (GPRS) system. Her research interests center on investigating component based software engineering methodologies using interesting combinations of formal methods and empirical studies. Before joining UTD, she worked as a senior systems engineer on Motorola's GPRS core network project, developing system requirements and extending the product architecture.

Dr. Cooper is a member of the Software Engineering Group and the Embedded Software Center. Currently, her research in the Software Engineering group is investigating component-based software engineering methodologies. Dr. Cooper is a member of the International Council on Systems Engineering (INCOSE).

Kendra M. L. Cooper continued

AGILE DEVELOPMENT IN PRODUCT LINE ENGINEERING

The need to rapidly develop high quality software in specific domains has led to interesting research in agile methods, component engineering, and product-line development. Here, these three areas are integrated into a requirements-driven technique that draws upon the strengths of each area. This is a joint research project with Trintech, Inc.

ASPECT-ORIENTED DESIGN AND ANALYSIS FRAMEWORK: ASPECTS AS REUSABLE COMPONENTS

This research investigates the definition and use of aspects as reusable components for architecture level designs. An extended aspect-oriented version of UML is used to capture the design and the designs are automatically translated into a variety of formal notations such as architectural description languages (Rapide, Armani) and Promella. Existing tool support for these notations are used to automatically analyze the models. Dr. Cooper is investigating both performance and security aspects for distributed, real-time systems.

COTS-AWARE REQUIREMENTS SPECIFICATION AND SOFTWARE ARCHITECTING TECHNIQUE (CARE/SA)

The effective selection and use of commercial off-the-shelf (COTS) components is being viewed as a solution for rapidly building high quality software systems. CARE/SA provides a systematic methodology that addresses two of the early phases in software development from a component-based perspective: requirements engineering and software architecture. The stakeholders' needs and the availability of COTS components require an iterative approach, in which the requirements, software architecture, selection and use of components are addressed in parallel.

FORMALIZING UML USE CASES

As part of her study of software requirements as reusable components, Dr. Cooper is defining a formal syntax and operational semantics for use cases. This effort supports the automated translation of requirements into test specifications. Future work will investigate the semi-automated translation of use cases into an analysis model using compiler and natural language processing techniques.

STATE MODEL ADAPTIVE RUN TIME FRAMEWORK: COMPONENT BASED DYNAMIC SYSTEMS

Dr. Cooper's research supports the architecture and design of dynamically adaptable systems and uses feedback control theory to support the continuous monitoring and control of such systems. This effort also supports the effective specification, matching, and selection of which are represented and reasoned about in fuzzy logic.

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Research Interests

- Computational Geometry
- Algorithms and Optimization
- Bio-Medical Computing

"Pushing the limits of research to boldly go where no one has gone before… ."

Education

- Ph.D., Computer Science and Engineering, University of Notre Dame, IN (2000)
- M.S., Computer Science, University of Notre Dame, IN (1997)
- Engineer Diploma in Computer Science and Automation, Technical Military Academy, Bucharest, Romania (1991)

Professional Highlights

Dr. Daescu received his Ph.D. from the University of Notre Dame in 2000. He is currently an Assistant Professor in UTD's Department of Computer Science, where he has taught and conducted research since September 2000. Dr. Daescu's research interests are in algorithm design for optimization problems in computational geometry, computational medicine, and computational biology. He has designed efficient algorithms for problems arising in diverse areas, such as medical treatment planning (robot assisted surgery, radiation therapy), robot/unmanned navigation, emergency preparedness and intervention, and structural biology. His research work is currently supported by a grant from the National Science Foundation (NSF). Dr. Daescu is a member of the UTD Institute for Biomedical Sciences and Technology, where he is involved in finding efficient solutions for a variety of problems that arise in structural biology and medical treatment planning. He has served as reviewer for many journals and has been a program committee member for conferences in his field of research. Dr. Daescu has published more than 50 papers in prestigious journals and conferences. Among his many published works are:

- **Proximity Problems On-line Segments Spanned by Points**, with Jun Luo and David Mount, from *Computational Geometry: Theory & Applications*, Vol. 33, No. 3, 2006
- **Farthest-point Queries with Geometric and Combinatorial Constraints**, with Ningfang Mi, Chan-Su Shin and Alexander Wolff, from *Computational Geometry: Theory & Applications*, Vol. 33, No. 3, 2006
- **Extremal Point Queries with Lines and Line Segments and Related Problems**, with Robert Serfling, from *Computational Geometry: Theory & Applications*, Vol. 32, No. 3, 2005
- **Efficient Algorithms and Implementations for Optimizing the Sum of Linear Fractional Functions, with Applications**, with Danny Z. Chen, Yang Dai, Naoki Katoh, Xiaodong Wu and Jinhui Xu, from *The Journal of Combinatorial Optimization*, Vol. 9, No. 1, 2005
- **Polygonal Path Approximation: a Query Based Approach**, with Ningfang Mi, from *Computational Geometry: Theory & Applications*, Vol. 30, No. 1, 2005
- **K-Link Shortest Paths in Weighted Subdivisions**, with Joseph S.B. Mitchell, Simeon Ntafos, James Palmer and Chee Yap, found in *Lecture Notes in Computer Science*, Vol. 3608, Springer-Verlag, *Proceedings of the 9th Workshop on Algorithms and Data Structures*, August 2005
- **Guarding a Terrain by Two Watchtowers**, with Pankaj K. Agarwal, Sergey Bereg, Haim Kaplan, Simeon Ntafos and Binhai Zhu, from the *Proceedings of the 21st Annual Symposium on Computational Geometry*, June 2005
- **Stabbing Balls and Simplifying Proteins**, with Jun Luo, from the *Series in Mathematical Biology and Medicine, Advances in Bioinformatics and its Applications, Proceedings of the International Conference on Bioinformatics and its Applications,* Vol. 8, May 2005
- **Finding an Optimal Path without Growing the Tree**, with Danny Z. Chen, Xiaobo Hu and Jinhui Xu, from *The Journal of Algorithms*, Vol. 49, No. 1, 2003
- **Space-Efficient Algorithms for Approximating Polygonal Curves in Two Dimensional Space**, with Danny Z. Chen, from the *International Journal of Computational Geometry & Applications*, Vol. 13, No.2, 2003

G. R. Dattatreya

Associate Professor, Computer Science

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Research Interests

- Telecommunication Networks and Cognitive Radio (CR) - Performance Modeling, Analysis, and Optimization

Education

- Ph.D., Computer Science and Automation, Indian Institute of Science, Bangalore, India (1981)
- M.E., Electrical Communication Engineering, Indian Institute of Science, Bangalore, India (1977)
- B.Tech., Electrical Engineering, Indian Institute of Technology, Madras, India (1975)

"Fearless Engineering is daring to develop simpler models."

Professional Highlights

G. R. Dattatreya is currently an Associate Professor in the Department of Computer Science at UTD. He conducts research and publishes in the areas of performance modeling, analysis, and optimization of computer network subsystems at several layers of the network organization. His research projects have been sponsored by the telecommunications companies Alcatel, Electrospace, and SBC, and the industry forum QuEST. He currently serves as a consultant to Rockwell Collins, Inc., Richardson, Texas. Dr. Dattatreya has served as Visiting Faculty at University of Maryland, College Park, Purdue University's Malaysia Polytechnic Development Project, and IETSM, Monterrey, Mexico. He teaches courses on computer hardware, computer networks, and performance of networks.

COGNITIVE RADIO AND WIRELESS COMMUNICATION

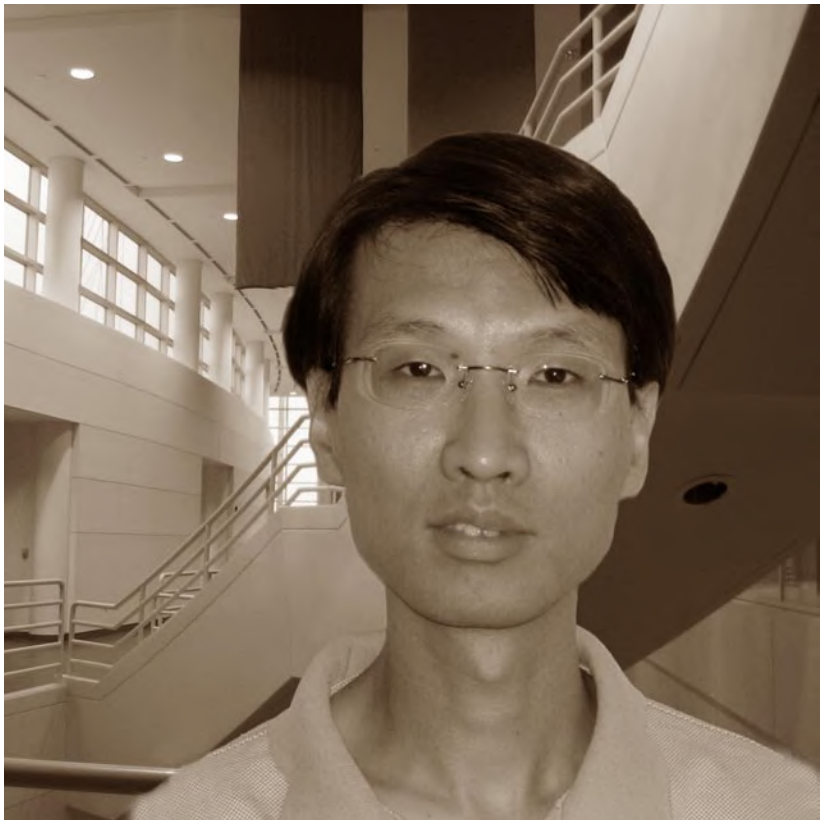
Cognitive Radio (CR) is being heralded as an important new frontier in radio communication—one that promises to overcome spectrum-congestion hotspots through intelligent and adaptive management and reallocation of channels with the help of software-defined radio systems. A fundamental issue in CR is being able to assess and track users on a wireless channel. This problem occurs when the CR system is searching for friendly data or usable channels. A similar problem arises in surveillance and interception of adversaries' wireless networks for military and security applications. In these situations, the received and preprocessed signal typically turns out to be a Gaussian mixture random variable with a common component variance. Depending on the sub-problem, different levels of knowledge about the transmission system are available. A 2004 computer science Ph.D., Larry Singh, and Dr. Dattatreya have solved some of these problems. Similar problems are also being addressed in pattern recognition, medical, and econometric fields.

ANALYSIS AND ADAPTIVE OPTIMIZATION OF MEDIUM ACCESS CONTROL (MAC)

At the Medium Access Control (MAC) layer of computer network organization, Dr. Dattatreya is directing Ph.D. student Ajay Kulkarni and two M.S. theses students—Umadevi Ananthakrishnan and Thanh Nguyen—to develop simple models to evaluate and optimize the performance of commonly implemented channel access procedures. Ajay is also working on optimum Time Division Multiple Access (TDMA) transmission schedules in sensor networks. Dr. Dattatreya and another graduate student, Srikant Kuppa, have developed and demonstrated the superiority of frame aggregation techniques to improve performance of wireless LANs.

GRAPHICAL AND MULTI-MODAL PROXY SYSTEM

Along with four faculty PIs and several graduate students, Dr. Dattatreya has defined objectives toward developing sophisticated integrated graphical and multi-modal user interfaces for Internet telephony for modeling and evaluating the performance of the architecture. Dr. Dattatreya also constructed performance model and evaluated the effectiveness of the system for different hardware configurations. This was an Alcatel funded project for the period 2002 to 2004.



Jing Dong

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Research Interests

- Software Engineering
- Design Patterns
- Component-based Software Development
- Service-oriented Computing
- Formal Methods

"The fascination of the new technologies and tools drives my research and study."

Education

- Ph.D., Computer Science, University of Waterloo, Canada (2002)
- M.Math., Computer Science, University of Waterloo, Canada (1997)
- B.S., Computer Science, Peking University, China (1992)

Professional Highlights

Dr. Dong is an Assistant Professor in the Department of Computer Science, where he has taught and conducted research since September 2002. Dr. Dong is one of the principal investigators in the CyberSecurity and Emergency Preparedness Institute at UTD, where he is involved with finding solutions to rapidly growing homeland security problems in cyber crime, information assurance, and emergency preparedness. His research interest is software engineering, particularly the modeling, composition, evolution, and analysis of software design and development. His research on this topic has drawn from several sub-areas of software engineering: component-based software development, design patterns, software architecture, Unified Modeling Language (UML), object-oriented analysis and design, web service, commercial off-the-shelf (COTS) software, agent-based development, security, frameworks and the application of formal methods to specify and verify software systems. He is also interested in the development and application of software engineering tools and techniques in different domains such as service-oriented, hypermedia, e-commerce, telecommunications, and high-assurance systems. Dr. Dong has served as a committee member in many prestigious conferences, symposiums, and workshops and has reviewed papers for well-known international journals such as *IEEE Transactions on Software Engineering*. He has co-authored numerous book chapters including an entry in the *Encyclopedia of Computer Science and Engineering*. Dr. Dong has published more than 40 papers in prestigious journals and conferences.

VISUALIZING SOFTWARE DESIGN AND ARCHITECTURE

Design patterns document quality design solutions to a recurring problem in a particular context. Design patterns have been widely adopted for software design and development in industry. When an individual design pattern is applied and composed in a system design, pattern-related information is often lost since the UML does not trace such information. Without pattern-related information, designers cannot easily identify the design patterns from the system design diagrams, thereby compromising the benefits of using design patterns. To solve this problem, Dr. Dong's team has extended the UML with new techniques to explicitly visualize and trace pattern-related information in system design. He has developed static and dynamic methods that improve expressiveness and scalability.

SOFTWARE EVOLUTIONS BASED ON MODEL TRANSFORMATIONS

Change, a constant scheme in current software design and development, often introduces system inconsistencies into the system design. Documenting changes and the analysis of their impact are important issues in software development. One of the main goals of design patterns is to "design for change." To solve the problem of inconsistencies that result from the misunderstanding of a design pattern's document and missing steps in the evolution process, Dr. Dong has developed an approach based on model transformation. The evolution processes of each design pattern are defined as model transformations and automated based on Extensible Stylesheet Language Transformations (XSLT). In addition to automated transformations, a service-oriented architecture has been developed to allow users to access the applications of these evolution processes as services. He has also developed a semantic web based analysis tool using a theorem prover to check the system consistency.

COMPONENT-BASED SOFTWARE DEVELOPMENT

Component-based software development focuses on building large software systems by integrating existing software components. In practice, the component paradigm has so far mainly penetrated the latter phases of a software lifecycle (such as the implementation phase). Component technologies such as CORBA, .NET, and J2EE essentially focus on the technical interoperation of binary software building blocks created by different manufacturers, development tools, and languages. They are responsible for the prevailing view that components are of importance only in the implementation and deployment phases of a project. However, the concept of a component has value as a central part of all software development concepts, methods, and processes. In addition to the implementation level, Dr. Dong has been working on the definition, composition, instantiation, replacement, and upgrade of software components at the design level. He is also interested in the integration and interoperability of the COTS components.

FORMAL METHOD APPLICATIONS

Formal specification and verification techniques are useful for design analysis in that formal specifications are more precise, clear, expressive, and unambiguous than informal representations like graphical and textual notations, and can therefore be the basis for formal verifications (such as model checking) that can help detect errors. Failure to discover the errors in software design and development can result in huge losses of money and even human lives, as demonstrated by the failed launch of the $500 million Ariane 5 in 1996 and the failed automation of the London Ambulance Service. As a mature engineering discipline is normally based on a solid foundation, formal methods are the foundations of software engineering. Dr. Dong's research is developing a formal foundation for software composition at the design level. He has formally defined these components as design component contracts and provided methods on reasoning their composition based on logic programming and process algebra. He is currently working on issues concerning the replacement, refinement, and security of these components.

Ding-Zhu Du

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Research Interests

- Theory of Computation
- Combinatorial Optimization
- Communication Networks

Education

- Ph.D., Mathematics, University California, Santa Barbara (1985)
- M.S., Operations Research, Chinese Academy of Sciences (1981)

Professional Highlights

Dr. Du is a Professor in the Department of Computer Science. He has previously worked at the Mathematical Sciences Research Institute, Berkeley, California, at the Massachusetts Institute of Technology (MIT), and at Princeton University. Dr. Du was an Associate Professor and Professor in the Department of Computer Science and Engineering, University of Minnesota from 1991 to 2005 and was a Research Professor at the Institute of Applied Mathematics, Chinese Academy of Sciences from 1987 to 2002. His research interests include the design and analysis of approximation algorithms for combinatorial optimization problems, with various applications in computational biology, networking, and security.

Dr. Du has published more than 140 journal papers, written 10 textbooks/monographs, and edited 27 books on various topics in theoretical computer science. He is the editor-in-chief of *Journal of Combinatorial Optimization* and a book series on *Network Theory and Applications*. He is also on the editorial boards of more than 10 journals. He is very well known for proving the Gilbert-Pollak conjecture on the Steiner ratio, the Derman-Leiberman-Ross conjecture on optimal 2-out-of-n consecutive systems, and the global convergence of Rosen gradient projection method in nonlinear programming.

Recent books published by Dr. Du include:

- **Problem Solving in Automata, Languages, and Complexity**, with Ker-I Ko, John Wiley, New York, 2001
- **Mathematical Theory of Optimization**, with Panos M. Pardalos and Weili Wu, Kluwer Academic Publishers, 2001
- **Theory of Computational Complexity**, with Ker-I Ko, John Wiley, New York, 2000
- **Combinatorial Group Testing and Its Applications** (2nd Edition), with Frank K. Hwang, World Scientific, 1999

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Research Interests

- Modeling and Optimization of Communication Networks
- Analysis Methods for Networks
- Network Protocols
- Wireless Networking
- Algorithms for Network Design

Education

- Doctor of Habilitation - a distinguished post-Ph.D. degree, awarded by the Technical University of Budapest (1997)
- Doctor of the Hungarian Academy of Sciences (1996)
- Ph.D., Electrical Engineering, Technical University of Budapest (1981)
- M.Sc., Electrical Engineering, Technical University of Budapest (1979)
- B.Sc., Electrical Engineering, Technical University of Budapest (1976)

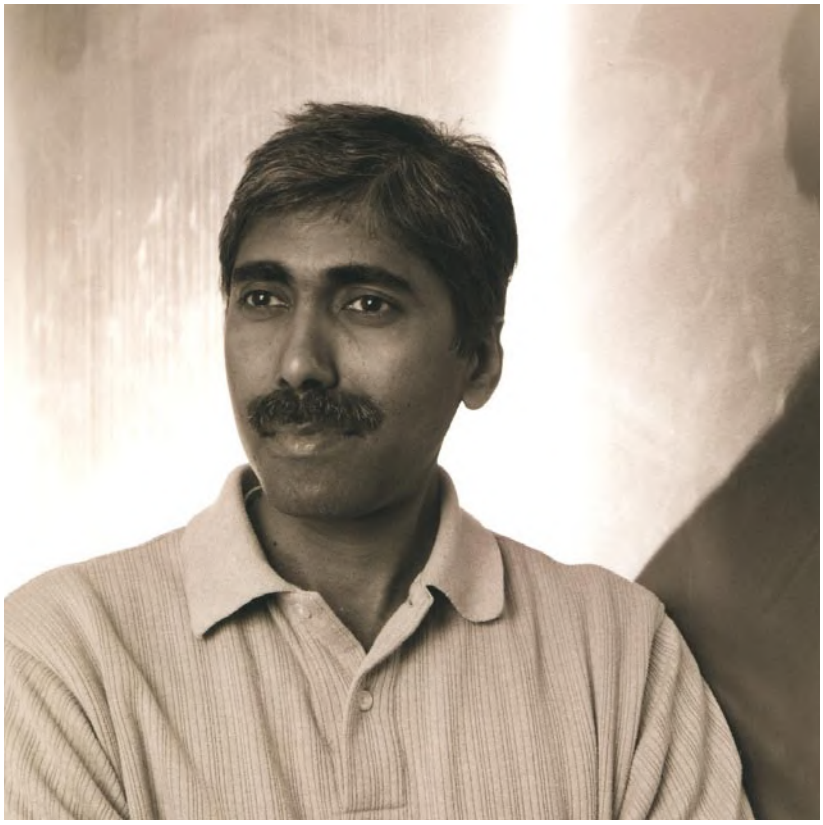
"In my view, the key component of research is the enthusiasm about creating new knowledge, the burning desire to explore the unknown. This passion somehow marvelously transcends any formal job description: you can pay people to do many things, but you cannot pay them to feel genuine enthusiasm and curiosity."

Professional Highlights

In recent years, Dr. Faragó's research has concentrated on three projects that have been funded by the National Science Foundation (NSF), with grants totaling over $1.2 million. One of the projects focuses on Medium Access Control (MAC) protocols with special emphasis on intelligent adaptation to unknown network conditions. The second investigated issues of reliability and protection in optical networks, and the third addressed the issue of the quality assessment of routing protocols in mobile ad hoc networks. Dr. Faragó's technical field of interest is network algorithms and protocols, modeling, analysis and optimization problems in communication networks. He is a Professor in the Department of Computer Science.

Representative publications of Dr. Farago's work include:

- **On the Typical Case Complexity of Graph Optimization**, from *Discrete Applied Mathematics*, 153, 2005
- **Algorithmic Challenges in Ad Hoc Networks**, from *Mobile Ad Hoc Networking*, edited by S. Basagni, M. Conti, S. Giordano and I. Stojmenovic, IEEE Press and Wiley-Interscience, 2004
- **MERIT: A Scalable Approach for Protocol Assessment**, with V.R. Syrotiuk, from *Mobile Networks and Applications (MONET)*, Special Issue on *Mobile Ad Hoc Networks*, 8, 2003
- **Meta-MAC Protocols: Automatic Combination of MAC Protocols to Optimize Performance for Unknown Conditions**, with A.D. Myers, V.R. Syrotiuk, and G. Zaruba, from *IEEE Journal on Selected Areas in Communications*, 18, 2000



John Fonseka

Professor, Electrical Engineering

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Research Interests

- Bandwidth Efficient Modulation
- Continuous Phase Modulation
- Coded Modulation, Error Control Coding
- Receiver Construction, Performance Analysis
- Channel Capacity Calculations
- Orthogonal Frequency-Division Multiplexing (OFDM)
- Chip-to-Chip Communications

Education

- Ph.D., Electrical Engineering, Arizona State University (1988)
- M.Eng., Memorial University of Newfoundland, Canada (1985)
- B.Sc. (Honors), Electronic and Telecommunication Engineering, University of Moratuwa, Sri Lanka (1980)

Professional Highlights

Dr. Fonseka is a Professor in the Department of Electrical Engineering. He specializes in communication theory with an emphasis on modulation and coding. Dr. Fonseka's research interests include the investigation of efficiently combined coded modulation techniques including continuous phase modulation (CPM) signaling formats. Dr. Fonseka investigates efficient, simplified, coherent and non-coherent detection techniques. He is also interested in performance analysis over narrowband fading channels, chip-to-chip communications, orthogonal frequency-division multiplexing (OFDM) systems, and turbo codes.

BANDWIDTH EFFICIENT MODULATION FORMATS

Dr. Fonseka is continuing to investigate bandwidth efficient signaling formats. He has introduced non-linear CPM signals and is currently investigating single sideband type bandwidth efficient CPM signaling formats.

INVESTIGATION OF SIMPLE RECEIVER STRUCTURES

Dr. Fonseka is investigating simpler receiver structures for the detection of CPM type signaling formats. He has studied the use of soft phase detectors and soft differential phase detectors for the detection of signals with memory and their applications in Bluetooth.

PERFORMANCE ANALYSIS OVER FADING CHANNELS

Dr. Fonseka is continuing research analysis of the performance of various signaling schemes with and without diversity over different types of fading channels. He is investigating the effects of system impairments on performance and the different methods that can be used to examine the impact of such impairments. He is also studying the channel capacity of different types of fading channels with and without diversity. This analysis is being extended to correlated fading channels and frequency selective fading channels.

MULTI-INTERVAL LINE CODING

With his colleague Dr. Jin Liu, Dr. Fonseka is investigating a novel multi-interval line coding technique that can increase the transmission rate without expanding the bandwidth or employing higher order signals. This technique is attractive for high-speed transmission systems, and they have been examining its applications for a printed circuit board (PCB) trace. The National Science Foundation (NSF) and the Semiconductor Research Corporation (SRC) sponsor this project.

William Robert Frensley

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Research Interests

- Electron Transport in Semiconductor Devices, High-Performance Devices, and Quantum Devices
- Quantum Transport Theory and Kinetic Theories
- Physics of Semiconductor Heterostructures, Band Lineup, Size Quantization, Resonant Tunneling, and Electron Waveguides
- Device Simulation Techniques and the Development of Interactive Modeling Tools
- Computer Graphics and Object-Oriented Software Design

Education

- Ph.D., Physics, University of Colorado, Boulder (1976)
- B.S., Physics, California Institute of Technology (1973)

"Electrons are inevitably the preferred medium for processing information. Information processing (as opposed to transmission) requires nonlinear interactions. The type of particle which interacts nonlinearly is the charged massive Fermion, and the electron is the lightest such particle available."

Professional Highlights

Dr. Frensley is a Professor in the Department of Electrical Engineering. In 1995, he was appointed Head of the Electrical Engineering program and served in this capacity until 2000. His Ph.D. thesis research was done under the direction of Herbert Kroemer, winner of the Nobel Prize in Physics in 2000, and concerned the theory of the electronic structure of semiconductor heterojunctions. Dr. Frenlsey continued this work in a post-doctoral position at the University of California, Santa Barbara. He joined the Central Research Laboratories of Texas Instruments (TI) in 1977, where he performed experimental and theoretical work on gallium arsenide metal-semiconductor field-effect transistors (GaAs MESFETs). He contributed to the development of GaAs bipolar transistor integrated circuits and the more novel, vertically structured GaAs field-effect transistors (FETs).

Dr. Frensley joined TI's pioneering Nanoelectronics Program in 1984, working on quantum-effect heterostructure devices and contributing to the conceptual design and evaluation of tunneling devices. As a part of this work, Dr. Frensley developed several theoretical approaches to the simulation of tunneling devices, including both rapid-response design aids and more comprehensive physical models. Since joining the faculty at UTD, he has continued the development of simulation and design tools for heterostructure devices. Dr. Frensley's research interests also involve quantum transport theory and the development of interactive design software.

Dr. Frensley holds several U.S. Patents, including:

- **Optically Powered Resonant Tunneling Device**, G. A. Frazier and W. R. Frensley, issued 2002
- **Three Terminal Tunneling Device and Method**, W. R. Frensley and M. A. Reed, issued in both 1990 and 1991
- **Ballistic Transport Filter and Device**, W. R. Frensley, issued 1989 (TI)
- **Infrared Detector System Based Upon Group III-V Epitaxial Material**, A. J. Lewis and W. R. Frensley, issued 1989 (TI)
- **Spatial Light Modulator**, G. A. Frazier, W. R. Frensley and M. A. Reed, issued 1987 (TI)
- **Two-Port Amplifier**, B. Bayraktaroglu, B. Kim and W. R. Frensley, issued 1985

Andrea Fumagalli

Professor, Electrical Engineering

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Research Interests

- Optical Network Architectures and Protocols
- Dynamic Allocation and Rapid Provisioning of Bandwidth
- Restoration and Protection Switching Schemes
- IP over Wavelength-Division Multiplexing (WDM) Networking
- Multi-hop, Multi-rate Optical Networks
- Sensor Networks
- Cooperative Radio Networks
- Network Optimization and Planning
- Performance Analysis of Computer Networks
- Development of Network Simulators
- Testing with Network Testbeds and Networking Live-Equipment

Education

- Ph.D., Electrical Engineering, Politecnico di Torino, Italy (1992)
- Laurea Degree in Electronics Engineering, Politecnico di Torino, Italy (1987)

Professional Highlights

Dr. Fumagalli is a Professor in the Department of Electrical Engineering and is currently Head of UTD's OpNeAR Lab (the Open Networking Advanced Research Lab). From 1992 to 1998, he was an Assistant Professor in the Electronics Engineering Department at the Politecnico di Torino, Italy. Dr. Fumagalli's research interests include aspects of mobile and optical networks, related protocol designs, and performance evaluations. He has published more than 150 papers in refereed journals and conferences.

Dr. Fumagalli has made multiple earlier contributions to the area of high speed and optical network architectures, including protocol design and performance evaluation. He has been involved in a number of research projects focusing on packet switched and survivable networks, with multi-million dollars of funding from various sponsors such the National Science Foundation (NSF) and the Defense Advanced Research Projects Agency (DARPA).

THE OPEN NETWORKING ADVANCED RESEARCH LABORATORY (OpNeAR)

Communication today depends primarily on speed and acute precision in connectivity. Advances in the area of information transport are developing at a rate almost as fast as the technologies themselves. The need for better and faster communication translates into continuous research on core technologies like optical and wireless networking. Under Dr. Fumagalli's direction, OpNeAR is involved in the continuous research that is the key to developing existing technology and breaking new ground with recently evolved concepts. The OpNeAR Lab continuously explores new research topics in the field of optical and wireless networks, and is currently involved in active research of the following areas: all-optical network architectures and protocols, photonic slot routing, storage area networks, wavelength routing and protection switching, network optimization and planning, optical networks in support of next generation Internet (NGI), multi-hop and multi-rate optical networks, and optical and high speed network simulators. The lab also accomplishes the performance analysis of computer networks, optical networks for grid computing, sensor networks, cooperative wireless networks, dynamic allocation and rapid provisioning of bandwidth, testing by means of networking live equipment, and VoIP (Internet telephony) with convergent networks in telecommunications systems.

Bruce Gnade

Professor, Electrical Engineering
and Chemistry

Distinguished Chair in Microelectronics

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Research Interests

- Passivation and Release for Microelectromechanical System (MEMS) Devices
- Low Temperature Processing for Flexible Electronics
- High-k Gate Dielectrics and Metal Gates
- Micro Gas Analysis

Education

- Ph.D., Nuclear Chemistry, Georgia Institute of Technology (1982)
- B.A., Chemistry, St. Louis University (1976)

"Using research projects to teach and train students, as well as to learn from them, is the best job in the world. Where else can you work on anything you want, as long as you can find financial support to fund the research?"

Professional Highlights

A Professor of both Electrical Engineering and Chemistry, Dr. Gnade obtained a Ph.D. in Nuclear Chemistry from the Georgia Institute of Technology. For 14 years, he primarily worked on materials integration of advanced silicon devices for Texas Instruments. For three years, at the Defense Advanced Research Projects Agency (DARPA), Dr. Gnade was program manager or co-manager for the High Definition Systems program, the Molecular Electronics program, and the Heterogeneous Integration of Materials on Silicon program. His research at UTD is performed in collaboration with Professors R. Wallace, M. Kim, and J. Kim.

PASSIVATION / RELEASE FOR MEMS DEVICES

Dr. Gnade is currently part of a team working on a National Institute of Standards and Technology (NIST) Advanced Technology Program (ATP) funded project with Zyvex, Inc., to study organic and Atomic Layer Deposition (ALD) inorganic coatings to reduce stiction and wear in silicon-based MEMS devices.

LOW TEMPERATURE PROCESSING FOR FLEXIBLE ELECTRONICS

(Processing temperature <150°C, with applications in woven displays, electronic textiles and RFID tags)

A key area of Dr. Gnade's research is the design and fabrication of flexible, plastic substrates that have low permeability to water and oxygen. His team is working on process flows to integrate transistors, capacitors, diodes, light-emitting diodes and resistors in the same organic integrated circuit. A central part of this work is to understand the role of organic/inorganic interfaces to improve electron transport across these interfaces. The U.S. Army, Texas Instruments, and Raytheon currently fund this work.

HIGH-k GATE DIELECTRICS AND METAL GATES

Supported by the Semiconductor Research Corporation, and Sematech, Dr. Gnade is currently involved in programs looking at the stability of metal gates on high-k gate dielectrics, and the role of microstructure in metal gates with respect to threshold voltage control.

HYDROGEN DIFFUSION THROUGH BARRIER MATERIALS

The goal of this research is developing barriers that can reduce hydrogen diffusion during backend Si CMOS processing. The Semiconductor Research Corporation supports this work.

MICRO GAS ANALYZER

In conjunction with the Massachusetts Institute of Technology (MIT), Dr. Gnade's team is working toward developing a micro gas analyzer based on a combination of field ionization and electron impact ionization sources in combination with a micro quadrupole and MEMS micro pump. The goal of the program is to build a gas analyzer that is less than 2 cm^3 and will autonomously operate for 24 hours. This work is supported by DARPA.

HIGH POWER GaN AMPLIFIERS

Working with Stellar Micro Devices of Austin, Texas, Dr. Gnade is part of a team developing a high power amplifier based on a GaN field emission device. The vacuum microelectronic architecture allows the efficient separation of the high temperature portion of the device from the semiconductor. This work is supported by Phase II Air Force Small Business Technology Transfer (STTR) funding.

OHMIC CONTACTS TO GROUP V-VI MATERIALS

Working with Marlow Industries, Dr. Gnade is investigating materials and processes to fabricate very low resistance contacts to thermoelectric materials to improve thermoelectric device performance and reliability.

MINIATURE BROADBAND LASER MAGNETOMETER

Dr. Gnade is working with Polatomic to develop an advanced high-sensitivity scalar laser magnetometer for next generation undersea ASW gradiometer arrays. This work is supported by Phase I Office of Naval Research Small Business Innovation Research (SBIR) funding.

SILICON-BASED RESONANT TUNNELING DEVICES

Supported by DARPA, Dr. Gnade's team is working with The University of Texas at Austin to develop silicon-based quantum devices using ultra high vacuum wafer bonding to form electrically active interfaces between dissimilar materials that are very difficult to grow using conventional methods.

Matthew Goeckner

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Research Interests

- Plasma Science
- Plasma Chemistry
- Material Processing
- Chemical Sensors
- Material Diagnostics

Education

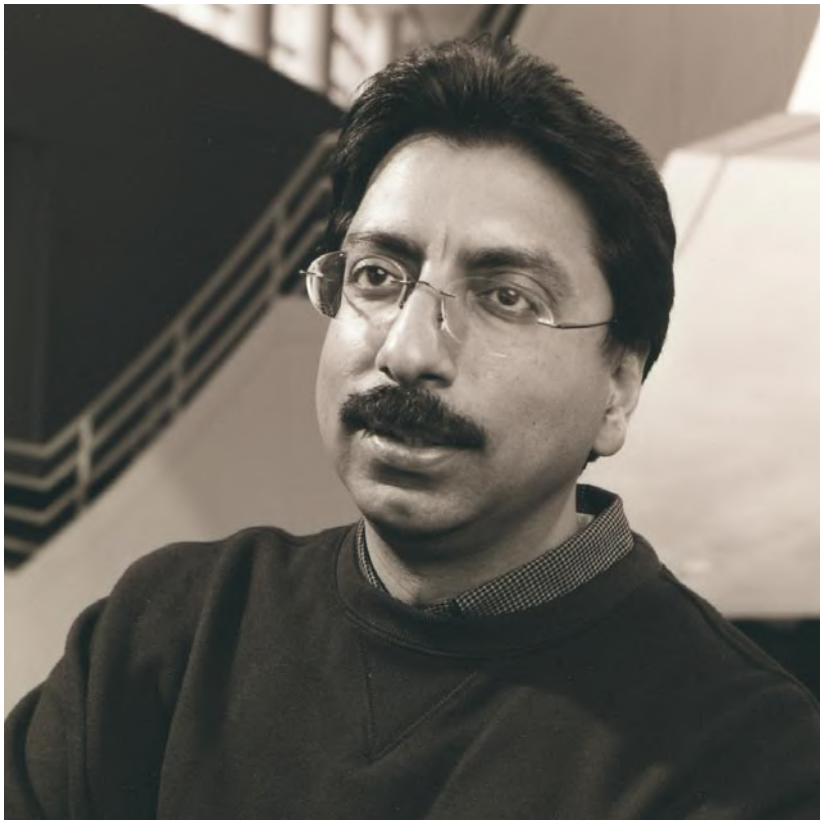
- Ph.D., Physics, University of Iowa (1990)
- M.S., Physics, University of California, Los Angeles (UCLA) (1984)
- B.S., Physics, Southern Illinois University (1983)
- B.S., Mathematics, Southern Illinois University (1982)

Professional Highlights

Dr. Goeckner is an Associate Professor in the Department of Electrical Engineering and directs UTD's Plasma Science Laboratory. The Plasma Science Laboratory is dedicated to the development of the science of industrially relevant plasmas and related tools. This lab, along with the Plasma Applications Laboratory run by Dr. Overzet, make up the electrical engineering department's plasma engineering core. Additionally, UTD has continued its strong presence in Space Plasmas (Professor Heelis and Professor Earle) as well as plasmas for photonic applications (Professor Cunningham). Dr. Goeckner has worked as a Research Physicist at the Princeton Plasma Physics Laboratory, a Research Engineer at Varian (now Varian Medical Systems) Central Research, and a Research Engineer at Varian Semiconductor Equipment Central Research. He is a member of the American Vacuum Society (AVS) Plasma Sciences and Technology Division and a Senior Member of IEEE, Nuclear and Plasma Sciences Division. Dr. Goeckner has performed research on a wide variety of plasma systems and related diagnostics. His Ph.D. research was on magnetron sputtering systems using an advanced optical diagnostic. Since then, he has worked with CVD of polymer materials, Laser CVD/CVD of metals, etching of a variety of thin films, implant of dopants and related diagnostics.

Examples of Dr. Goeckner's recently published work include:

- **Plasma Doping for Shallow Junctions**, with S.B. Felch, Z. Fang, A. Oberhofer, V.K.F Chia, G.R. Mount, M. Poulakos and W.A Keenan, from the *Journal of Vacuum Science and Technology* B 17, 1999
- **Profiling of Ultra-Shallow Junctions**, with S.B. Felch, Z. Fang, A. Oberhofer, V.K.F. Chia, G.R. Mount, M. Poulakos and W.A. Keenan, from the *Journal of Vacuum Science and Technology* B 18, 2000
- **Nitrogen Atom Energy Distributions in a Hollow-Cathode Planar Sputtering Magnetron**, with Zhehui Wang, Samuel A. Cohen, and David N. Ruzic, from *Physical Review* E 61, 2000
- **The Effects on Plasma Properties of a Current Node on Inductively Coupled Plasma Sources**, with S. Srinivasan, J. Marquis, L. Pratti, M.H. Khater, and L.J. Overzet, from *Plasma Sources Science and Technology* 12, 2003
- **A Modified Gaseous Electronics Conference Reference Cell for the Study of Plasma-Surface-Gas Interactions**, with J.M. Marquis, B.J. Markham, A.K. Jindal, E.A. Joseph, B.S. Zhou, from the *Review of Scientific Instrumentation* 75, 2004
- **Investigation and Modeling of Plasma-Wall Interactions in Inductively Coupled Fluorocarbon Plasmas**, with E. A. Joseph, B. Zhou, S. P. Sant, and L. J. Overzet, from the *Journal of Vacuum Science and Technology* A 22, 2004
- **FTIRCharacterization of a Pulsed Butadenye Plasma**, with A.K. Jindal and L. J. Overzet, from the *Journal of Vacuum Science and Technology* A 23, 2005



Gopal Gupta

Professor and Associate Department Head,
Computer Science

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Research Interests

- Programming Language (Implementation and Semantics)
- Compilers, Compile-time Analysis, Static Analysis
- Internet Markup Languages
- Assistive Technology and User Interfaces
- Logic & Constraint Programming
- Parallel/Distributed Processing

Education

- Ph.D., Computer Science, The University of North Carolina at Chapel Hill (1991)
- M.S., Computer Science, The University of North Carolina at Chapel Hill (1987)
- B.Tech., Indian Institute of Technology, Kanpur, India (1985)

"I joined UTD six years ago. What drew me to UTD was its vast potential to be a great university that can rival the best in the world. UTD's emphasis on science and technology, its location in a vibrant metropolitan area rife with high-tech companies, its excellent faculty and students, its infrastructure and resources, were all very positive signs. In fact, I did not see a single reason why UTD could not achieve its lofty goal then, and I do not see a single reason now, as UTD makes giant strides towards achieving this goal."

Professional Highlights

Dr. Gupta is a Professor in the Department of Computer Science and Director of the Applied Logic, Programming Languages, and Systems (ALPS) Laboratory. He has published more than 100 papers in refereed journals and conferences in areas of programming languages, parallel processing, logic programming, and assistive technologies. Dr. Gupta has produced several research software systems, some publicly distributed, and has been awarded more than two dozen research grants totaling more than $8 million from agencies such as the National Science Foundation (more than a dozen grants), the Environmental Protection Agency, the Department of Education, the Department of Energy, the National Research Council, and the North Atlantic Treaty Organization (NATO). He is a member of the Editorial Board, *Theory and Practice of Logic Programming*, an executive board member of the Association for Logic Programming and the European Association on Programming Languages and Systems, and the Founder/Coordinator of COMPULOG Americas, a network of logic/constraint programming research groups. Dr. Gupta and his students have received several Best Paper Awards, most recently at the 2nd European Conference on Web Services in 2005.

UNIVERSAL SERVICE-SEMANTICS DESCRIPTION LANGUAGE (USDL)

For Web Services to become more practical an infrastructure needs to be supported that will allow users and applications to discover, deploy, compose, and synthesize services automatically. This automation can take place only if a formal description of the Web Services is available. In this project, together with Metallect Corporation, Dr. Gupta's team is developing an infrastructure for Web Services based on the Universal Service-Semantics Description Language (USDL), a language for formally describing the semantics of Web Services. USDL is based on the Web Ontology Language (OWL) and employs WordNet as a common basis for understanding the meaning of services. USDL can be regarded as formal service documentation that will allow sophisticated conceptual modeling and searching of available Web Services, automated service composition, and other forms of automated service integration.

LOGICAL SPREADSHEETS

Dr. Gupta's team is adapting the spreadsheet paradigm for solving a large class of constraint satisfaction problems. Solutions of many such problems, including scheduling problems, timetabling problems, and recreational puzzles can be represented as a table. The constraints that need to be set up (and solved) for such tabular problems are fairly regular in nature and naturally fit into the spreadsheet paradigm of programming. The team is working on melding the two paradigms of Constraint Logic Programming with Finite Domains [CLP (FD)] and spreadsheets to produce a system that allows non-expert users to solve complex constraint satisfaction problems.

DYNAMIC AURAL WEB ACCESS

One frontier of research for the Web is to make it universally accessible via both audio and voice. A voice/audio accessible Web will not only make it more accessible to people who are visually impaired; it will also permit novel applications of the Web to be developed, such as those used for e-commerce over cellular phones. Dr. Gupta's solution relies on *VoiceXML*, a standard for marking-up documents so they can be browsed aurally. To make the current HTML-based Web aurally navigable, two issues need to be addressed: (1) HTML should be automatically translated to VoiceXML; and (2) users of the voice/audio Web should be able to freely aurally navigate the VoiceXML document. Dr. Gupta's team is developing solutions to address these issues in order to obtain a truly interactive voice and audio accessible Web. The technology being developed is also useful for automatically generating interactive "talking books" once they have been published on the Web.

BUFFER OVERFLOW ATTACK-PROOFING CODE BINARIES

About 60% of attacks over networks exploit the *buffer-overflow vulnerability*, a flaw that is present in a software system due to the negligence of its developer. Dr. Gupta's team is developing a system that will transform a code binary in such a way that the code will no longer be vulnerable to a buffer-overflow attack. The advantage of an approach based on transforming code-binaries, in contrast to other approaches, is that the source code of an application is not needed. A prototype system has been developed and is operational.

STATIC ANALYSIS OF CODE BINARIES

Dr. Gupta's team is developing tools and techniques for checking if a code-binary is reusable. They have developed necessary and sufficient conditions for ensuring that software binaries are reusable and have related them to coding standards that have been developed in the industry. These coding standards discourage both the use of hard-coded pointers and the writing of non-reentrant code. Checking that binary code satisfies these standards/conditions, however, is generally undecidable. Dr. Gupta's team is developing static analysis-based methods for checking if a software's binary satisfies these conditions. They have applied their approach to analyze the presence of hard coded pointer variables in assembly code obtained from binaries of digital signal processing applications.

NEXT GENERATION OF REASONING ENGINES FOR THE SEMANTIC WEB

Applications for the semantic Web will require fast and sophisticated reasoning engines. Dr. Gutpa's team is developing general-purpose reasoning engines that are based on logic programming and its extensions.

John H.L. Hansen

Department Head and Professor of Electrical Engineering

Distinguished Chair in Telecommunications Engineering

Professor, School of Brain and Behavioral Sciences (Speech & Hearing)

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Research Interests

- Robust Speech Processing & Recognition
- Analysis of Speech and Speaker Traits
- Speech Enhancement and Feature Estimation
- Robust Speaker Recognition

Education

- Ph.D., Electrical Engineering, Georgia Institute of Technology (1988)
- M.S., Electrical Engineering, Georgia Institute of Technology (1983)
- B.S.E.E. (Highest Honors), Rutgers University (1982)

"Research for next generation man-machine interaction requires an interdisciplinary framework that fearlessly breaks down traditional barriers between academic disciplines and balances speech signal processing in electrical engineering with speech and hearing sciences, text-based natural language processing in computer science, cognitive sciences, linguistics, and artificial intelligence."

Professional Highlights

Dr. Hansen is Professor and Department Head of Electrical Engineering, and holds the Distinguished Chair in Telecommunications Engineering. He also holds a joint appointment in the School of Brain and Behavioral Sciences (Speech & Hearing). At UTD, he established the Center for Robust Speech Systems (CRSS) which is part of the Human Language Technology Research Institute. Previously, Dr. Hansen served as Department Chairman and Professor in the Department of Speech, Language and Hearing Sciences (SLHS) and as a Professor in the Department of Electrical & Computer Engineering at the University of Colorado at Boulder, where he co-founded the Center for Spoken Language Research. He is serving as IEEE Signal Processing Society Distinguished Lecturer for 2005, is a Member of the IEEE Signal Processing Technical Committee, and has served as Technical Advisor to the U.S. Delegate for NATO (IST/TG-01), Associate Editor for *IEEE Trans. Speech & Audio Processing* (1992-99), Associate Editor for *IEEE Signal Processing Letters* (1998-2000), and as an Editorial Board Member for the *IEEE Signal Processing Magazine* (2001-03). Dr. Hansen served as guest editor of the October 1994 special issue on Robust Speech Recognition for *IEEE Trans. Speech & Audio Proc.* He has served on the Speech Communications Technical Committee for the Acoustical Society of America (2000-03), and is currently serving as a member of the International Speech Communications Association (ISCA) Board. His research interests span the areas of digital speech processing, analysis and modeling of speech and speaker traits, speech enhancement, feature estimation in noise, robust speech recognition with emphasis on spoken document retrieval, and in-vehicle interactive systems for hands-free human-computer interaction. He is the author/co-author of more than 200 journal and conference papers in the field of speech processing and communications, coauthor of the textbook *Discrete-Time Processing of Speech Signals* (IEEE Press, 2000), co-editor of *DSP for In-Vehicle and Mobile Systems* (Springer, 2004), and lead author of the report "*The Impact of Speech Under 'Stress' on Military Speech Technology*," (NATO RTO-TR-10, 2000). He also organized and served as General Chair for ICSLP-2002: International Conference on Spoken Language Processing in September 2002.

UT-DRIVE

This project is focused on modeling driver behavior and developing strategies for low task stress and robust-based interactive systems for information access, route navigation, and hands-free communications for in-vehicle environments. Prior support has been provided by from Defense Advanced Research Projects Agency (DARPA) (CU-Move) and corporate sponsors including IBM, Motorola, Speechworks, Voice Signal Technologies, Panasonic/STL, Visteon/Ford, HRL/GM, Mitsubishi Electric R&D, Toyota, and Philips. Dr. Hansen's team has produced a base platform for robust speech recognition systems for in-vehicle systems. The New Energy and Industrial Technology Development Organization (NEDO) Foundation have also funded this work.

IN-SET SPEAKER RECOGNITION

Funded by the U.S. Air Force, this research is focused on developing automatic speech processing algorithms for detecting speakers within a predefined group, versus out-of-domain speakers.

DIALECT CLASSIFICATION

Dr. Hansen's research projects are focusing on the modeling and algorithm development of speech and language processing methods to detect dialects of English, Spanish, and Arabic. The U.S. Air Force funds this effort.

NORMALIZATION FOR SPEECH SYSTEMS

Dr. Hansen's work is focused on defining strategies for normalizing speech and feature sequences to maintain robust speech system performance in the presence of interfering background noise, speaker variability due to Lombard effect, stress, emotion, accent, and dialect.

SPEECHFIND

Funded by the National Science Foundation (NSF), this research is making advances with spoken document retrieval for the National Gallery of the Spoken Word. http://Speechfind.utdallas.edu. Among Dr. Hansen's recent published works are:

- **Advances in Acoustic Noise Sniffing for Robust In-Vehicle Systems**, with M. Akbacak, Chapter 10 in *Advances in DSP for In-Vehicle and Mobile Systems*, Springer-Verlag Publishers, 2006
- **Speaker Source Localization Using Audio-Visual Data and Array Processing Based Speech Enhancement for In-Vehicle Environments**, with X.X. Zhang, K. Takeda, T. Maeno, and K. Arehart, Chapter 11 in *Advances in DSP for In-Vehicle and Mobile Systems*, Springer Publishing, 2006
- **Speechfind: Advances in Spoken Document Retrieval for a National Gallery of the Spoken Word**, with R. Huang, B. Zhou, M. Seadle, J.R. Deller, Jr., A.R. Gurijala, and P. Angkititrakul, from the *IEEE Trans. Speech & Audio Proc., Special Issue on Data Mining*, vol. 13, no. 5, 2005
- **Rapid Discriminative Acoustic Modeling Based on Eigenspace Mapping for Fast Speaker Adaptation**, with B. Zhou, from the *IEEE Trans. Speech & Audio Proc.*, vol. 13, no. 4, 2005
- **Efficient Audio Stream Segmentation Via the T2 Statistic Based Bayesian Information Criterion**, with B. Zhou, from the *IEEE Trans. Speech & Audio Proc.*, vol. 13, no. 4, 2005
- **Cu-Move: Advanced In-Vehicle Speech Dialogue Systems for Route Navigation**, with X.X. Zhang, M. Akbacak, U.H. Yapanel, B. Pellom, W. Ward, and P. Angkititrakul, Chapter 2 in DSP for *Vehicle and Mobile Systems*, Springer Publishing, 2004

Sanda Harabagiu

Associate Professor, Computer Science
Erik Jonsson School Research Initiation Chair

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Research Interests

- Question Answering
- Reference Resolution
- Information Extraction
- Summarization

Educational Background

- Ph.D., Computer Engineering, University of Southern California (1997)
- Ph.D., Computer Engineering, University of Rome 'Tor Vergata', Italy (1994)
- Diploma Engineer, Computer Science and Electrical Engineering, Polytechnic Institute of Bucharest, Romania (1983)

"Teaching is a privilege. You get the chance to inspire a student, to transfer your passion for your research, and to show them a universe that may inhabit a student's mind from then on and fuel their curiosity."

Professional Highlights

Dr. Harabagiu holds the Erik Jonsson School Research Initiation Chair and is an Associate Professor in the Department of Computer Science. She is the initiating Director of UTD's Human Language Technology Research Institute (HLTRI), where she supervises both the Center for Emerging Natural Language Applications and the Center for Search Engines and Web Technologies. The goal of the institute is to stimulate and foster research in the area of human language technology, comprising Natural Language Processing (NLP) and automatic speech recognition and synthesis. Dr. Harabagiu's research interests are in natural language processing, information extraction, discourse processing and textual question answering. Dr. Harabagiu is a recipient of the National Science Foundation (NSF) CAREER award.

ANSWERING QUESTIONS USING INFERENCE AND ADVANCED SEMANTICS (AQUINAS)

On this collaborative project between UTD, the International Computer Science Institute (ICSI) Berkeley, and Stanford University, Dr. Harabagiu has performed research that involves innovating language analysis, innovating question processing, devising new forms of indexing using semantic information, the extraction and inference of answers based on event inter-relationships and context-sensitive inference over multiple sentences and discourse fragments, and developing learning techniques for abductive reasoning.

NSF CAREER: REFERENCE RESOLUTION FOR NATURAL LANGUAGE UNDERSTANDING

Dr. Harabagiu is addressing major obstacles in building robust systems that extract and interpret information and that summarize and answer questions from texts, and which are needed to identify the entities referred to by pronouns or other referential expressions. This research departs from previous approaches to reference resolution in that it promotes data-driven techniques instead of relying on combinations of linguistic and cognitive aspects of language. The NSF sponsored this research.

NSF CADRE: A TOOL FOR TRANSFORMING WORDNET INTO A CORE KNOWLEDGE BASE

Dr. Harabagiu was co-PI on this project, which extends a popular database of English words to make it more useful in such tasks as question answering, information retrieval, and summarization. The NSF sponsored this research.

Among Dr. Harabagiu's recently published works are the following:

- **Advances in Textual Question Answering**, edited with Tomek Strzalkowski, Springer Publishing House, 2006
- **Questions and Intentions**, to appear in *Advances in Textual Question Answering*, Kluwer Publishing House, 2006
- **Textual Question Answering**, with D. Moldovan, *Oxford Handbook for Computational Linguistics*, Oxford Press, 2003, paperback 2005

E. Douglas Harris

Executive Director, CyberSecurity & Emergency Preparedness Institute

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Research Interests

- Highly Secure Rapidly Deployable Networks
- High Performance Architectures
- Information Assurance
- "Immunized" and/or "Attack-Proof" Information Systems

Education

- D.Eng., Doctor of Engineering in Management of Technology, Southern Methodist University (1985)
- M.S., Management of Technology/CAD/CAM, Southern Methodist University (1980)
- M.B.A, General Management, Southern Methodist University (1978)

"The ability to securely share information globally has become an important aspect of doing business and sharing research results for the foreseeable future."

Professional Highlights

Dr. E. Douglas Harris is the Executive Director of UTD's CyberSecurity and Emergency Preparedness Institute. Dr. Harris served for three years on the Human Subjects Internal Review Board (IRB) at UTD. During the past seven years, Dr. Harris has been the PI for several programs regarding the planning, development, and implementation of complex information systems that collect and store vital data and then securely deploy the information to personnel nationally and globally. Under his direction, UTD was designated a National Center of Academic Excellence in Information Assurance Education by the National Security Agency and the Department of Homeland Security. In addition, Dr. Harris developed the first computer information system in the U.S. to be certified to the British Standards Institution BS 7799 for Information Security.

Dr. Harris began his career at Texas Instruments, where he spent more than 20 years. From 1967 to 1978 he was corporate manager of automation at TI. After joining Southern Methodist University in 1978 he also served as Vice President at Productivity International, Inc. where he completed several major consulting jobs in the area of CAD/CAM systems and Management of Technology. In 1988 he was appointed Assistant Dean in the School of Engineering and Applied Sciences at SMU. Dr. Harris has published more than 40 papers and has taught in both engineering and business schools. He is a member of Tau Beta Pi, Omega Rho, and is an honorary member of the Golden Key National Honor Society. Dr. Harris has graduated 12 doctoral students and has worked as an advisor on 19 other doctoral committees. He serves on the Advisory Board of the National White Collar Crime Center and several other boards as well.

TELECOMMUNICATION INDUSTRIES GLOBAL INFORMATION/ COMMUNICATION SYSTEM

Since 1999, Dr. Harris has been UTD's PI for the telecommunication industries global information/communication system that was designed to meet very rigorous confidentiality, security, reliability, and availability requirements. He is PI for an EPA-funded emergency response system. This system allows first responders to instantly view critical hazardous material information and emergency plans on site during emergencies. This program is currently considered one of the best first responder information programs in the U.S. to help mitigate HAZMAT incidents and terrorist acts. It is operational in all 50 states and 4 U.S. territories.

TEXAS HEALTH ANALYTICS SYSTEM INFORMATION TECHNOLOGY (TxHASIT) SYSTEM

In early 2005, Dr Harris was chosen by the Inspector General of Texas to plan and implement a system for Medicaid research using the past six years of Texas Medicaid medical history which is updated monthly ensuring that the data is fresh for the researchers.

QUALITY MEASUREMENTS REPOSITORY SYSTEM (MRS)

Dr. Harris is UTD's PI for the worldwide telecommunications industry's Quality Measurements Repository System (MRS) for the QuEST Forum. The system was designed to meet very rigorous confidentiality, security, reliability, and availability requirements. The QuEST Forum is an international consortium of service providers and suppliers. The UTD MRS Computer Information System is considered to be one of the most secure in the world and meets the rigid British Standards Institute Standard BS 7799 for Information Security.

THE EPA'S EMERGENCY RESPONSE SYSTEM

Dr. Harris is UTD's PI for an EPA-funded emergency response system, the "E-Plan," which allows first responders to instantly view critical hazardous material information and emergency plans at the site during emergencies. This program has been implemented in key regions across Texas, Louisiana, and Arkansas. It is currently considered one of the best first responder information programs in the U.S. to help mitigate HAZMAT incidents and terrorist acts.

THE CYBERSECURITY AND EMERGENCY PREPAREDNESS INSTITUTE RESEARCH TEAM

This Institute is composed of a world-class research team with a proven track record. This team has the experience, the desire and the initiative to help secure our homeland. The Institute develops advanced technologies to assist emergency response teams and protect the nation's critical communication and information infrastructures. The key to emergency response and counter-terrorist activities is the ability to rapidly deploy highly secure information and communication technologies. The team is working on highly secure, highly available, rapidly deployable, rapidly configurable networks, as well as on advanced sensor networks.

Vasileios Hatzivassiloglou

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Research Interests

- Statistical Natural Language Processing and Machine Learning
- Automated Acquisition of Semantic Knowledge from Large Amounts of Text
- Summarization, Question Answering, and Intelligent Information Retrieval
- Digital Libraries, Text Mining, Bioinformatics, and Medical Informatics

Education

- Ph.D., Computer Science, Columbia University (1998)
- M.Sc., Computer Science, Columbia University (1992)
- Diploma, Computer Science & Computer Engineering, University of Patras, Greece (1990)

Professional Highlights

Dr. Hatzivassiloglou is an Associate Professor in the Department of Computer Science. As a researcher, he has received more than $19 million in funding after submitting 14 grant proposals as PI or co-PI. His sources of support have included the National Science Foundation (NSF), the Defense Advanced Research Projects Agency (DARPA), the Advanced Research Development Activity (ARDA) funding intelligence-related research, the National Institutes of Health (NIH), the National Library of Medicine (NLM), the Department of Homeland Security (DHS), industry, and New York state agencies. He has published more than 55 papers as book chapters or in major journals and international conferences, given 18 invited talks to academia, industry, and government institutions in the US, Europe, and Japan, and has served as a member of the CIA, NSF, and European Union advisory committees. Articles about his work have appeared in publications such as *The New York Times, USA Today, The Economist, BBC News, Wired, Le Monde*, and *La Stampa*.

AQUAINT PHASE II: FUSING RICH INFORMATION EXTRACTED FROM MULTIPLE MEDIA AND LANGUAGES TO GENERATE CONTEXTUALIZED, COMPLEX ANSWERS

Intelligent question answering is one way to focus the relevant parts of multiple related documents to a particular information need. This collaborative project between UTD, Columbia University, the University of Colorado at Boulder, and Stanford University aims to develop question answering technology for questions with complex time- and perspective-dependent answers that are several paragraphs long, such as definitions, opinions, events, and biographies. Dr. Hatzivassiloglou serves as the Director of this project, which have been funded at approximately $1 million per year by ARDA and the Defense Intelligence Agency.

SECURE AGENCY INTEROPERATION FOR EFFECTIVE DATA MINING IN BORDER CONTROL AND HOMELAND SECURITY APPLICATIONS

Effective communication among multiple agencies is necessary for supporting and interpreting automated alerts, such as for suspicious shipments at ports. This project is a collaboration with Rutgers University and the University of Illinois at Chicago and addresses several aspects of data mining, flow control, and data interoperability. Dr. Hatzivassiloglou's focus has been on automatically creating ontologies aligning the different terminologies that different agencies use, thereby enabling the transfer of information between agencies. The project is funded by the DHS under the NSF's Digital Government Initiative.

PROBABILISTIC EXTRACTION AND INFERENCE OF MOLECULAR INTERACTIONS FROM TEXTUAL AND NON-TEXTUAL DATA

Information about molecular interactions is published at a high rate, but much of it is inaccessible to the average biologist or researcher exactly because of its sheer volume. This project, in collaboration with Columbia University's Genome Center and the Department of Biomedical Informatics, and Yale University, has developed automatic methods that analyze hundreds of thousands of published articles, extract information about genes and proteins and their introduction, and maintain an extensive knowledge base with validation and visualization capabilities. Several large grants have funded this effort since 1998, including awards from NSF/ITR, DARPA, and NIH.

Wenchuang (Walter) Hu

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Research Interests

- Nanoimprint, e-Beam Lithography, Plasma Etching and Deposition
- Biomedical Nanoelectromechanical Systems (bio-NEMS)
- Nanostructured Biomaterials for Tissue Engineering
- Photonic and Molecular Nanodevices and Nanosystems

Education

- Post-Doctoral Work, University of Michigan, Ann Arbor, MI (2005)
- Ph.D., Electrical Engineering, University of Notre Dame, IN (2004)
- M.S.E.E., University of Notre Dame, IN (2001)
- B.S., Electronics, Peking University, Beijing, China (1999)

"Many applications of nanotechnology emerge at the boundaries of multiple disciplines. Therefore, to invent we need to be fearless in continuously reaching out for new knowledge and in expanding our abilities to work with other people. Dare to think and dare to do."

Professional Highlights

Dr Hu's expertise includes electron beam lithography, nanoimprint lithography, surface chemistry, micro/nano-fluidics, and semiconductor devices. His current research explores the boundaries of nano/microelectronics, chemistry, and biology. His group is making biomedical and molecular nanodevices and systems with an approach using a combination of nanoimprint and self-assembly. Recently, he has established the capability of nanoimprint lithography, a nanometer (10^{-9} m) precision, high throughput, and low cost fabrication technology at UTD. Dr. Hu is bringing together a multidisciplinary team to establish a nano-foundry in North Texas to promote nanotechnology research.

NANOFLUIDIC ELECTRICAL/MAGNETIC FIELD EFFECT DEVICES/SYSTEMS

This project is for the nano-manipulation and analysis of DNA and other biospecies. The work has been performed in collaboration with chemists and biologists at UTD and physicists at The University of Texas at Arlington.

NANOSCALE ORGANIC LIGHT-EMISSION DIODES (NANO-OLEDs)

This project involves the development of nano-OLEDs for applications in bio-NEMS and flexible display.

DESIGN AND FABRICATION OF BIOMIMETIC NANOSTRUCTURED BIOMATERIALS

Dr. Hu's team is designing and fabricating the nanostructured biomaterials needed for artificial corneas and for tissue engineering in general. This research is being performed in collaboration with The University of Texas Southwestern Medical Center at Dallas.

NANOIMPRINT TEMPLATE DEVELOPMENT

In collaboration with several faculty members in UTD's Department of Electrical Engineering and researchers at Photronics Inc., Dr. Hu's team is working on a diamond-like carbon coating for better template durability. An e-beam assisted template repair method is currently under exploration.

Louis Roberts (Bob) Hunt

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Director, Center for Systems Communications and Signal Processing

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Research Interests

- Power Electronics
- Programmable Optical Filters
- Nonlinear Systems
- Nonlinear Control
- Nonlinear Signal Processing

Education

- Ph.D., Mathematics, Rice University (1970)
- B.S., Mathematics, Baylor University (1964)

"Learning and teaching engineering, mathematics and science make me passionate about my career."

Professional Highlights

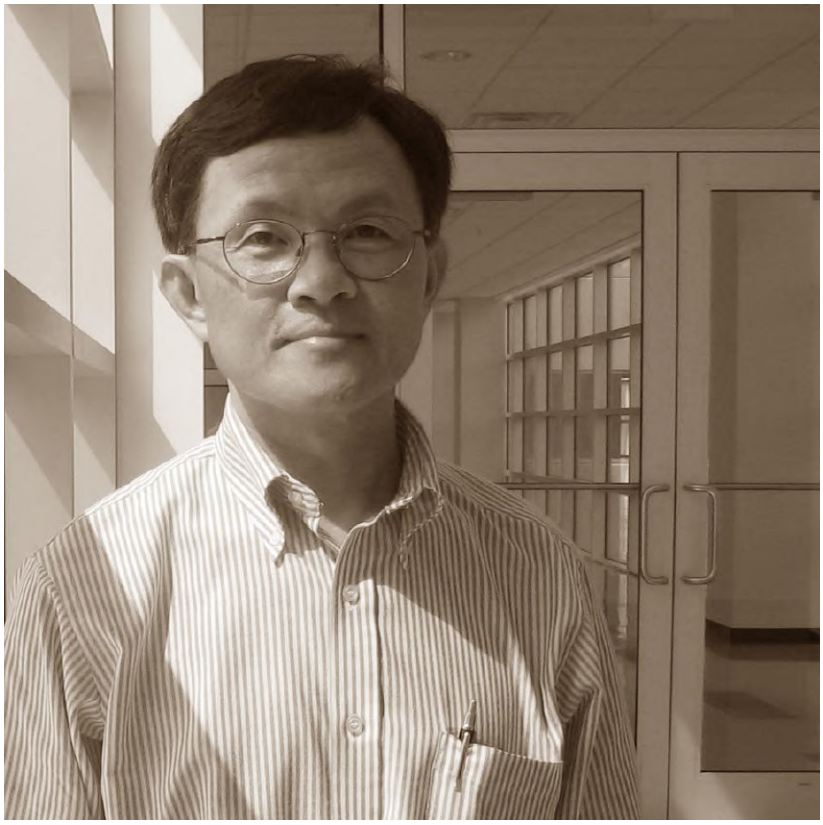
Dr. Hunt was one of the early researchers in feedback linearization and was elected an IEEE Fellow for his work on nonlinear systems and control. Professor Hunt worked with the NASA Ames Research Center on automatic flight control of high performance aircraft for 21 years. He has developed theories and methods for feedback linearization and the system inversion of nonlinear control systems that have been successfully applied in flight simulations, flight tests, and aircraft design. Dr. Hunt's research concentration also involves the use of modern nonlinear control methods in power electronics as well as other applications.

DESIGN OF BOOST AND BUCK-BOOST POWER CONVERTERS

Professor Hunt and his PhD student Robert Taylor (graduated 2004) applied modern nonlinear control methods to develop new design algorithms for boost and buck-boost converters. Using nonlinear to linear transformations, design is on a linear system instead of a nonlinear system, is guaranteed to remain stable, and is independent of the desired output voltage. Implementation can be carried out on both Digital Signal Processors (DSPs) and Field-Programmable Gate Arrays (FPGAs).

DESIGN OF PROGRAMMABLE (TUNABLE) OPTICAL ACTIVE FILTERS

Dr. Hunt is part of a team that has performed studies of optical filters using driving applications in the areas of high-speed communications and signal processing. This fundamental research encompasses modeling, analysis, design, simulations, experiments, and prototyping. Fabrication of a variety of devices is currently underway. Presently, Dr. Hunt's team is continuing development of various models, such as transfer functions and lattice filters, which involve both the system parameters and gains (for active filters). For the one-dimensional lattice filters with gains, methods to choose those gains that generate a desired set of transfer functions have been developed. Novel lattice filter structures comprised of four directional couplers have been analyzed, and two parametric decompositions of the couplers themselves have been provided. The use of four directional couplers in thick linear lattice filters and two-dimensional lattice filters has also been studied. In addition to optical lattice filters, Dr. Hunt's team has derived direct form realizations of photonic filters.



D. T. Huynh

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Research Interests

- Computational Complexity Theory
- Automata and Formal Languages
- Concurrency Theory
- Communications Networks and Protocols
- Parallel Computation
- Software Engineering

Education

- Ph.D., Computer Science, The University of Saarland, Germany (1978)
- M.S., Computer Science, The University of Saarland, Germany (1977)

Professional Highlights

Dr. Huynh is the Department Head and a Professor in the Department of Computer Science. Prior to joining UTD in 1986, he was a Visiting Assistant Professor at the University of Chicago. He then spent three years as an Assistant Professor of Computer Science at Iowa State University. Dr. Huynh is a member of the Advisory Board of the *Journal of Automata, Languages and Combinatorics*. His research interests include computational complexity theory, communications networks and protocols, and parallel computation.

Examples of Dr. Huynh's upcoming and recently published work include:

- **Connected D-Hop Dominating Sets in Mobile Ad Hoc Networks**, with Trac N. Nguyen, to appear in *Proceeding of the 4th International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks*, Boston, MA, April 3-7, 2006
- **Adapting Connected D-Hop Dominating Sets to Topology Changes in Wireless Ad Hoc Networks**, with Jason Bolla, to appear in the *Proceedings of the 25th IEEE International Performance, Computing and Communications*, Conference, Phoenix, Arizona, April 10-12, 2006
- **PatZip: Pattern-Preserved Spatial Data Compression**, with Yu Qian and Kang Zhang, from the *Proceeding of the 9th Pacific-Asia Conference on Knowledge Discovery and Data Mining, Lecture Notes in Artificial Intelligence*, Springer-Verlag, 2005
- **Connected D-hop Dominating Sets in Ad Hoc Networks**, with T Vuong, from the *Proceedings of the 6th World Multiconference on Systemics*, Cybernetics and Informatics, Florida, 2002
- **Max-Min D-Cluster Formation in Wireless Ad Hoc Networks**, with A. Amis, R. Prakash, and T. Vuong, from the *Proceedings of INFOCOM 2000*

Jason Jue

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Research Interests

- Optical Network Control and Management
- Optical Network Survivability
- Photonic Packet-Switched Networks
- Optical Burst-Switched Networks

Education

- Ph.D., Electrical and Computer Engineering, University of California, Davis (1999)
- M.S., Electrical Engineering, University of California, Los Angeles (1991)
- B.S., Electrical Engineering and Computer Science, University of California, Berkeley (1990)

"Optical technology has enabled the transmission of terabits of information per second over a single strand of optical fiber.The primary challenge facing us today is how to manage the vast amount of critical information that is being transported over these fibers. In an attempt to tackle these problems, our research focuses on issues related to the intelligent design of optical network architectures and protocols. Next-generation optical networks will be capable of providing the high-bandwidth reliable services necessary for tomorrow's demanding applications."

Professional Highlights

Dr. Jue is an Associate Professor in the Department of Computer Science. His research interest include high-speed communication networks, with an emphasis on the design and performance evaluation of architectures and protocols for wavelength division multiplexed (WDM) optical networks. Dr. Jue's research is funded by grants from the National Science Foundation (NSF), and he currently is the principal investigator for projects related to the design and analysis of optical packet-switched networks and the design of survivable optical and wireless networks. Dr. Jue has served as a guest editor for *SPIE/Kluwer Optical Networks Magazine*, and is on the editorial board of *IEEE Communications Surveys and Tutorials*. He has been involved in the organization of several conferences and symposia on optical networking, serving as General Co-Chair of the Broadband Optical Networking Symposium at BroadNets 2004, the Technical Program Co-Chair of the IEEE Globecom 2005 Symposium on Photonic Technologies for Communications, and the Co-Chair of the Fifth IEEE/CreateNet International Workshop on Optical Burst Switching. He has recently co-authored a book entitled *Optical Burst Switching*. Dr. Jue is a member of the IEEE and the IEEE Communications Society, and he currently serves as Vice-Chair of the IEEE Communications Society Optical Networking Technical Committee. He was a recipient of the NSF CAREER Award in 2002.

OPTICAL NETWORK CONTROL AND MANAGEMENT

In order to establish circuit-switched connections in optical networks, a route must be found and wavelength resources must be assigned to the connection along each link in the route. As Internet traffic begins to dominate networks, it will be increasingly desirable to both establish and take down connections quickly and dynamically in order to accommodate increasingly bursty traffic. When connection requests arrive and depart quickly, it becomes difficult to maintain updated network state information. The lack of current state information may lead to the blocking of connection requests if the routing and wavelength assignment decisions are made based on this stale information. Dr. Jue's team is currently developing routing and control protocols that are uniquely suited for handling dynamic connection requests. The protocols are being defined in such a manner as to be compatible within existing standardized control frameworks, such as Generalized Multiprotocol Label Switching (GMPLS). This project has been funded in part by Alcatel.

OPTICAL NETWORK SURVIVABILITY

An important issue in optical networks is survivability, or the ability of the network to continue carrying traffic in the event of a failure in the network. In this research, Dr. Jue's team is investigating optical-layer survivability schemes for handling single and multiple link failures. Dr. Jue's work focuses primarily on protection schemes in which dedicated or shared network resources are set aside ahead of time to handle traffic in the event of a failure. Several heuristic algorithms have been developed to find a minimal-cost set of back-up resources for a given set of working connections under various constraints. His efforts are currently being extended to consider the integration of survivability in multi-layer network environments, particularly schemes which integrate IP-layer survivability schemes with optical-layer survivability schemes.

Murat Kantarcioglu

Assistant Professor, Computer Science

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Research Interests

- Privacy, Security, Data Mining and Databases
- Distributed Data Mining Techniques
- Security Issues in Databases
- Applied Cryptography and Secure Multi-Party Computation Techniques
- The Use of Data Mining for Intrusion Detection

Education

- Ph.D., Computer Science, Purdue University (2005)
- Graduate Cert., Applied Statistics, Purdue University (2005)
- M.S., Computer Science, Purdue University (2002)
- B.S., Computer Engineering (Minor in Finance), Middle East Technical University, Ankara, Turkey (2000)

"Privacy and security issues in computer science will become more important in the future. In order to be able to use the new solutions such as RFID tags, biometrics, and so on without violating privacy and security, we need to develop new technologies. Accomplishing that is what makes me passionate about my career."

Professional Highlights

Murat Kantarcioglu is an Assistant Professor in the Department of Computer Science. During his graduate years, he worked as a summer intern at IBM Almaden Research Center and at NEC Labs. His research interests lie at the intersection of privacy, security, data mining and databases. Dr. Kantarcioglu is especially interested in those security and privacy issues raised by data mining, distributed data mining techniques, security issues in databases, applied cryptography and secure multi-party computation techniques, and the use of data mining for intrusion detection. He has been a program committee member for the 8th International Conference on Data Warehousing and Knowledge Discovery (DAWAK) '06 and the European Conference on Principles of Data Mining and Knowledge Discovery (PKDD) '05.

PRIVACY-PRESERVING DATA MINING

Data mining can extract important knowledge from large data collections; however, these collections are, at times, split among various parties. Privacy concerns may prevent the parties from directly sharing the data and some types of information about the data. Dr Kantarcioglu's work addresses secure mining of data over partitioned data. His methods incorporate cryptographic techniques to minimize the information shared, while adding little overhead to the mining task. Dr. Kantarcioglu has also addressed related privacy issues including how to use learned data mining models securely and the potential privacy effect of the data mining results.

INCENTIVE COMPATIBLE DATA SHARING

Dr. Kantarcioglu develops innovative techniques based on game theory and decision sciences for encouraging the participants of a coalition to tell the truth and share data as much as possible. Essentially, this work addresses questions pertaining to incentives for organizations to share data even when security, privacy and trust policies are satisfied.

ADVERSARIAL LEARNING

Classification tasks—ranging from intrusion detection to spam filtering to homeland security—face malicious adversaries that try to adapt to deceive the classifier. An efficient classifier that works well on training data may become ineffective after an adversary adapts to the system. Using results from game theory, Dr. Kantarcioglu addresses this problem to create robust data mining methods that can withstand malicious adversaries.

Nasser Kehtarnavaz

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Research Interests

- Signal Processing
- Image Processing
- Real-Time Image Processing
- Biomedical Image Analysis
- Pattern Recognition

Education

- Ph.D., Electrical and Computer Engineering, Rice University (1987)
- M.S., Electrical and Computer Engineering, Rice University (1984)
- B.S., Electronic and Communication Engineering, University of Birmingham, England (1982)

"One of the field's biggest challenges involves bridging the gap between the communities of image processing theorists and image processing practitioners by bringing the two communities closer through conferences and promotion of real-time image processing publications."

Professional Highlights

Dr. Nasser Kehtarnavaz is a Professor in the Department of Electrical Engineering. Previously, he was a Professor in the Department of Electrical Engineering at Texas A&M University. Dr. Kehtarnavaz's research areas include signal and image processing, real-time image processing, biomedical image analysis, and pattern recognition. He has authored or co-authored 5 books and more than 130 journal and conference papers in these areas. He has had industrial experience in various capacities at Texas Instruments, AT&T Bell Labs, the US Army TACOM Research Lab, and the Houston Health Science Center. Dr. Kehtarnavaz is currently serving as Co-Editor-in-Chief of the *Journal of Real-Time Image Processing*, as Chair of the Dallas Chapter of the IEEE Signal Processing Society, and as Chair of the SPIE Conference on Real-Time Image Processing. Dr. Kehtarnavaz is a Fellow of SPIE, a Senior Member of IEEE and a Professional Engineer.

IMPROVEMENTS IN DIGITAL AND CELL-PHONE CAMERA IMAGE PIPELINE

The market for digital still and cell-phone cameras has experienced a tremendous growth in recent years. Digital cameras use a CCD/CMOS sensor to produce digital images via a number of image processing modules, collectively referred to as image pipeline or imagepipe. This research has involved the development, improvement, and implementation of various aspects of the digital camera imagepipe including color filter array interpolation, auto white balancing, auto-exposure, auto-focus, zoom tracking, continuous auto-focus, hand-shake blur reduction, and print-from-video.

CROSS-MODALITY IMAGE REGISTRATION IN fMRI BRAIN IMAGING

Functional Magnetic Resonance Imaging (fMRI) is becoming a powerful tool for the study of functional activities of brain abnormalities. Although functional images provide a good temporal resolution, they suffer from low spatial resolution and image distortions, which make accurate registration of functional images to anatomical images challenging. This collaborative research project with The University of Texas Southwestern Medical Center at Dallas involves the development of advanced image processing techniques for registering functional to anatomical brain images in order to produce accurate functional maps for clinical use.

Latifur Khan

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Director of the UTD Data Mining Laboratory

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Research Interests

- Data Mining
- Multimedia Information Management
- Intrusion Detection and Worm Detection
- Database Systems
- Semantic Web

"What makes me passionate about my career? Freedom and flexibility."

Education

- Ph.D., Computer Science, University of Southern California (2000)
- M.S., Computer Science, University of Southern California (1996)
- B.Sc., Computer Science and Engineering, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh (1993)

Professional Highlights

Dr. Khan is an Assistant Professor in the Department of Computer Science at UTD, where he has taught and conducted research since September 2000. His research work is currently supported by grants from the Air Force Office of Scientific Research (AFOSR), the National Science Foundation (NSF), the Nokia Research Center, Alcatel, and the SUN Academic Equipment Grant program. Dr. Khan is one of the principal investigators at the CyberSecurity and Emergency Preparedness Institute at UTD, where he is involved with finding solutions to rapidly growing Homeland Security problems in cyber crime, information assurance, and emergency preparedness. In addition, Dr. Khan is the director of the state-of-the-art DBL@UTD (UTD Data Mining/Database Laboratory), the primary center of research related to data mining and image/video annotation. Dr. Khan's research areas include data mining, multimedia information management, semantic web and database systems, with his primary focus on the first three research disciplines. He has served as a committee member in numerous prestigious conferences, symposiums and workshops including the ACM SIGKDD Conference on Knowledge Discovery and Data Mining. Dr. Khan currently serves on the editorial board of *North Holland's Computer Standards and Interface Journal*, Elseiver Publishing. Dr. Khan has published more than 70 papers in prestigious journals and conferences.

CLUSTERING COMPLEX DATA

Dr. Khan's group has introduced a promising new tree-structured self-organizing neural network called a *dynamical growing self-organizing tree (DGSOT)*. This DGSOT algorithm constructs a hierarchy from top to bottom by division. The DGSOT algorithm overcomes the drawbacks of traditional hierarchical clustering algorithms, such as hierarchical agglomerative clustering. The DGSOT algorithm has been tested on various domains such as text data and complex data, including the bio-informatics area in the form of 112 gene rat central nervous system and 3,000 gene micro array expression data, demonstrating impressive results. The National Science Foundation (NSF) supported this research.

IMAGE ANNOTATION

Dr. Khan's research team has proposed a novel framework for semantic image annotation. This novel approach augments a classical model with the generic, knowledge-based WordNet. To identify irrelevant keywords, the team has investigated various semantic similarity measures between keywords, and fuse outcomes of all these measures together to make a final decision using a *Dempster-Shafer* evidence combination. They have implemented various models to link visual tokens with keywords based on knowledge-based WordNet, evaluated performance using precision and recall using a benchmark dataset. This research has been supported by the Nokia Research Center.

WEB NAVIGATION PREDICTION

The improvement of many applications such as web search, latency reduction, and personalization/recommendation systems depends on the accuracy of web-surfing predictions. Here, Dr. Khan's group has proposed a hybrid model that combines classification techniques, namely, the *Markov model, Support Vector Machine* and *Artificial Neural Networks*, to resolve prediction using *Dempster Shafer's Rule*.

INTRUSION DETECTION

Dr. Khan has proposed a scalable solution using DGSOT along with Support Vector Machine (SVM) for network-based anomaly detection. His group has presented a study for enhancing the training time of SVM—specifically when dealing with large data sets—using hierarchical clustering analysis.

ANALYSIS OF FIREWALL POLICY RULES USING DATA MINING TECHNIQUES

Firewalls are the *de facto* core technology of today's network security and defense. However, the management of firewall rules has proven to be complex, error-prone, costly and inefficient for many large-networked organizations. These firewall rules are mostly custom-designed and hand-written, and thus in constant need of tuning and validation due to the dynamic nature of the traffic characteristics, ever-changing network environment, and market demands. Dr. Khan's group has presented a set of techniques and algorithms to analyze and manage firewall policy rules, including: (1) data mining techniques to deduce efficient firewall policy rules by mining its network traffic logs based on frequency; (2) filtering-rule generalization (FRG) to reduce the number of policy rules by generalization; and (3) a technique to identify any decaying rule, and a set of a few dominant rules to generate a new set of efficient firewall policy rules. As a result of these mechanisms, network security administrators will be able to automatically review and update firewall rules.

WORM DETECTION

Dr. Khan's group has looked for ways to detect novel email-born worms automatically by applying data mining. The main idea is to collect samples of normal and infected emails, extract interesting features from these emails, and then train a classifier to learn a hypothesis that can distinguish between normal and viral emails. Finally, they have applied the Naïve Bayes classifier and Support Vector Machine for this classification task and compared its results with an existing algorithm. Findings and suggestions for methods for future improvements are currently under discussion.

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Research Interests

- Wireless Communications
- Code Division Multiple Access (CDMA) Multiplexing
- Channel Estimation Techniques
- Free-Space Optical Communications Systems and Propagation Issues
- Coding and Modulation for Unguided (Infrared) Optical Channels
- Multiple Access Techniques for Wireless Access

Education

- Ph.D., Electrical Engineering, University of Southern California (1986)
- M.S., Electrical Engineering, University of Southern California (1982)
- B.S. (cum laude), Electrical Engineering, University of Southern California (1981)

"The evolution of modern communication systems over the past few decades has impacted our lives in profound ways. The future holds an interesting challenge – to harness the rapid advancements in the emerging field of nanotechnology to realize the next quantum leap in the field of communications technology"

Kamran Kiasaleh continued

Professional Highlights

Dr. Kiasaleh is a Professor and Associate Department Head for the Department of Electrical Engineering. After receiving his Ph.D., Dr. Kiasaleh was employed by Teknekron Communication Systems, Berkeley, CA, where he was responsible for conducting research on the advanced telecommunications integrated circuits (IC) products, application-specific integrated circuit (ASIC) design (DS-1 controller), and was involved in the development of network control management systems. He was also a lecturer in the Department of Electrical Engineering at San Francisco State University in 1986. From December 1996 to December 1997, Dr. Kiasaleh was on special assignment with the digital signal processor (DSP) Research and Development Center at Texas Instruments, where he conducted research on various aspects of 3rd generation wireless communication systems. From 2000 to 2003, Dr. Kiasaleh was with Optical Crossing, Inc. (OCI) where he was responsible for the development of state-of-the-art free-space and millimeter-wave communications systems.

Dr. Kiasaleh is a recipient of a Research Initiation Award (RIA) from the National Science Foundation (NSF). He was also a recipient of the NASA/ASEE Faculty Fellowship Award at the Jet Propulsion Laboratory (JPL) in 1992 where he participated in the Galileo Optical Experiment (GOPEX) demonstration, the first successful demonstration of an optical communications link involving a deep-space vehicle. For his participation in this project, he received the NASA Group Achievement Award. In 1993, he was again the recipient of the NASA/ASEE Faculty Fellowship Award at JPL where he participated in the Compensated Earth-Moon-Earth Laser Link (CEMERLL) demonstration. Dr. Kiasaleh's research interests include synchronization, novel detection schemes for phase noise and fading impaired digital communication systems, optical communication systems, and wireless as well as optical CDMA systems. He is an Associate Editor for *IEEE Communications Letters*.

Among Dr. Kiasaleh's recently published works:

- **Performance of Coherent DPSK Free-Space Optical Communication Systems in K-Distributed Turbulence**, *IEEE Transactions on Communications*, accepted Oct. 2005, to appear in April 2006 issue
- **On the Scintillation Index of a Multi-Wavelength Gaussian Beam in Turbulent Free-Space Optical Communications Channel**, the *Journal of Optical Society of America A*, accepted July 2005, to appear in March 2006 issue
- **Reverse Link Erlang Capacity of OFDMA Wireless Systems with Adaptive Resource Allocation**, with B. Zhang and R. Iyer, the *IEEE Wireless Communications and Networking Conference (WCNC)*, 2006
- **Performance of APD-Based, PPM Free-Space Optical Communication Systems in Atmospheric Turbulence**, in the *IEEE Transactions on Communications*, Vol. 53, No. 9, 2005
- **A Joint Pre-Coding and Scheduling Technique for Multi-User MIMO Systems**, with Feng Teng, the *39th Asilomar Conference on Signals, Systems and Computers*, 2005
- **Receiver Architectures for On-Off-Keying, Free-Space Optical Communications with Avalanche Photodiode Arrays**, with M. Cole, *Frontier in Optics*, 89th OSA Annual Meeting, Laser Sciences XXI, 2005

Jiyoung Kim

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Research Interests

- Gate Stack Engineering for the Next Generation Complementary Metal-oxide-semiconductor (CMOS) Applications
- Nano-structure Materials and Devices for Nanoelectronics
- Novel Atomic Layer Deposition (ALD) Applications
- Novel Memory Device Materials, Fabrication and Applications
- Nano-sensor Fabrication and Applications

Education

- Ph.D., Materials Science and Engineering, The University of Texas at Austin (1994)
- M.S., Metallurgical Engineering, Seoul National University (1988)
- B.S., Metallurgical Engineering, Seoul National University (1986)

"Nanomaterials, nanofabrication and nanodevices will open a new world soon."

Professional Highlights

Dr. Kim is an Associate Professor in the Department of Electrical Engineering. Prior to joining UTD's faculty, Dr. Kim worked for Texas Instruments, Inc., as a process integration engineer. In 1996, he became a faculty member of Advanced Materials Engineering at Kookmin University in Seoul, Korea. Dr. Kim was the director of the Research Institute of Nanotechnology and Science at Kookmin University from 2004 to 2005. His general areas of research interest are those involving CMOS technology and nanotechnology, including nano-materials, nano-fabrication and nano-devices, particularly inorganic nanotubes and their applications.

ADVANCED GATE STACKS FOR CMOS APPLICATIONS

Dr. Kim's research involves the characterization and processing of alternative high-k materials, the stability and work function of metal gates, as well as the integration issues of advanced gate stacks for CMOS applications. He concentrates on the reliability and electrical characterization of high-k dielectrics/metal gate devices. Samsung, COSAR (The Consortium Of Semiconductor Advanced Research, Korea), KOSEF (The Korean Science and Engineering Foundation), and KRF (The Korean Research Foundation) have provided funding for this research.

NANOSTRUCTURE MATERIALS AND DEVICE APPLICATIONS

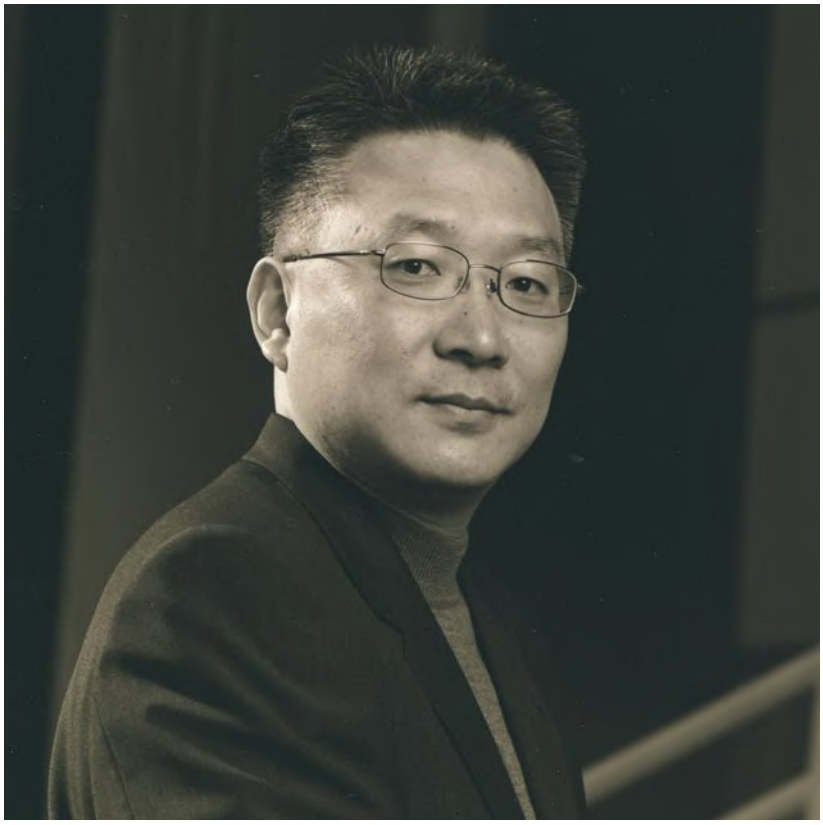
Dr. Kim's work in this area concentrates on the fabrication of metal, oxide, and semiconductors with their hybrid nanotubes using atomic layer deposition and nano-templates. Multilayer nanotube and multi-core nano-wire, fabrication and characterization of stand-alone functional nanotube devices, nano-manipulation and alignment of nano-structured materials and allow novel nanotube applications for IT, BT, and ET. This work has been funded by CNMT (The Center for Nano-structured Materials and Technology, Ministry of Science and Technology, Korea) since 2002. He has worked in close collaboration with Dr. Moon Kim.

NOVEL ATOMIC LAYER DISPOSITION (ALD) APPLICATIONS

Dr. Kim studies and defines the process development of conventional high-k and metal gate for advanced gate stack capacitors, multi-level metallization applications, and 3-D conformal coating for nanoelectromechanical system (NEMS) and microelectromechanical system (MEMS) applications. Selective atomic layer deposition (ALD) processing uses self-assembled monolayers and low temperature deposition for flexible deposition. This work has been funded by KRF, CMPS (the Center for Materials and Process of Self-assembly), CNMT, and COSAR.

NOVEL MEMORY DEVICE MATERIALS, FABRICATION, APPLICATIONS

Ferroelectric random access memory (FeRAM) with PZT (lead zirconate titanate) and SBT ($SrBi_2Ta_2O_9$) is an important allocation of Dr. Kim's research efforts. Novel node structure for high temperature oxidation processes, Metal-Ferroelectric-Insulator-Si (MeFIS) stack capacitors for non-destructive non-volatile memory applications, resistive RAMs, and novel non-volatile memory nano-electronics are under intense investigation. KOSEF, Hynix, and the KRF have funded this work since 1996.



Moon J. Kim

Professor, Electrical Engineering

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Research Interests

- Atomic Structure and Chemistry of Materials
- Nano-fabrication and Nano-manipulation
- Heterogeneous Materials Integration
- High Resolution Electron Microscopy
- Nanoelectronics

Education

- Ph.D., Materials Science, Arizona State University (1988)
- M.S., Materials Science, Arizona State University (1986)
- B.S., Materials Science, Arizona State University (1984)

"Fearlessness is 'out of the box' research themes with no limits – such as using nano-science technology to create the world's smallest three-dimensional flag."

Professional Highlights

A Professor in the Department of Electrical Engineering, Dr. Moon Kim is also the Director of UTD's new Nano-Characterization Facility. He has authored/co-authored more than 120 refereed papers and given more than 40 invited talks. Dr. Kim has both designed and built a unique ultra high vacuum (UHV) wafer-bonding instrument. Dr. Kim's current research is funded by the National Science Foundation (NSF), the US Army's Night Vision and Electronic Sensors Directorate (NVESD), the National Institute of Standards and Technology (NIST), the Korea Electronics Technology Institute (KETI), the Korea Automotive Technology Institute (KATECH), Texas Instruments (TI), Micron, and Semiconductor Research Corporation (SRC), with a current funding level of more than $2.1M.

NANO & BEYOND RESEARCH LABORATORY

Dr. Kim supervises UTD's Nano & Beyond Research Laboratory. His primary research focus is nano-fabrication and the manipulation and characterization of materials for electronic and photonic applications. Dr. Kim's current research includes heterogeneous materials integration by wafer bonding, nanoscale strains in Si CMOS, ultra low-k dielectrics, scaled microelectromechanical systems/nano-electromechanical systems (MEMS/NEMS), nanoelectronic materials, and nano-studio.

UHV WAFER BONDING

Wafer bonding technology offers significant advantages for synthesis of heterostructures that cannot be usefully synthesized by more familiar methods such as epitaxial techniques. Materials with large misfits or different lattice structures across interfaces can be bonded without causing defect formation in the crystal adjacent to the bonded interfaces. The objective of Dr. Kim's research is to integrate dissimilar materials by wafer bonding technique for applications in three areas: (1) electrically active bonded junctions, (2) the fabrication of alternative substrates for semiconductor materials with no natural lattice matched substrate, and (3) System-on-Chip (SoC) integration for multi-functionality. Dr. Kim has designed and built an ultra high vacuum (UHV) wafer-bonding unit to integrate dissimilar materials suitable for electronic and optical properties measurements, fracture mechanical testing, and structural characterization by electron microscopy. There are **only two other similar instruments in the world**: at Lawrence Livermore National Laboratory, and at the University of Tokyo in Japan. Dr. Kim's unit is capable of synthesizing planar interfaces (for metals, ceramics, and semiconductors) suitable for both microscopy and quantitative interface property measurements with both control of interface orientation and additional element chemistry.

NANO-FABRICATION & MANIPULATION

Dr. Kim's research focus in this key area of nanotechnology includes the fabrication and/or manipulation of individual nano-materials of various forms. As opposed to a more conventional approach, the single form nano-material is characterized as being *in-situ* (or "in place"). Electrical and optical behavior of single TiO_2 nanotubes, electrical characteristics of single carbon nanotubes, the 3D assembly of scaled MEMS/NEMS arrays, and semiconductor nanowires for bio and environmental sensors are all being examined in this manner.

HIGH RESOLUTION TRANSMISSION ELECTRON MICROSCOPY (HRTEM)

High resolution analytical transmission electron microscopy is a powerful and essential tool for investigators in nanoscale science and engineering, and offers analytical capability with an unprecedented spatial resolution for nanostructure and chemistry of materials down to atomic scale. Dr. Kim's expertise in high resolution analytical electron microscopy includes high resolution electron microscopy (HREM) phase contrast and Z-Contrast STEM—scanning transmission electron microcopy (TEM) imaging—convergent beam electron diffraction (CBED), energy dispersive x-ray (EDX) and electron energy loss spectroscopy (EELS). Dr. Kim served as a lab instructor and a committee member in the User Program of the *National Facility for HREM* at Arizona State University for more than 10 years during his tenure there. He is currently conducting extensive interdisciplinary collaborative research involving state-of-the-art TEM nanostructural characterization while directing UTD's new Nano-Characterization Facility.

Gil S. Lee

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Research Interests

- Semiconductor Material Properties
- Physics of Semiconductor Devices
- Device Fabrication
- Measurement and Characterization of Materials and Devices

Education

- Ph.D., Electrical Engineering, North Carolina State University (1987)
- M.S., Electrical Engineering, The University of Texas at Austin (1983)
- B.S., Kyungpook National University, Korea (1975)

"I like the following three words: fair, consistent, and humble. I am trying to be a good teacher based on those three words."

Professional Highlights

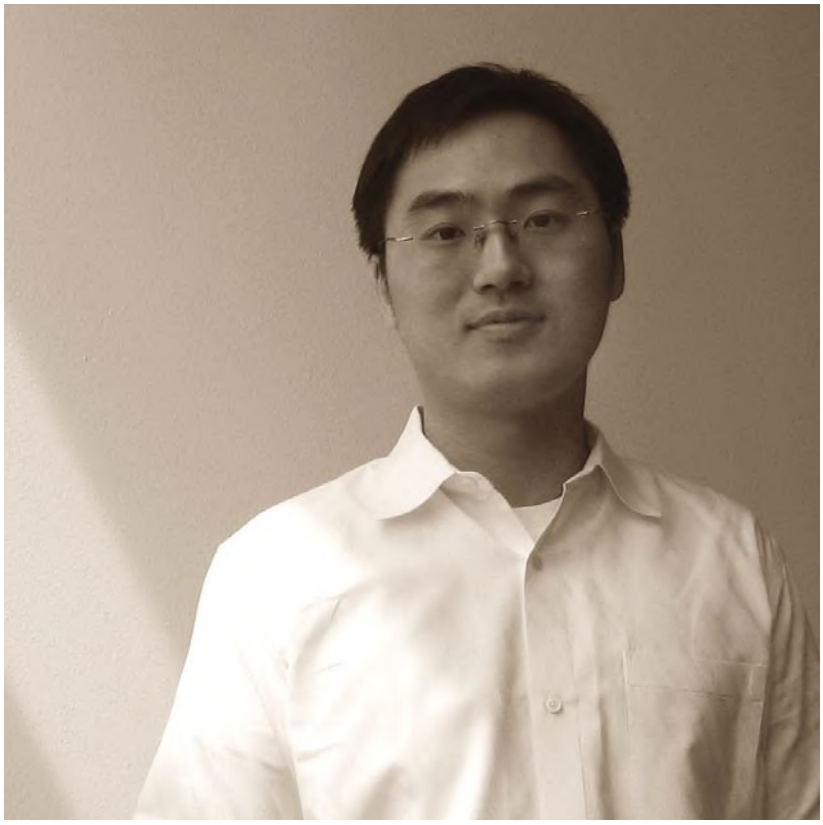
Dr. Lee is a Professor in the Department of Electrical Engineering. After obtaining his Ph.D. from North Carolina State University, he performed research on the electrical properties and materials growth of strained layer heterostructures, device fabrication and material growth, carbon nanotubes grown by atmospheric plasma-enhanced chemical vapor deposition and its device applications, piezoelectric materials and projection display, low dielectric constant film deposition by plasma-enhanced chemical vapor deposition, and carbon nanotube growth using atmospheric pressure chemical vapor deposition. Prior to joining UTD, Dr. Lee was an Assistant and then an Associate Professor at Louisiana State University, where he worked on compound semiconductor device fabrication and material growth, electro-optics, and dielectric film deposition by plasma-enhanced chemical vapor deposition. Dr. Lee has also been a consultant to Optek Technology and was a Visiting Scientist at the Naval Research Laboratory in Washington, DC, where he worked on the growth and photodiode fabrication of indium antimonide (InSb) and related compound semiconductors.

LARGE PROJECTION DISPLAYS USING DIFFRACTIVE CONTROL

Dr. Lee's project used a piezoelectric device to change its control surface from flat to ripple. Projection light that strikes the flat areas is blocked from reaching the screen while projection light that strikes the rippled area is diffracted around the block and is able to reach the screen. Depending on the amplitude of the ripple, the diffraction efficiency can be very high, so that the projection light is used efficiently and a bright display is readily formed. The ripples are formed by the relative expansion of an array of piezoelectric columns compared to a reference array. An inexpensive piezoelectric device will be fabricated, and its use as a control component imaged by a projection system to create large, bright displays will be demonstrated.

GROWTH OF CARBON NANOTUBES

Funded by Lockheed Martin, Dr. Lee's project involved the deposition of carbon nanotubes via atmospheric pressure plasma enhanced chemical vapor deposition. Dr. Lee manufactured carbon nanotube (CNT) transistors and super capacitors. Using carbon nanotubes, he is currently developing a DNA chip. Dr. Lee is concurrently developing a manufacturing system of CNT for continuous harvesting. The nanotube forests are synthesized by catalytic chemical vapor deposition on a substrate, using acetylene gas as the carbon's source. The forests are grown by a batch process at 680°C, i.e., deposition of metal nanoparticles on a substrate such as a silicon wafer followed by growing of the forests on it. Dr. Lee's team has discovered that they can combine a metal-nanoparticles deposition process and the CNT growth process into one step, utilizing their plasma-enhanced chemical vapor deposition (PECVD) expertise. His team has also found that the CNT growth rate is higher with their method than by a typical CVD method, at a given temperature. These results have encouraged the further investigation of a unique three-step sequence for generating CNT-based materials. New processes, if successful, will render CNTs one step closer to being an economically affordable developed product.



Hoi Lee

Assistant Professor, Electrical Engineering

Director, Mixed-Signal and Power Integrated Circuits (IC) Laboratory

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Research Interests

- High-Performance Power Management Integrated Circuits
- Ultra Low-Power Analog Implementations of Speech Processor for Auditory Prostheses
- Substrate Noise Minimization for Mixed-Signal SoC Systems
- Low-Voltage Low-Power Analog and Mixed-Signal Integrated Circuits

Education

- Ph.D., Electrical and Electronic Engineering, The Hong Kong University of Science and Technology (2004)
- M.Ph., Electrical and Electronic Engineering, The Hong Kong University of Science and Technology (2000)
- B.E., Electrical and Electronic Engineering, The Hong Kong University of Science and Technology (1998)

"My current research focuses on the cross-disciplinary engineering fields of power management integrated circuits and biomedical integrated systems. I've always treasured working with different students and collaborators to address different challenges."

Professional Highlights

Dr. Hoi Lee is an Assistant Professor in the Department of Electrical Engineering. His current research interests include analog and mixed-signal integrated circuits for power management, biomedical and telecommunication systems. Dr. Lee was the first recipient of the Best Student Paper Award at the 2002 IEEE Custom Integrated Circuits Conference for the paper, *Active-Feedback Frequency Compensation for Low-power Multi-stage Amplifiers*.

HIGH-EFFICIENCY HIGH-FREQUENCY SWITCHING DC-DC CONVERTERS

High-frequency switching DC-DC converters can reduce the required size of passive components, thereby reducing cost. However, high-frequency operation generates larger switching power loss and decreases the power efficiency of switching converters. Dr. Lee's research project involves developing techniques to reduce both the switching power loss and the shoot-through current loss when the switching converters operate at high switching frequency. Low-voltage low-power analog building blocks such as voltage references, operational amplifiers, and oscillators require investigation in order to conserve power dissipation in the circuit level.

SUBSTRATE NOISE MINIMIZATION FOR MIXED-SIGNAL SYSTEMS-ON-A-CHIP SYSTEMS

The monolithic integration of digital, analog and radio frequency (RF) systems to realize mixed-signal systems-on-chip (SoCs) is continually driven by scaling of complementary metal-oxide-semiconductor (CMOS) technologies for reducing chip size, power consumption, and cost. A major bottleneck of SoCs is the substrate coupling between digital circuits and sensitive analog and RF circuits through a shared substrate. This research project involves developing effective circuit techniques to significantly reduce large-amplitude and high-frequency substrate noise.

STIMULATOR SYSTEM OF PDA-BIASED SPEECH PROCESSOR

Dr. Lee collaborates with Drs. Philip Loizou, Nasser Kehtarnavaz, Murat Torlak, and Anu Sharm to accelerate research in cochlear implants on all fronts. This arena includes clinical applications and basic science. Dr. Lee is responsible for developing a laboratory simulator system for a Personal Data Assistant (PDA)-based speech processor to obtain measures of neural responses to pulses at high rates.

Dr. Lee's recently published work includes:

- **Design of Low-Power Analog Driver Based on Slew-Rate-Enhancement Circuit for CMOS Low-Dropout Regulators**, with P. K. T. Mok and K. N. Leung, in the *IEEE Transactions on Circuits and Systems-II*, vol. 52, pp. 563-567, Sep. 2005.
- **Switching Noise and Shoot-Through Current Reduction Techniques for Switched-Capacitor Voltage Doubler**, with P. K. T. Mok, in the *IEEE Journal of Solid-State Circuits*, vol. 40, pp. 1136-1146, May 2005.
- **An SC DC-DC Converter with Pseudo-Continuous Output Regulation Using a Three-Stage Switchable Opamp**, with P. K. T. Mok, in the *IEEE International Solid-State Circuits Conference Dig. Tech. Papers*, San Francisco, California, 2005, pp. 288-289.
- **Switching Noise Reduction Techniques for Switched-Capacitor Voltage Doubler**, with P. K. T. Mok, in the *Proceedings of the IEEE Custom Integrated Circuits Conference*, San Jose, CA, 2003, pp. 693-696.

Jeong-Bong (J.B.) Lee

Associate Professor, Electrical Engineering

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Research Interests

- Radio Frequency (RF) Microelectromechanical Systems (MEMS) - Micro Inductors, RF MEMS Switches, Micro Radio Frequency Identification (RFID)
- Bio MEMS - Microneedles, Neural Probes, Wireless Bio Sensing, Microfluidics
- Photonics - Tunable Nano Photonic Crystals, Packaging of Optoelectronic Devices, On-Chip Optical Table
- Nano and Micro Fabrication - Focused Ion Beam (FIB) Nano Patterning, E-Beam Lithography

Education

- Ph.D., Electrical Engineering, Georgia Institute of Technology (1997)
- M.S., Electrical Engineering, Georgia Institute of Technology (1993)
- B.S., Electronics Engineering, Hanyang University, Seoul, Korea (1986)

Professional Highlights

Dr. Lee has established a solid research program in Microelectromechanical Systems (MEMS) at UTD through his Micro/Nano Devices and Systems Laboratory. Numerous externally sponsored research programs have funded his research activities. In his more than six years as a faculty member, he has been awarded and received $2M in research grants and gift money. Dr. Lee is quite active in collaborative research with other institutions including many local companies. Dr. Lee's long-term research career goal is to become an internationally renowned researcher in the field of MEMS and nanotechnology. His long-term teaching career goal is to become an excellent teacher and mentor in the field of MEMS, microelectronics, and newly emerging nanotechnology. Dr. Lee was awarded the CAREER Award from the National Science Foundation (NSF) in 2001, which is a highly competitive nationwide and prestigious award given to promising faculty in their early career.

MICRO/NANO DEVICES AND SYSTEMS (MiNDS) LABORATORY (http://mems.utdallas.edu/)

Dr. Lee supervises UTD's Micro/Nano Devices and Systems (MiNDS) Laboratory. The MiNDS Lab's primary research expertise is in the area of MEMS and NEMS (Nanoelectro-Mechanical Systems). Dr. Lee has been involved with research in this area for more than 10 years. UTD MiNDS research addresses fabrication technologies, device development, and packaging issues in MEMS and NEMS. Areas of current research include Radio Frequency (RF) and microwave, biomedical, and optical applications of MEMS, as well as assembly technologies for micro/nano scale devices. Currently, the MiNDS Lab's major research funding sources are Federal Government agencies. Dr. Lee's research team has had partnerships with Raytheon Systems Company, Zyvex Corporation, MicroFab Technologies, Inc, and MEMtronics Corp.

RF/MICROWAVE MEMS

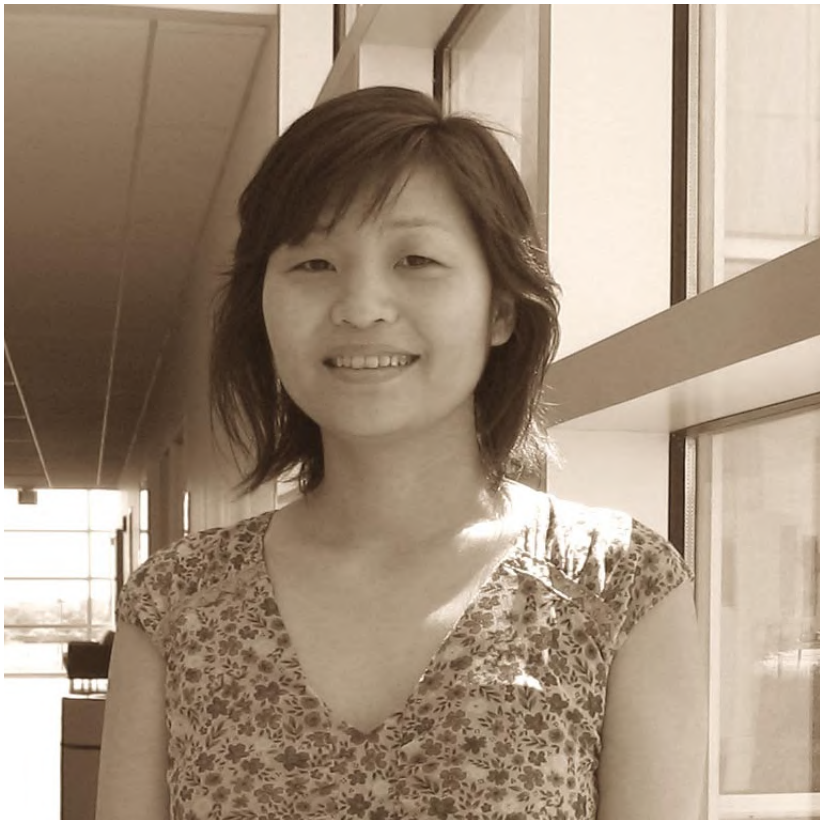
Dr. Lee's team has developed on-chip passive components such as 3D spiral, toroidal, solenoid inductors, tunable inductors, on-chip metallic shield structures, and on-chip antennas. They are also developing methods of monolithic integration of on-chip 3D passive components directly on RF circuits on a chip and at wafer scale as well as on a board level (system in a package). A chip level transmitter/receiver in very high frequencies (multi GHz range) is envisioned as part of this research.

BIO MEMS

Dr. Lee is investigating the development of novel plastic bio-chips, a hollow metallic microneedle array for drug delivery and body fluid sampling, and wireless monitoring of neuronal activities of the brain using micro-fabricated coils and detection circuits.

OPTICAL MEMS

Dr. Lee has developed dynamically tunable silicon nano photonic crystals using electron beam lithography with MEMS actuators. Such nano photonic crystals show giant negative refraction and can be used for beam steering and superlens applications for frequencies from infrared to THz. In the assembly techniques, components and base technology for micro and nano scale assembly are developed. This includes the development of microgrippers, MEMS spring-based holders for assembly of Vertical-Cavity Surface-Emitting Lasers (VCSELs), methods of rapid replication of precision plastic, and metallic micro- and nano-scale structures.



Jin Liu

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Research Interests

- High Speed Data Communication Circuits
- Wireless Sensor Interface Circuits

Education

- Ph.D., Electrical and Computer Engineering, Georgia Institute of Technology (1999)
- M.S., Electrical and Computer Engineering, University of Houston (1995)
- B.S., Electronics and Information Systems, Zhongshan University, China (1992)

"Being a professor means life-long learning to continuously improve myself while helping students improve themselves. To me, this is the most rewarding part of my career."

Professional Highlights

Dr. Jin Liu is an Associate Professor in the Department of Electrical Engineering. Her research interests are high-speed communication circuits, wireless sensor interface circuits, and system integration and miniaturization. Dr. Liu's current research projects include adaptive equalization and clock/data recovery circuits for high-speed data communication, low-power CMOS motion detection imagers, rad-hard sensor interface circuits for satellites, power and data transmission circuits for battery-less and wireless sensors, and high-speed analog/digital (A/D) converters. Dr. Liu serves as an Associate Editor of the *IEEE Transactions on Circuits and Systems II*.

HIGH SPEED DATA COMMUNICATIONS CIRCUITS

In high-speed data communication links, the demand for increased interconnection density and wider bandwidth conflicts with the cost constraints of interconnected design. Low-cost channels limit bandwidth and deteriorate signal integrity. The increase of channel bandwidth is feasible, for example, by using better cable with higher cost., however, comes at the expense of a higher system cost. The goal of Dr. Liu's research is to investigate transceiver equalization techniques in order to improve the effective bandwidth of low-cost band-limited interconnection. Her group has developed a low-power and area-efficient analog finite impulse response (FIR) equalizer for Gb/s serial links. The design uses active inductors to replace on-chip passive inductors to save die area and to reduce system cost. The performance of the equalizer is the best so far in the literature, and can equalize channel attenuation of 50dB at symbol rate frequencies. Dr. Liu's team has also developed an automatic self-adaptation scheme for high-speed equalizers. A new adaptation criterion called "pulse extraction" has been designed to use a simple digital circuit to infer the bit error rate test (BERT) performance of the transceiver, resulting in a very low power and area-efficient self-adaptation for different channels.

WIRELESS SENSOR INTERFACE CIRCUITS

Another area of Dr. Liu's research expertise is in ultra-low-power sensor interface circuits, including power extraction and data transmission circuits for batteryless and wireless sensors for radio frequency identification (RFID), prosthetics, glucose sensing applications, high-speed CMOS motion detection circuits, and wide-dynamic range CMOS imagers. An ultra-low-power, 35nW/pixel, 2D visual motion sensor has been developed by her team.

Dr. Liu's most recently published works include:

- **A 2.5- to 3.5-Gb/s Adaptive FIR Equalizer with Continuous-Time Wide-Bandwidth Delay Line in 0.25mm CMOS**, with X.F. Lin, H. Lee, and H. Liu, from the *IEEE Journal of Solid-State Circuits*, accepted for publication.
- **High Time-Resolution Motion Detection with Time Stamped Pixel Design**, with G.B. Zhang, from *Analog Integrated Circuits and Signal Processing*, vol. 46, no. 2, 2006
- **A CMOS 0.25-µm Continuous-Time FIR Filter with 125 ps per Tap Delay as Fractionally Spaced Receiver Equalizer for 1Gbps Data Transmission**, with X.F. Lin, and S. Saw, from the *IEEE Journal of Solid-state Circuits*, vol. 40, 2005

Yang Liu

Assistant Professor, Computer Science

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Research Interests

- Speech Recognition and Understanding
- Spoken Dialog Systems
- Natural Language Processing
- Machine Learning and Data Mining

Educational Background

- Postdoctoral Work, International Computer Science Institute (ICSI), Berkeley, CA (2004-2005)
- Ph.D., Electrical and Computer Engineering, Purdue University (2004)
- M.S., Electrical Engineering, Tsinghua University, China (2000)
- B.S., Electrical Engineering, Tsinghua University, China (1997)

"Speech interface is very important in human-computer interaction systems. Ubiquitous information access to multimodality data – text, speech, and video – needs to be more efficient."

Professional Highlights

Dr. Liu is currently an Assistant Professor in the Department of Computer Science and performs research in UTD's Human Language Technology Research Institute (HLTRI). Her work involves the study of human language processing, including both speech and written text. Her primary research interests include speech recognition, spoken dialog systems, natural language processing, speech quality and disorders, machine learning in speech/language processing, and data mining. Dr. Liu was a Post-Doctoral Research Fellow at the International Computer Science Institute (ICSI), Berkeley, California from 2004 to 2005.

INFORMATION EXTRACTION FROM BROADCAST NEWS SPEECH

Dr. Liu's project is part of the Defense Advanced Research Projects Agency (DARPA) GALE (Global Autonomous Language Exploitation) Program, the goal of which is to develop systems that can interpret huge amount of speech and text data in multiple languages. She is currently developing algorithms to automatically identify information in speech, such as sentence boundaries and speaker role, and to provide rich structural information to subsequent language processing modules for information extraction.

SPEECH SUMMARIZATION

While text summarization research has made significant progress, Dr. Liu is identifying many issues that exist with speech data. These issues include missing punctuation marks in speech recognition output, disfluencies in spontaneous speech, and the identification of speaker turn change, all of which pose serious problems to current text summarization approaches. Using the rich information available in speech compared to written text, Dr. Liu's research aims to address speech-related issues to summarization of broadcast news speech and meetings.

SPOKEN DIALOG SYSTEM DESIGN

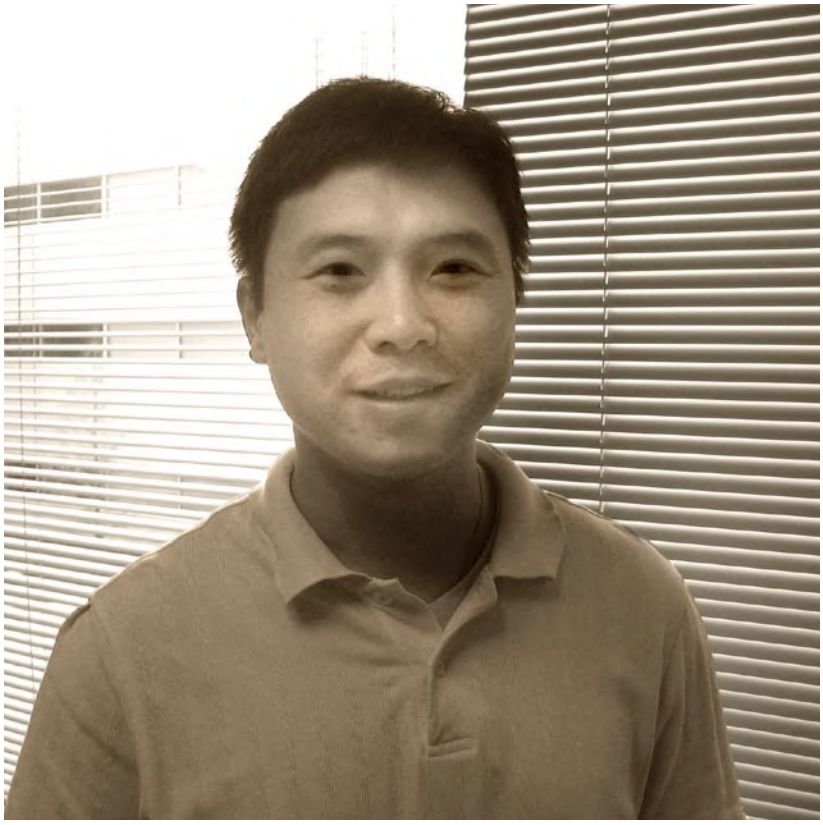
The goal of this research is to design effective and robust spoken dialog systems that are easy to use and can reduce the cognitive load of users.

MACHINE LEARNING IN SPOKEN LANGUAGE PROCESSING

Machine learning is an important aspect in many spoken language processing tasks. Dr. Liu is investigating machine learning approaches in order to effectively incorporate a variety of knowledge sources (textual, acoustic, and prosodic information) in spoken language processing. The tasks under investigation include emotion detection, speaker role detection, topic segmentation, and dialog act modeling.

SPEECH RECOGNITION AND SPEECH DISORDER

Dr. Liu is investigating how automatic speech and language processing techniques can be used to help quantitatively measure disordered speech and improve language learning.



Ying Liu

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Research Interests

- Bioinformatics
- Medical Informatics
- Computational Biology
- Data Mining
- Text Mining

Education

- Ph.D., Computer Science, Georgia Institute of Technology (2005)
- M.S., Computer Science, Georgia Institute of Technology (2001)
- M.S., Bioinformatics, Georgia Institute of Technology (2001)
- M.S., Biology, Nanjing University, Jiangsu, China (1998)
- B.S., Biology, Nanjing University, Jiangsu, China (1995)

"To meet our research field's biggest challenges, we are dedicated to developing efficient and effective bioinformatics systems to analyze, mine, organize, and manage the biological data to assist in biomedical research."

Professional Highlights

Dr. Ying Liu is an Assistant Professor in the Department of Computer Science. His research interests include bioinformatics, medical informatics, computational biology, and data mining. Dr. Liu's thesis work focused on applying machine learning algorithms for DNA micro-array data analysis and text mining biomedical literature to discover gene-to-gene relationships. He has been working closely with biomedical researchers from the Emory University School of Medicine and the Centers for Disease Control and Prevention (CDC). In 2002, he worked as a research intern at the General Electric Global Research Center, where he designed a cardiovascular pathway database. Dr. Liu also developed algorithms to mine different biological databases to discover information such as consensus sequences and protein domains.

TEXT MINING BIOMEDICAL LITERATURE

Dr. Liu's group has designed and implemented the GeneTrek system, a text mining system to cluster genes by keyword association from biomedical literature. For each gene, functionally informative terms have been extracted. A new clustering algorithm, BEA-PARTITION, has been developed for the data and text mining of biomedical literature to discover novel gene-to-gene and gene-to-disease relationships. New gene-to-disease and gene-to-gene relationships have been discovered, with biomedical researchers confirming the relationships and the data being published. This research is partially supported by the National Institutes of Health (NIH).

COMPUTATIONAL NETWORK BIOLOGY

Biological research, especially modern genome research, has provided a wealth of knowledge about individual cellular components and their functions. Correctly identifying molecular interaction schemes often sheds light on molecular mechanisms underlying biological processes. A key challenge in functional genomics is to systematically characterize the structure and the dynamics of the complex molecular interactions within a living cell. Dr. Liu's group has proposed a new mining algorithm to analyze the protein-protein interaction network based on graph theory to discover protein functional modules and protein complexes. This algorithm's design is based on an artificial neural network and evolutionary computing algorithm and has resulted in high quality research data.

MICROARRAY QUALITY CONTROL

DNA microarrays technologies are among the most rapidly growing tools for genome analysis, making possible the monitoring of changes in the expression patterns of thousands of genes. Several commercial microarray systems are currently available, each having its own requirements in terms of the amount of RNA needed, data acquisition required, and their transformation and normalization techniques. An urgent need exists for a standardization that will facilitate the comparison of microarray data across different platforms. Dr. Liu's group has developed a new statistical and computational algorithm for this comparison that provides cross-validation between microarray platforms. This algorithm outperforms currently available approaches. This project is partially supported by the Food and Drug Administration (FDA).

Philipos Loizou

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Research Interests

- Speech Processing: Enhancement, Compression, and Recognition
- Signal Processing for Cochlear Implants
- Signal processing and Adaptive Signal Processing Algorithms
- Speech Perception

"Fearless engineering means innovation and thinking beyond the state of science today."

Education

- Ph.D., Electrical Engineering, Arizona State University (1995)
- M.S., Electrical Engineering, Arizona State University (1991)
- B.S., Electrical Engineering, Arizona State University (1989)

Professional Highlights

Dr. Philipos Loizou is a Professor in the Department of Electrical Engineering. His research specialty is in digital signal processing (DSP), especially as related to the analysis of speech. He has expertise in the areas of automatic speech recognition, compression of speech for low-bandwidth transmission, and speech perception. He has worked in the areas of adaptive signal processing, spectrum estimation, fixed-point implementation of DSP algorithms, and non-linear signal analysis. Dr. Loizou is currently developing speech processing algorithms that will aid people with hearing impairment, particularly, those wearing cochlear implants. His research on cochlear implants is funded by the National Institutes of Health (NIH) and has received their Shannon Award.

SPEECH ENHANCEMENT AND NOISE SUPPRESSION

Speech enhancement techniques are used to remove noise from the speech signal or to enhance the speech quality. Dr. Loizou's current projects include the development of Minimum Mean-Square Estimation (MMSE) algorithms for speech enhancement, the development of noise estimation algorithms suitable for highly non-stationary noisy conditions, the development of subspace algorithms for non-stationary environments, and active noise control for functional Magnetic Resonance Imaging (fMRI) scanner rooms. This research has been supported in part by NIH and performed in collaboration with The University of Texas Southwestern Medical Center at Dallas.

COCHLEAR IMPLANTS

Several million Americans today have profound hearing loss, and for years they have had to rely on conventional hearing aids. Although hearing aids have been found to benefit those with moderate deafness, they have not been found to benefit individuals with severe (sensorineural) deafness. Cochlear implants have now been established as a new option for individuals with profound hearing impairments. Many of these individuals, who are implanted with cochlear prosthesis, are able to understand some speech without lip-reading. Several speech-sound processing techniques have been developed over the years that improved the benefits derived from the cochlear implant. Moderate levels of speech understanding can now be achieved with current speech-processing techniques. Dr. Loizou's research focuses on the development of new speech-sound processing strategies that improve the levels of speech performance even further. This research includes the development of signal processing algorithms for cochlear implant processors, the development of speech coding algorithms for music, the development of noise reduction algorithms for cochlear implants, speech perception by cochlear implant patients, the fixed-point implementation of speech processing algorithms on Texas Instrument's TMS320C54x DSPs, and the optimization of signal processing algorithms on TMS320C6x DSP. This work has been supported by the NIH and by the Advanced Bionics Corporation.

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Research Interests

- Photonic Devices and Systems
- Signal Processing in Optics
- Photonic Integrated Circuitry
- Optical Instrumentation

Education

- M.B.A., Southern Methodist University, Dallas, TX (1998)
- Ph.D., Electrical Engineering, Portland State University (1989)
- M.S., Electrical Engineering, Brown University (1985)
- B.S. (Honors), Electrical Engineering, Brown University (1984)

"An important lesson of modern electronic integrated circuitry is the ability to achieve large economies of scale even for niche applications. The photonics community needs to develop programmable integrated circuitry for optical processing of information – one device, programmable by the customer, for many different applications."

Professional Highlights

Dr. MacFarlane is a Professor in the Department of Electrical Engineering. He has written more than 100 technical papers or patents in the general area of photonic systems and components. His specific research projects have included work with micro-optics, ultrafast lasers, photonic integrated filters, nonlinear optics, semiconductor lasers, ellipsometry, and advanced displays. Dr. MacFarlane's work with photonic filters is widely used by practicing optical component and system engineers in industry. He pioneered the manufacture of micro-optics using ink jet techniques, and invented a novel 3D volumetric display that has found application in aerospace. Dr. MacFarlane has worked at Schafer Associates, Texas Instruments, and the JDS Uniphase Corporation, and he helped found Celion Networks, a telecommunications system start-up company backed by Sequoia. He teaches graduate and undergraduate courses in Electromagnetics, Microwave Engineering, Optics, Probability and Statistics, and Electronics, and is the Associate Dean for Interdisciplinary Programs. Dr. MacFarlane is a registered Professional Engineer in the State of Texas.

PHOTONIC INTEGRATED CIRCUITS

Dr. MacFarlane has studied the use of photonic integrated circuits for true time delay, quantum encryption and computation, signal processing, and phase-locked loops. Funding for work in this area has been provided by the National Reconnaissance Office (NRO), the Office of Navy Research (ONR), the Air Force Office of Scientific Research (AFOSR), and Photodigm.

FIBER OPTIC BASED MAGNETOMETERS WITH FTESLA SENSITIVITY

Dr. MacFarlane's fiber optic based magnetometer work has developed applications for use in defense, space exploration and, potentially, earthquake prediction. The U.S. Navy and Polatomic continue to fund this research.

ADVANCED DISPLAYS

With funding from the Defense Advanced Research Projects Agency (DARPA) and Stellar Micro Devices (SMD), Dr. MacFarlane has performed the scientific analysis of volumetric 3D displays.

Rym Zalila Mili

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Research Interests

- Software Engineering
- Multi-Agent System Engineering
- Information Visualization

Education

- Ph.D., Computer Science, University of Ottawa, Canada (1996)
- Doctorat de Spécialité, Computer Science, The University of Tunis, Tunisia (1991)

"What does 'Fearless Engineering' mean to me? It means tackling problems that challenge the way we think, the way we design and engineer our systems. It means not being afraid to come up with ideas and address problems in a manner that may not be easily accepted by my research community in the short term, and persevering until acceptance."

Professional Highlights

Dr. Rym Mili is an Associate Professor in the Department of Computer Science. Her research interests include software engineering, multi-agent system engineering, and information visualization. Dr. Mili is the Head of UTD's Visualization and Agent Engineering Research Laboratory. Her research projects have been sponsored by several organizations including the National Science Foundation (NSF) and Sandia National Laboratories. She is the recipient of the CS department Teaching Excellence Award.

ENGINEERING LARGE SCALE MULTI-AGENT SYSTEMS

Agent-based system development is a promising paradigm that focuses on autonomous, mobile, interacting components. Agents, although small in nature, are incredibly powerful when collaborating as a community. Multi-agent systems combine local behavior, autonomy, mobility, and distributed decision-making to form efficient and flexible architectures. Dr. Mili's research focuses on the development of processes, methods, and techniques for the systematic development of large-scale multi-agent systems. The application of this technology is vast: simulation tools, bioinformatics, Web applications, and network systems among others.

AGENT SIMULATION SYSTEMS

Dr. Mili's team is currently working on the development of a large-scale multi-agent simulation tool suite. The system includes several components. The agent framework creates large distributed artificial worlds and populates them with agents. Agent planning and decision making is based on fuzzy logic. The data management system uses algorithms for data clustering through sequencing and partitioning. It also uses core decomposition in the k-core algorithm to identify isolated agents. The visualization framework is based on dynamic graph drawing algorithms and it visualizes the emergence of organizational structures, the aggregation of agents during the constitution of organizations, and the dynamics of a large number of agents. Location graph prevention models are used to assess node vulnerability and monitor information propagation. Algorithms are being used to dynamically update optimal cost paths and cover various substructures of the graph. Prediction models are also being studied. An adapted version of the *Xtractis* tool suite is being used to generate prediction models, even when data is sparse or incomplete. *Xtractis* uses innovative algorithms based on fuzzy logic, genetic algorithms, and hybrid approaches.

Hlaing Minn

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Research Interests

- Cognitive Signal Designs and Algorithms
- Cross-layer Optimization Techniques
- Joint and Iterative Signal Processing Algorithms
- Estimation, Detection, Synchronization, Channel Estimation
- Multiple-Input Multiple-Output (MIMO) Communications Systems

Education

- Ph.D., Electrical Engineering, University of Victoria, Canada (2001)
- M.Eng., Telecommunications, Asian Institute of Technology, Thailand (1997)
- B.E., Electronics, Yangon Institute of Technology, Yangon, Myanmar (1995)

"The very high capacity requirements of future ubiquitous communication systems impose several research challenges. Physical layer capacity enhancement techniques are fundamentally crucial, based on which cognitive algorithms and cross-layer optimization will answer the capacity demand."

Professional Highlights

Dr. Minn is an Assistant Professor in the Department of Electrical Engineering. His primary research area involves information transmission and processing in communication systems. Dr. Minn is currently performing research activities in the areas of cognitive signal design and algorithms, cross-layer design, joint and iterative signal processing algorithms, detection, synchronization, and channel estimation. He has authored more than 50 refereed journal and conference publications and is an editor of the *IEEE Transactions on Communications*. Dr. Minn has presented numerous tutorials and seminars on Orthogonal Frequency Division Multiplexing (OFDM) and training signal designs.

CAPACITY-ENHANCED TRAINING SIGNAL DESIGNS AND RECEIVER PROCESSING ALGORITHMS

Dr. Minn is concentrating on research challenges facing the high capacity demand of future ubiquitous communication systems. Physical layer capacity enhancement techniques are fundamentally crucial, based on which cognitive algorithms and cross-layer optimization will answer the capacity demand. Dr. Minn focuses on the Cognitive Radio (CR) concept, which is boosting capacity by adapting operating parameters to different environments. Capacity-enhanced training signal designs and receiver processing algorithms are crucial for future MIMO OFDM/OFDMA/MB-OFDM systems and for CR systems. Dr. Minn's training signal designs yield more robust performance while providing flexibility in frequency-agile systems. Dr. Minn's team is currently investigating signal design and algorithms suitable for the time-varying spectral occupancy of the CR systems. His team also intends to develop training signal designs and synchronization algorithms for cooperative communications systems.

ORTHOGONAL FREQUENCY DIVISION MULTIPLE ACCESS (OFDMA)

OFDMA is a promising technology for future communications systems due to its inherent multi-user diversity, scalability in sub-carrier-wise modulation / data rate / spectral occupancy, and its low complexity equalization in dispersive channels. Dr. Minn is investigating critical issues that realize advantages in uplinking OFDMA systems, in particular synchronization, channel estimation, and the data detection of multiple simultaneous users with unsynchronized time and carrier frequencies. His team develops efficient iterative joint synchronization, channel estimation, and detection algorithms for uplink OFDMA systems.

CROSS-LAYER DESIGNS IN OFDMA SYSTEMS

Dr. Minn's team has developed a distributed opportunistic medium access scheme for OFDMA systems by utilizing multi-user diversity and physical layer conditions. His team is currently investigating the optimization of cross-layer design and will incorporate Quality of Service (QoS) requirements and other physical layer constraints and characteristics into cross-layer design.

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Research Interests

- Distributed Systems
- Fault-Tolerant Computing
- System Monitoring
- Cognitive Radios
- Wireless Sensor Networks

Education

- Ph.D., Computer Science, The University of Texas at Austin (2002)
- M.S., Computer Science, The University of Texas at Austin (1997)
- B.Tech., Computer Science and Engineering, Indian Institute of Technology (1995)

"I love teaching and being in the classroom in front of the students, helping their young minds to understand and discover computer science. I also love conducting research in computer science and solving hard problems especially those involving distributed computing."

Professional Highlights

Dr. Mittal is an Assistant Professor in the Department of Computer Science. His research interests include the study of distributed systems, fault-tolerant computing, system monitoring, Cognitive Radios (CRs), and wireless sensor networks (WSNs). Dr. Mittal is a member on the Program Committee of the Fifth IEEE International Workshop on Assurance in Distributed Systems and Networks (ADSN), 2006, a Chair, Program Committee for the First IASTED International Workshop on Distributed Algorithms and Applications for Wireless and Mobile Systems (DAAWMS), 2005, and a reviewer of many journal, conference, symposia, and workshop materials.

BUILDING RELIABLE DISTRIBUTED SYSTEMS

Recent advances in communication technologies have led to a rapid proliferation of distributed systems. This proliferation has been demonstrated by the cluster of servers providing Web coverage of the Sydney Summer Olympics in 2000 and by mass-distributed computing being recently used to discover the largest known prime number. As distributed systems evolve from the special case to commonplace, ensuring their reliable operation has emerged as an important and challenging problem. Ensuring tolerable levels of reliability is difficult even in conventional systems. In distributed systems, factors such as non-determinism, diverse environments, unpredictable hardware, and inherently complex software make the task even more difficult. Building dependable distributed systems requires efforts at multiple levels. In the design phase, availability of high-level communication primitives can make it easier to develop distributed algorithms. Later, debugging tools can be employed to detect and eliminate errors in the design and implementation of these algorithms. In spite of extensive testing and debugging, software faults persist even in commercial grade software. Many distributed systems, especially those employed in safety-critical environments, should be able to operate properly even in the presence of software faults. Distributed systems are also particularly vulnerable to various hardware failures such as machine crashes and link failures. Fault tolerant systems should be able to recover from such hardware failures as well. Dr. Mittal's team has attempted to address the problems that arise at each of these levels. They have developed novel techniques for analyzing and debugging distributed programs based on the combination of computation slicing and controlled re-execution. These techniques can be used to verify the correctness of distributed program traces and to localize software faults quickly. Dr. Mittal's team has also developed efficient algorithms for monitoring distributed systems at run time even when processes can join and leave the system while the execution is in progress. For specific problems, his team has developed a framework for transforming any problem solving distributed algorithm into an efficient fault-tolerant distributed algorithm that can tolerate process crashes.

COGNITIVE RADIOS

Cognitive Radio (CR) technology allows wireless devices to dynamically adapt to spectrum availability in their geographical region. The owner of a "licensed" channel is referred to as the primary user and all other users of the channel as secondary users. CR technology enables secondary users to scan, identify, and temporarily use the available channels in a frequency spectrum. Since secondary users independently scan the spectrum and identify their own set of available channels, some fundamental problems exist in determining how nodes detect their neighbors and then collectively form a communication infrastructure in the absence of a central authority and how the nodes decide on the set of channel(s) that can be used for communication. Dr. Mittal is currently working on efficient distributed algorithms for solving these problems.

Dan Moldovan

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Research Interests

- Natural Language Processing
- Machine Learning
- Artificial Intelligence
- Intelligent Systems

Education

- Ph.D., Electrical Engineering and Computer Science, Columbia University, New York (1978)
- M.S., Electrical Engineering and Computer Science, Columbia University, New York (1974)
- Diploma, Engineer in Electrical Engineering from the Polytechnic Institute of Bucharest, Romania (1969)

Professional Highlights

Dr. Moldovan is a Professor in the Department of Computer Science and is the Co-Director of UTD's Human Language Technology Research Institute (HLTRI), where he supervises the InterVoice Center for Conversational Technologies, the Center for Basic Research in Natural Language Processing, and the Center for Text Mining. The goals of the institute include fostering research in the area of human language technology, which comprises both Natural Language Processing (NLP) and automatic speech recognition and synthesis. Dr. Moldovan has co-directed the development of a state-of-the-art question answering system.

TRANSFORMING WORDNET INTO A CORE KNOWLEDGE BASE

Dr. Moldovan's research project extends a popular database of English words to make it more useful in such tasks as question answering, information retrieval, and summarization. The National Science Foundation (NSF) has sponsored this project.

INTERVOICE CENTER FOR CONVERSATIONAL TECHNOLOGIES

This project focuses on the integration of syntactic and semantic knowledge with current automatic speech recognition techniques. Dr. Moldovan's research has been made possible by a generous gift from InterVoice.

Among Dr. Moldovan's recent published works are:

- **Automatic Discovery for Part-Whole Relations**, with R. Girju and A. Badulescu, from *Computational Linguistics*, Vol. 32(1), 2006
- **On the Semantics of Noun Compounds**, with R. Girju, M. Tatu, D. Antohe, from the *Journal of Computer Speech and Language-Special Issue on Multiword Expressions*, edited by Aline Villavicencio, Francis Bond, and Diana McCarthy, vol. 19, no. 4, 2005
- **On the Role of Information Retrieval and Information Extraction in Question Answering Systems**, from *Information Extraction in the Web Era*, Springer, 2003
- **Word Sense Disambiguation of WordNet Glosses**, with Adrian Novischi, from the *Journal of Computer Speech and Language*, Vol. 18, no. 3, 2004
- **Textual Question Answering**, in *The Oxford Handbook of Computational Linguistics*, Oxford Press, edited by R. Mitkov, 2003

Vincent Ng

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Research Interests

- Natural Language Processing
- Machine Learning
- Artificial Intelligence

Education

- Ph.D., Computer Science, Cornell University (2004)
- M.S., Computer Science, Cornell University (2002)
- B.S., Computer Science, Carnegie Mellon University (1997)

"How can we effectively and efficiently exploit the massive amounts of textual and multimedia data available online to aid the automatic construction of high-performing text-processing systems? This will be one of the biggest challenges in natural language processing in the coming decade."

Professional Highlights

Dr. Vincent Ng is a member of UTD's Human Language Technology Research Institute (HLTRI) in the Department of Computer Science, working in the area of natural language understanding. The primary goal of his research is to build intelligent systems that can automate the process of interpreting and summarizing information extracted from textual data. His research has generally proceeded at two different levels: (1) developing tools to support natural language applications such as question answering, information extraction, and text summarization; and (2) constructing statistical models of syntax, semantics, and discourse. His research group has adopted a data-driven approach to exploring the mechanisms that underlie natural language understanding, focusing on applying machine learning and data mining techniques to automatically acquire the knowledge needed to build high-performing text-processing systems that can be easily portable to new, complex domains.

MACHINE LEARNING FOR COREFERENCE RESOLUTION

The goal of coreference resolution is to determine which noun phrases in a text or dialogue refer to the same real-world entity. Coreference resolution is one of the critical problems that currently limit the performance for many practical natural language processing tasks. Most of the existing coreference algorithms employ handcrafted heuristics, the design of which may require a great deal of linguistic expertise. To overcome this knowledge acquisition bottleneck, Dr. Ng is investigating the use of machine learning techniques to automate the acquisition of coreference resolution heuristics.

WEAKLY SUPERVISED NATURAL LANGUAGE LEARNING

To date, the most successful natural language learning techniques for a wide variety of linguistic phenomena are supervised inductive learning algorithms. However, these algorithms require large and manually annotated training corpora (a collection of text) that can be time consuming and difficult to obtain. Progress in natural language processing is currently limited in part by the speed with which new annotated corpora can be created. To overcome this corpus annotation bottleneck, Dr. Ng's team is investigating machine learning paradigms that can significantly reduce human annotation costs while maintaining the accuracy of learning-based natural language systems.

INFORMATION EXTRACTION FOR TEXT SUMMARIZATION

Natural language applications such as information extraction for the task of extracting key pieces of information from a document and text summarization for producing a short summary of a set of related documents have received a great deal of research attention in recent years. Very few investigations have yet to explore the potential of merging summarization and information extraction techniques. Dr. Ng is investigating whether information extraction-supported summarization can enable the generation of more accurate and targeted summaries in specific domains.

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Research Interests

- Processing and Communication of Multimedia Signals (Digital Signal Processing, Image Processing, and the Coding of Images and Video)
- Wireless Communication of Multimedia Signals (Audio, Images and Video)

Education

- Ph.D., Electrical and Computer Engineering, University of Illinois at Urbana-Champaign (1996)
- M.Sc., Electrical Engineering, University of Windsor, Canada (1991)
- B.S., Electrical Engineering, University of Tehran, Iran (1988)

Professional Highlights

Dr. Aria Nosratinia is a Professor in the Department of Electrical Engineering and is the Director of UTD's Multimedia Communications Laboratory (MCL). After receiving his Ph.D. in Electrical and Computer Engineering from the University of Illinois at Urbana-Champaign in 1996, he joined the faculty of Princeton University, and was later a visiting professor and faculty fellow at Rice University in Houston, Texas. Dr. Nosratinia received the National Science Foundation (NSF) CAREER award in January 2000. He actively participates in the Dallas Chapter of the IEEE and has served as the Program Chair for the Signal Processing Society, Dallas Chapter. Dr. Nosratinia received the Outstanding Service Award from the Dallas Chapter of IEEE Signal Processing Society in 2001 and 2002. He is the Associate Editor for the *IEEE Transactions on Image Processing* and the *Journal of Circuits, Systems, and Computers*.

WIRELESS COMMUNICATIONS

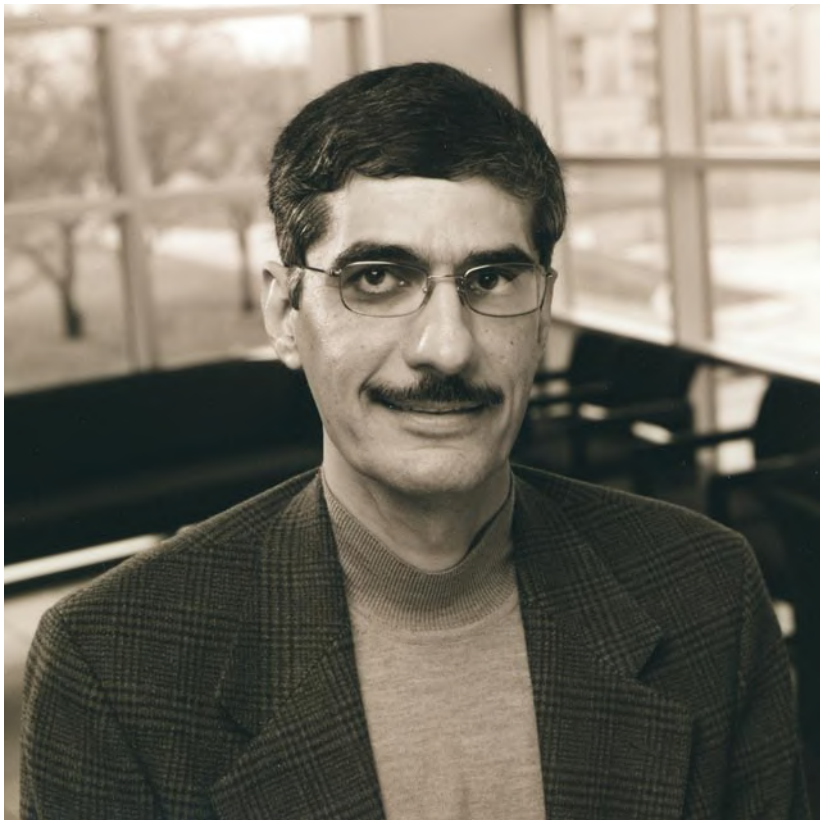
Dr. Nosratinia's lab has produced several key results, including pioneering work on cooperative wireless communications, asymptotic capacity analysis of multiple-input multiple-output (MIMO) antenna selection, and the generalized analysis of space-time codes in temporally/spatially correlated MIMO channels. His work in video coding and image processing includes joint source-channel coding, post-processing, and error concealment techniques, particularly in reference to standards JPEG-2000 and H.264. Dr. Nosratinia's lab continues to pursue cross-layer activities made possible by resident expertise in both the physical layer (wireless) and application layer (image and video compression and denoising), thereby attacking engineering problems with a perspective that will be of great utility to industry. Dr. Nosratinia's lab is working with Nortel Networks, which has funded a project entitled *Efficient Algorithms for Improved TCP/RLP Operation*, geared towards improving the data handling capabilities of the 1xRTT standard. The Eastman Kodak Company is also providing support for a project on image watermarking. These joint projects aim to increase the robustness of image watermarks for various applications through the development of new coding algorithms.

COOPERATIVE COMMUNICATION FOR WIRELESS CHANNELS

In this increasingly recognized work, Dr. Nosratinia's team produced a methodology with which single-antenna mobiles in a multi-user environment can share their antennas in a manner that enables uplink transmit diversity. Issues of transmit power, bandwidth, and security have been resolved, which allows this method to work much more effectively than a simple relay. This is of great significance for wireless LAN and ad-hoc networks. Ongoing work is continuing in this area, including the development of algorithms in the media access control (MAC) and network layers.

ANALYSIS OF SPACE-TIME CODES IN CORRELATED CHANNELS

Dr. Nosratinia's team has found generalized bounds for the performance of various space-time codes including block, trellis, super-orthogonal space time codes, as well as for linear dispersion and other so-called full-rate codes, under a variety of channel conditions. These channel conditions include but are not limited to block-fading, fast-fading, quasi-static, and arbitrary correlated fading (in space and time) for both Rayleigh and Rician statistics. The practical significance of this work for industry is that it allows the generation of fast, accurate simulators for large-scale multi-layer systems, where running full Monte Carlo simulations at the physical layer may be slow or impractical. The team has also provided analysis for concatenated systems that include outer channel codes.



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Research Interests

- Design for Testability
- System-on-Chip (SoC) testing
- Signal Integrity and Process Variation Modeling and Test
- High Level Synthesis and Design Automation
- Packet Processing Architectures

Education

- Postdoctoral Fellowship at Case Western Reserve University, OH, Department of Electrical Engineering & Computer Science (1994)
- Ph.D., Computer Engineering, Case Western Reserve University, OH (1993)
- B.Sc. & M.Sc., Electrical Engineering, University of Tehran, Iran (1986)

"Traditional design and test methodologies… those based on functionality… are no longer viable options for future nano-scale systems. We are exploring innovative strategies to design a reliable nano-scale system out of massive unreliable components and/or in the presence of process-aggravated problems."

Professional Highlights

Dr. Nourani is an Associate Professor in the Department of Electrical Engineering and a member of UTD's Center for Integrated Circuits and Systems (CICS). Prior to joining UTD, he was a member of the Department of Electrical and Computer Engineering at the University of Tehran, Iran from 1995 to 1998, and the Department of Electrical Engineering and Computer Science at Case Western Reserve University from 1998 to 1999. Dr. Nourani has received the Texas Telecommunications Consortium Award (1999), and the Clark Foundation Research Initiation Grant (2001). He was a recipient of the National Science Foundation (NSF) CAREER Award in 2002 and the Cisco Systems, Inc., URP Award in 2004. Dr. Nourani's current research interests include design for testability, System-on-Chip (SoC) testing, signal integrity modeling and test, high-level synthesis, packet processing architecture, and low power design methodologies. He is a member of the IEEE Computer Society and the ACM.

SCALABLE MULTI-SEARCH PER CYCLE TCAM ARCHITECTURES FOR HIGH-SPEED ROUTERS

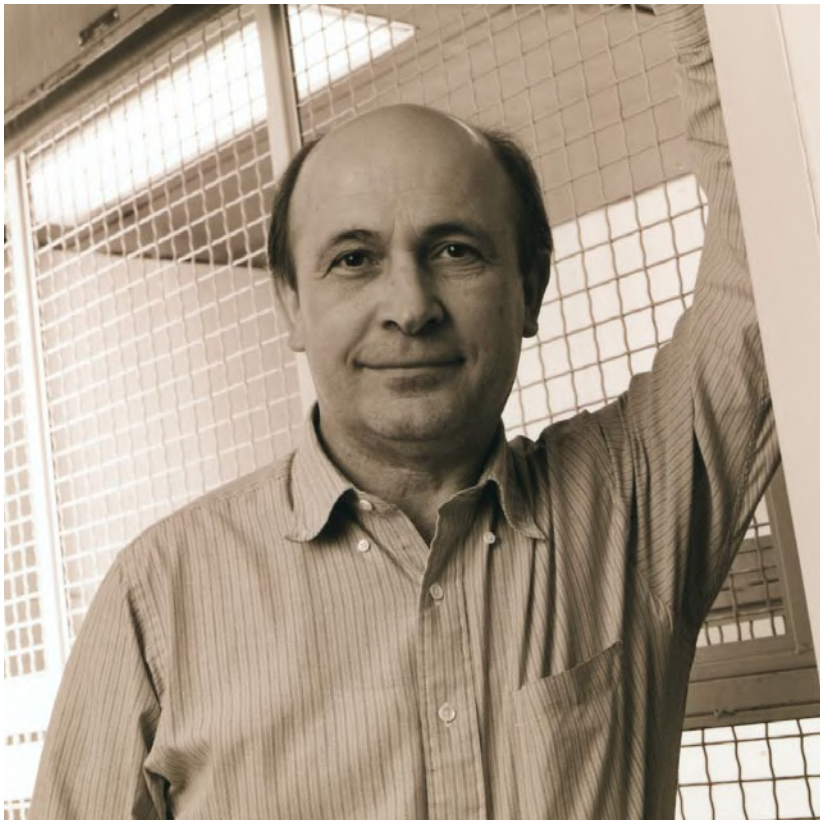
Dr. Nourani's main contribution to this project was a methodology to design scalable and flexible multi-search per cycle routing engines based on partitioned ternary content-addressable memory (TCAM) architecture. This two-stage architecture effectively works for dynamic and unpredicted Internet traffic. Using shortcut tables dynamically to store the most popular prefixes (which are the cause of most contentions) results in parallelism that comes at negligible cost. It also allows multi-threaded network processors to reduce the number of wait states in their search code pass and further improve the advantage of hardware-based search engines over software search algorithms. Cisco Systems sponsored this project.

SIGNAL INTEGRITY FAULT MODELING AND TESTING IN HIGH-SPEED SoCs

Dr. Nourani has investigated the impact of interconnect on signal integrity, which is becoming one of the main concerns in testing gigahertz (SoCs). Voltage distortion (noise) and delay violations (skew) contribute to signal integrity loss and ultimately functional error, performance degradation, shorter life and reliability problems. This research proposed a methodology to model and test signal integrity in deep-submicron high-speed interconnects that bind the internal cores in a SoC. The National Science Foundation (NSF) sponsored this research.

ENERGY EFFICIENT VLSI ARCHITECTURES FOR COMMUNICATIONS AND SIGNAL PROCESSING

The primary objective of this research was to design energy efficient Very Large-Scale Integration (VLSI) circuits and architectures for applications in telecommunications and digital signal processing (DSP). With the growing popularity of battery powered portable applications like personal communication systems, wireless/mobile computing etc., high performance circuits that dissipate less power (energy efficient) are gaining importance. This research explored two new techniques, Adiabatic Logic and vMOS (neuron-MOS) based Threshold Gate at the transistor and gate levels. Using these techniques resulted in the design and tradeoff analysis of widely used communication cores and DSP systems.



Simeon Ntafos

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Research Interests

- Algorithms
- Computational Geometry
- Program Testing
- Software Reliability

Education

- Ph.D., Computer Science, Northwestern University (1979)
- M.S., Electrical Engineering, Northwestern University (1977)
- B.S., Electrical Engineering, Wilkes College (1974)

Professional Highlights

Dr. Ntafos is a Professor in the Department of Computer Science and the Associate Dean for Undergraduate Education for the Jonsson School. Dr. Ntafos' research efforts are concentrated in the areas of computational geometry and program testing.

PATH PLANNING AND RELATED PROBLEMS FOR EMERGENCY PREPAREDNESS AND HOMELAND SECURITY APPLICATIONS

This research involves creating geometric algorithms for planning "best" strategies for dealing with emergencies like natural disasters, industrial accidents (fire, chemical spills, etc.), or terrorist attacks. By combining sophisticated models with adaptable algorithms, this effort aims to provide real-time, high quality path planning solutions to first responders and evacuation planners. These solutions take into account often conflicting factors like response time and risk. Dr. Ntafos uses weighted region and graph models that allow for dynamic changes of parameters so that the solutions can be adjusted in response to new information. Related problems currently under investigation include the optimum location of sensors, watchtowers, and cameras for homeland security applications.

PERFORMANCE INDICES AND ROOT-CAUSE ANALYSIS FOR THE TELECOM INDUSTRY

This ongoing project, funded by the Quality Excellence for Suppliers of Telecommunications (QuEST) Forum, involves the development of a basic Telecom Performance Index (TPI). Dr. Ntafos' research team has developed a draft TPI and is fine-tuning it to better capture performance data and reflect user perceptions. They are also integrating it with UTD's Measurement Repository System (MRS). Plans are in place to make full use of the unique opportunity afforded by UTD's involvement with the QuEST Forum in seeking funding for root-cause analysis research from QuEST and/or individual telecommunications companies.

IMPROVED SOFTWARE TESTING THROUGH FIELD FAILURE COST ESTIMATION

This research plan attempts to incorporate the cost of future field failures in allocating testing resources more effectively and making better software release decisions. Preliminary simulation results indicate that major benefits can be realized even with rather rude estimates of the cost of field failures. Techniques to predict these field failure costs and their frequency are currently under development. Industrial partners to carry out pilot projects that apply this research to important software development projects are being sought.

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Research Interests

- Fluorescence Microscopy (including Single Molecule Microscopy) for the Study of Cellular Dynamics
- Immunology
- Image Processing
- Signal Processing
- Systems Biology
- Surface Plasmon Resonance Experiments for the Study of Molecular Interactions

Education

- Ph.D., Engineering, Cambridge University, UK (1987)
- M.Phil., Operations Research and Control Engineering, Cambridge University, UK (1985)
- 'Vordiplom in Mathematik,' 'Zwischenpruefung in Physik,' Tuebingen University, Germany (1982)

"The detection of individual molecules in live cells using microscopic techniques is an important new tool for the understanding of cell biological functionalities. Advanced engineering methods can help to address many of the key challenges."

Professional Highlights

Dr. Ober is author or co-author of more than 100 refereed journal articles and conference papers. He also serves as associate editor for several professional journals.

Dr. Ober's recently published works include:

- **Calculations of the Fisher Information Matrix for Multidimensional Data Sets**, with Z. Lin, and Q. Zou, *IEEE Transactions on Signal Processing*, 51, (10), 2003
- **Exocytosis of IGG as Mediated by the Receptor, FCRN: An Analysis at the Single Molecule Level**, with C. Martinez, X. Lai, J. Zhou, and E.S. Ward, *Proceedings of the National Academy of Sciences*, 86, 2004
- **Simultaneous Imaging of Different Focal Planes in Fluorescence Microscopy for the Study of Cellular Dynamics in Three Dimensions**, with P. Prabhat, S. Ram, and E.S. Ward, *IEEE Transactions on Nanobioscience*, 3:237-242, 2004
- **Engineering the FC Region of Immunoglobulin G to Generate Reagents to Modulate in Vivo Antibody Levels**, with C. Vaccaro, J. Zhou, and E.S. Ward, *Nature Biotechnology*, 23, 1283-1288, 2005
- **Beyond Rayleigh's Criterion: A Resolution Measure with Application to Single Molecule Microscopy**, with S. Ram, and E.S. Ward, *Proceedings of the National Academy of Sciences*, in press.

Lawrence Overzet

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Research Interests

- Plasmas Used in Semiconductor Device Processing
- Time-Resolved Plasma Diagnostics and Surface Diagnostics
- Plasma Etching of New Materials or Structures with Plasma-Wall Interactions
- Plasma Deposition of Nanostructured Materials Using Atmospheric Pressure Plasmas and Liquid Precursors

Education

- Ph.D., Electrical Engineering, University of Illinois at Urbana-Champaign (1988)
- M.S.E.E, Electrical Engineering, University of Illinois (1986)
- B.S.E., Electrical Engineering, University of Illinois (1983)

Professional Highlights

Dr. Overzet is a Professor in the Department of Electrical Engineering and founded UTD's Plasma Applications Laboratory in 1989. He is a member of the American Vacuum Society (AVS), a Senior Member of the IEEE, and a registered Professional Engineer in the State of Texas. The primary focus of Dr. Overzet's research involves the plasmas used in semiconductor device manufacturing. The research is primarily experimental in nature as opposed to a simulation of plasmas. Dr. Overzet's team is best known for their research into pulsed plasmas and ion-ion plasmas. Pulsed-plasmas have the plasma source turned on-and-off periodically, while ion-ion plasmas have only positive and negative ions in them with no electrons. Both have significant advantages over continuous electron-ion dominated plasmas that warrant commercialization. Several diagnostics for studying these plasmas have been developed, and consequently, extensive experience in determining their kinetics has been gained. Dr. Overzet has studied plasma source design and has a serious interest in microelectromechanical systems (MEMS) device processing. He has patented a high-density plasma source that allows more uniform discharge and to make the plasma source much larger than present designs. While there is a primary focus to Dr. Overzet's research, many different kinds of projects have taken place in the Plasma Applications Labs. Among them are those receiving support from the National Science Foundation (NSF), the State of Texas, and several different companies.

PLASMA APPLICATIONS LABORATORY

The laboratory's research activities are primarily focused on the study of plasmas used in semiconductor processing. In particular, Dr. Overzet's team has developed plasma diagnostics for semiconductor processing discharges and gained extensive experience in determining plasma kinetics. They have submitted patents for a high-density plasma source, a plasma potential controller, and a fast double Langmuir probe. The lab has sophisticated Langmuir probes, B-dot probes, microwave interferometers, an energy analyzing mass spectrometer, and an intensified charged-coupled device (ICCD) camera with an imaging spectrometer.

PULSED PLASMA DIAGNOSTICS

Dr. Overzet has studied and extensively measured the properties of pulsed plasmas, including their process results. Pulsed plasmas can provide superior etch capabilities as well as reduce the dust (particulates) that can form in continuous plasmas.

NEGATIVE IONS IN PLASMAS

Dr. Overzet's research has determined which negative ions are present in a variety of plasmas and found proof that negative ions can etch effectively. Previously, it was thought that negative ions could *not* be brought to a surface in large enough fluxes to allow them to etch effectively. With his students, Dr. Overzet developed a technique for extracting negative ions that allows the team to accelerate them into a processing surface, determine their properties, and examine their etch (or deposition) capabilities. His team is investigating the possibility of developing some of the first industrially viable negative ion implants.

Ivor Paul Page

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Research Interests

- Distributed Algorithms
- Resource Allocation Problems
- Computer Graphics

Education

- Ph.D., Computer Science, Brunel University, UK (1979)
- B.Sc., Electrical Engineering and Electronics, Brunel University, UK (1968)

Professional Highlights

Dr. Page is an Associate Professor in Computer Science. He conducts research in computer graphics, dynamic storage allocation, and distributed algorithms. Dr. Page is passionate about teaching and runs local programming contests and trains students to compete in the Association for Computing Machinery (ACM) International Programming Contest.

FAST ALGORITHMS FOR DISTRIBUTED RESOURCE ALLOCATION

In this research problem, processes sit at nodes in a network and compete for resources by exchanging messages. Each process requires access to a fixed subset of the global resources and solutions to the problem must be free of deadlock and starvation. Dr. Page and his colleagues designed and developed a token passing scheme that provides polynomial waiting time and better average performance than other algorithms of its time.

IMPROVING THE PERFORMANCE OF BUDDY SYSTEMS

The problems of dynamic storage allocation have been studied for well over 30 years. Knowlton's Buddy System algorithm was published in 1976. It was a fast allocation scheme but its storage utilization was poor. Many authors published alternative schemes that improved internal fragmentation but made overall storage utilization worse. Dr. Page has published a dual-buddy algorithm that improved overall utilization.

LEADERSHIP

Dr. Page has assembled a Leadership Training module and has presented it to two groups of students. The objective of the module is to have students work in teams to solve a series of problems that require complete participation of all team members. Problem solving sessions are interspersed with discussions and didactic sessions on the principles of modern leadership: inclusion, building leaders within the team, encouraging leadership at all levels, taking responsibility for leadership, developing leadership skills, dealing with difficult people, and dealing with rapid change.

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Research Interests

- Multiple-Input Multiple-Output (MIMO) Digital Signal Processing (DSP)
- MIMO Adaptive Filters, System Identification, Source Separation, Spectral Estimation
- Acoustic Signal Processing, Biomedical Applications
- Fast Algorithms, DSP Architecture, System Designs

Education

- Ph.D., Electrical Engineering, University of Colorado at Boulder (1988)
- M.S., Electrical Engineering, Florida Institute of Technology (1978)
- B.S., Electrical Engineering, Tehran Polytechnique University, Iran (1974)

"My research goal is to continue developing innovative methods and bringing advanced powerful theoretical works to solving practical real life scientific and engineering problems."

Professional Highlights

Dr. Panahi is an Assistant Professor in the Department of Electrical Engineering. He teaches senior and graduate-level Digital Signal Processing (DSP) courses. Dr. Panahi is currently conducting DSP research involving applications for acoustic, bioacoustic, active noise control, speech enhancement, and active optical lattice filters analysis and design. Dr. Panahi established and is Director of the Statistical Signal Processing Research Lab at The University of Texas at Dallas-The University of Texas Southwestern Medical Center at Dallas (UTD-UTSW) Acoustic Research Lab in the Electrical Engineering department. He holds a U.S. patent and has been author or co-author of four of the Texas Instruments (TI) DSP-based books and more than 50 technical journal and conference publications. For ten years, Dr. Panahi served as TI's Chief DSP Architect, Worldwide Applications Manager, was a senior member of the technical staff, and Chief Technology Officer (CTO) and manager of advanced systems development at the DSP Embedded Systems business unit in Houston. He was OMAP application manager in TI's Wireless business unit before joining UTD. Dr. Panahi has been Program Chair and Secretary/Treasurer of the IEEE Dallas Chapter of Signal Processing Society. He received the 2005 IEEE-Dallas Outstanding Volunteer Award.

ACOUSTIC NOISE REDUCTION FOR fMRI ENVIRONMENT (UTD-UTSW MEDICAL CENTER)

Dr. Panahi is working on a joint research project with UTSW Medical Center to reduce acoustic and speech noise in fMRI environment (scanner and room, brain imaging applications) under high intensity electromagnetic field. This project will allow better interaction with the patients and enable applications of new medical diagnostics procedures for neurological problems using fMRI brain imaging systems.

SOURCE SEPARATION AND IDENTIFICATION METHODS

Together with his thesis students, Dr. Panahi has developed new techniques for single and multiple input/output source and channel modeling and identification. The focus of research work has been placed on acoustic signals that have applications in medical, speech, communication, and defense/security systems.

DESIGN OF ONE- AND TWO-DIMENSIONAL ACTIVE OPTICAL LATTICE FILTERS

Dr. Panahi has researched the development of theoretical frameworks and efficient algorithms for the modeling, analysis, and design of programmable one- and two-dimensional active lattice filter structures. This work will lead to a novel software package that receives desired input and output requirements—in time or frequency domain—and will determine a filter's parameters and its tunable gain values for analysis, design, and manufacturing purposes.

EFFICIENT ALGORITHMS FOR IMPLEMENTATION OF FUNCTIONS ON DIGITAL SIGNAL PROCESSORS

Dr. Panahi developed efficient algorithms that are based on polynomial approximation of the desired functions and do not require multiplications. The effects of round-off and overflow noise, in addition to the performance of each algorithm, have undergone extensive analysis. Dr. Panahi has proposed an efficient method for the online generation of time-optimal trajectories for servo-control systems.

William J. Pervin

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Research Interests

- The Programming of DSP Processors

Education

- Ph.D., Mathematics, University of Pittsburgh (1957)
- M.S., Mathematics, University of Pittsburgh (1952)
- B.S. (Honors), Mathematics, University of Michigan (1952)

"DSP processors have become so powerful that they have outstripped the ability of most programmers to make full use of their potential. I have been addressing this problem all the way from improving assembly language programming with my book "A Programmer's Guide to Assembler" to trying to introduce DSP programming and theory to Computer Science students. I anticipate that this will be an increasing problem as Moore's Law takes us to faster processors but no better programmers."

Professional Highlights

Dr. Pervin is a professor of Electrical Engineering, Computer Science, and Mathematics at UTD. He has worked in a wide variety of mathematical research areas. Dr. Pervin has recently written the book *A Programmer's Guide to Assembler,* published by McGraw-Hill Custom Publishing in 2005. He has also produced material for a Web-based course in symbolic logic being supported by The University of Texas System as part of its Multimedia Educational Information Delivery initiative. Dr. Pervin's research interest has been in the development of Digital Signal Processing (DSP) courses for computer science students. Additionally, he hopes to develop an advanced assembly language course based on a DSP chip. Dr. Pervin is a Senior Member of the IEEE and received the Outstanding Service Award, IEEE-CS Dallas Chapter, in both 1995 and 2000. He has been a grant recipient of funding from the National Science Foundation (NSF), Microsoft Corporation, Cray Research, Texas Instruments, and Rockwell International.

Dr. Pervin has written the following books:

- **Foundations of General Topology**, Academic Press, New York (1964)
- **A Programmer's Guide to Assembler**, McGraw-Hill Custom (2005)

Among Dr. Pervin's technical papers:

- "**Flux from Homogeneous Cylinders and Spheres Containing Uniform Source Distributions**", Westinghouse Atomic Power Division Technical Note 510, 1955
- "**Gauss-Jacobi Mechanical Quadratures**", Westinghouse Atomic Power Division (Large Ship Reactors - Physics) Note 38, 1955
- "**Program Verification**", Rockwell International, Technical Memorandum, 1985

Dr. Pervin has contributed to many technical conference proceedings, including:

- **Explicit Dynamic Mutual Exclusion Algorithm**, with Weidman and Page, in *Proceedings*, *Third IEEE Symposium on Parallel and Distributed Processing*, 1991
- **Optimized Implementation of the FFT Algorithm on the TMS320C62X and the TMS320C64X DSP**, with Sankaran and Cantrell, from the *International Signal Processing Conference*, 2003
- **Preferred Strategies for Optimizing Convolution (FIR) on VLIW DSP Architectures**, with Sankaran and Cantrell, from *GSPx (Global Signal Processing Conference),* 2004

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Research Interests

- Multimedia Systems
- Wireless Quality of Service (QoS)
- Multimedia Databases
- 3D Models and Motions Databases

Education

- Ph.D., Department of Computer Science & Engineering, Indian Institute of Technology, Chennai, (formerly Madras), India (1995)
- M.S., Department of Computer Science & Engineering, Indian Institute of Technology, Chennai, (formerly Madras), India (1990)
- Bachelor of Engineering, Electronics & Communication, Madurai-Kamaraj University (1986)

"My research area, multimedia systems and networking, is highly interdisciplinary in nature. It gives me avenues for working with researchers in diverse fields: physicians, neurologists, social scientists, and artists. I have been able to learn so many different things through interactions with those researchers. That's what I like best in my career."

Professional Highlights

Dr. Prabhakaran is an Associate Professor in the Department of Computer Science. He has been performing research in the areas of multimedia systems, databases, authoring and presentation, resource management, and scalable web-based multimedia presentation servers. Dr. Prabhakaran has published several research papers in prestigious conferences and journals in this area and received the National Science Foundation (NSF) CAREER Award in 2003 for his proposal on animation databases. He has served as an associate chair of ACM Multimedia 2003, ACM Multimedia 2000, and the ACM Multimedia 1999 conferences and has served as guest editor for *ACM Multimedia Systems Journal* (a special issue on Multimedia Authoring and Presentation). Dr. Prabhakaran is on the editorial board of the *Multimedia Tools and Applications Journal*. He has served as a program committee member on several multimedia conferences and workshops and has presented tutorials on topics such as network resource management, adaptive multimedia presentations, and scalable multimedia servers.

Recently published works by Dr. Prabhakaran include:

- **Middleware for Streaming 3D Progressive Meshes over Lossy Networks**, with Hui Li, and Ming Li, from *ACM Transactions on Multimedia Computing, Communications, and Applications (TOMCCAP)*, Vol. 2, Issue 4, 2006
- **MAC Layer Admission Control and Priority Re-Allocation for Handling QoS Guarantees in Non-Cooperative Wireless LANs**, with Ming Li, from *ACM/Springer Mobile Networks and Applications (MONET)*, Vol. 10, No. 6, 2005
- **Real-Time Classification of Variable Length Multi-Attribute Motion Data**, with Chuanjun Li, and Latifur Khan, from *Knowledge and Information Systems: An International Journal (KAIS)*, Springer, 2005
- **Segmentation and Recognition of Multi-Attribute Motion Sequences**, with Chuanjun Li, Peng Zhai, and S. Q. Zheng, from the *Proceedings of the ACM Multimedia Conference (ACM Multimedia 2004)*, New York, NY 2004
- **Presentation Planning for Distributed Video Systems**, with E. Hwang and V.S. Subrahmanian, from *IEEE Transactions on Knowledge and Data Engineering*, Vol. 14, No. 5, 2002

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Research Interests

- Mobile Computing
- Distributed Algorithms
- Sensor Networks
- Mobile Ad Hoc Networks

Education

- Ph.D., Computer and Information Science and Engineering, The Ohio State University (1996)
- M.S., Computer and Information Science and Engineering, The Ohio State University (1991)
- B.Tech., Computer Science and Engineering, Indian Institute of Technology, Delhi, India (1990)

"I expect to learn something new everyday from my peers and from my students. This continuous learning experience is the most satisfying aspect of university life."

Professional Highlights

Dr. Prakash is an Associate Professor in the Department of Computer Science. Previously, he was a Visiting Assistant Professor in the Computer Science Department, the University of Rochester. His areas of research are mobile computing, distributed computing, and sensor networks. He has published his results in various journals and conferences. He received the National Science Foundation (NSF) CAREER award in 2001. Dr. Prakash leads a research group investigating issues in dynamic multi-hop wire-less networks, referred to as Mobile Ad Hoc Networks (MANETs), at UTD's Distributed Systems Laboratory. Dr. Prakash was one of the first researchers to formulate the problem of MANET routing in the presence of unidirectional wireless links, and to propose a routing protocol for such networks. The NSF has funded his research. Dr. Prakash is an associate editor of the *IEEE Transactions on Mobile Computing*.

MOBILE AD HOC NETWORKS (MANETS) – NODE CONFIGURATION

Dr. Prakash is addressing the need to develop distributed protocols for MANETs. His team has developed one such protocol that requires network-wide flooding on the arrival of nodes, can adapt to abrupt departure of nodes, and handle network partitioning and mergers. Currently in work is the development of another protocol that utilizes the buddy data structure and incurs significantly lower communication overheads.

RELIABLE BROADCAST AND MULTICAST IN MANETS

MAC sub-layer protocols, like IEEE 802.11, only support unreliable local broadcast in a wireless network. Implementing reliable local broadcast or multicast through multiple unicasts is prohibitively expensive. Moreover, even if reliable local broadcast were possible, ensuring MANET-wide reliable broadcast is considerably more difficult due to changes in network topology and a lack of knowledge about the exact population of the network. Dr. Prakash's team has developed a protocol for reliable broadcast and multicast when some infrastructure nodes are present in the network. He is working on an efficient solution that does not rely on the presence of any infrastructure.

QUALITY OF SERVICE (QoS) SUPPORT FOR COMMUNICATION IN MANETS

The IEEE 802.11e protocol is being developed to support link-layer QoS when frames are marked with their priority levels. As the proposed protocol's internal contention solution is inadequate, it will result in unnecessary back-offs under low to moderate load situations, thereby resulting in lowered throughput and increased latency. Simultaneously, at high loads it may result in starvation of some low priority streams. To address this problem Dr. Prakash's team is researching stochastic modeling of the IEEE 802.11 protocol and developing of an alternative protocol for QoS in multi-hop wireless networks that ensures high throughput, low latency, and weighted fairness among various flows.

BASE STATION PLACEMENT AND ROUTING IN SENSOR NETWORKS

Multi-hop wireless sensor networks are amenable to the application of MANET routing protocols. However, each sensor node is not capable of exchanging topology information. Dr. Prakash's team has developed an offline Integer Linear Programming (ILP) solution that yields optimal placement of base stations—with base stations moving between a set of feasible sites—and forwarding protocol for sensor data. This solution ensures that all the sensor nodes consume their energy at roughly the same rate, and that some do not die well before the others.

Balaji Raghavachari

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Research Interests

- Design and Analysis of Algorithms
- Database Design
- Web-based Information Systems
- Approximation Algorithms
- Combinatorial Optimization
- Network Design
- Telecommunication Networks

Education

- Ph.D., Computer and Information Science and Engineering, Pennsylvania State University (1992)
- M.S., Computer Science, Pennsylvania State University (1992)
- B.Tech., Mechanical Engineering, Indian Institute of Technology, Madras (1984)

Professional Highlights

Dr. Balaji Raghavachari is a Professor in the Department of Computer Science. His research interests include the design and analysis of algorithms, database design, approximation algorithms, combinatorial optimization, network design, telecommunication networks, and, vehicle routing and traversal problems.

Among Dr. Raghavachari's many recently published works are:

- **Approximation Algorithms for the Capacitated Minimum Spanning Tree Problem and its Variants in Network Design**, with Raja Jothi, the *ACM Transactions on Algorithms*, ACM Press, 2005
- **Dual-Homing Protection in IP-Over-WDM Networks**, with Jianping Wang, Vinod Vokkarane, Raja Jothi, Xiangtong Qi, and Jason Jue, from the *IEEE/OSA Journal of Lightwave Technology*, Vol. 23, No. 10, 2005
- **Approximating the k-Traveling Repairman Problem with Repair Times**, with Raja Jothi, the *Journal of Discrete Algorithms*, Elsevier Press, 2004
- **Approximation Algorithms for Finding Low-Degree Subgraphs**, with P. N. Klein, R. Krishnan, and R. Ravi, from *Networks*, Volume 44, Number 3, 2004

Balaji Raghavachari continued

- **Load-Balanced for Reliable Multicast**, C. Gong, O. Daescu, R. Jothi, and K. Sarac, in the *Proceedings of the 3rd IASTED International Conference on Communications, Internet, and Information Technology* (CIIT), US Virgin Islands, 2004
- **Protein Folding in Hydrophobic-Hydrophilic Model How Good is Theory in Practice?** with R. Jothi, a *Poster Presentation at the 7th Annual Conference on Computational Genomics* (CG), Reston, VA, 2004
- **Degree-Bounded Minimum Spanning Trees**, with R. Jothi, in the *Proceedings of the 16th Canadian Conference on Computational Geometry (CCCG)*, Montreal, Canada, 2004
- **Approximation Algorithms for the Capacitated Minimum Spanning Tree Problem and its Variants in Network Design**, with R. Jothi, in the *Proceedings of the 31st International Colloquium on Automata, Languages and Programming* (ICALP), Springer-Verlag, LNCS 3142, Turku, Finland, 2004
- **Improved Approximation Algorithms for the Single-sink Buy-at-Bulk Network Design Problems**, with R. Jothi, in the *Proceedings of the 9th Scandinavian Workshop on Algorithm Theory (SWAT)*, Springer-Verlag LNCS 3111, Humlebaek, Denmark, 2004
- **Dynamic Dual-Homing Protection in WDM Mesh Networks**, with V. Vokkarane, J. Wang, R. Jothi, X. Qi, and J. Jue, in the *Proceedings of the IEEE International Conference on Communications (ICC)*, Vol. 3, Paris, France, 2004

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Research Interests

- Computer Architecture
- Adaptive Computing Systems
- Fault-Tolerant Systems Design
- Computer Communications and Networks

Education

- Ph.D., Computer Engineering, Iowa State University (2003)
- M.S., Electrical Engineering, University of Missouri (1999)
- B.S. (Distinction), Electrical and Electronics Engineering, National Institute of Technology, Warangal, India (1996)

Professional Highlights

Dr. Rama Sangireddy is an Assistant Professor in the Department of Electrical Engineering and is an affiliated faculty member to the Computer Engineering program. Dr. Sangireddy's research interests include computer architecture, adaptive and reconfigurable computing systems, application-specific systems design, fault-tolerant systems design, and computer communications and networks. Dr. Sangireddy received the Research Excellence Award in recognition of outstanding research accomplishments during his Ph.D. program at Iowa State University. He is a member of the IEEE.

SCALING PERFORMANCE USING CONFIGURATION DECOMPOSITION AND FABRIC DESIGN

The total time to execute an application, the power consumed, and the flexibility to manage a large set of applications are among the most important performance parameters used to measure the quality of a computing system. Superior architectures with flexible reconfigurable arrays lead to innovation beyond the limits of traditional silicon. In Dr. Sangireddy's preliminary study, his team has explored the performance and power trade-offs in reconfigurable computing architectures for various multimedia applications. The study reveals various interesting performance and energy behavior patterns depending on the application characteristics and the amount of on-chip reconfigurable hardware provided. The objective of the research is to develop architectural solutions that can dynamically adapt the configuration decomposition to a specific granularity and scale the performance, for a wide range of applications, to achieve an optimal energy and execution time combination specific for each application.

"Computer processor architecture is an extremely fast-changing area with new trends and technologies emanating every year. Researching the area demands me staying ahead of such new trends, and teaching in that area requires breathing freshness into courses every time. This is a challenging and exhausting experience, and I am enjoying every bit of it at UTD."

Rama Sangireddy continued

LOW POWER FRONT-END DESIGNS FOR HIGH-PERFORMANCE ARCHITECTURES

The processor's front-end, constituting level-1 instruction cache (IL1) and register rename logic, is one of the high power-density components forming a hot-spot on the chip. The processor does not utilize the fetch bandwidth to the full extent due to bottlenecks like control dependencies. Also, the power dissipation due to switching activity from continuous accesses makes IL1 a prominent hot-spot. Dr. Sangriddy's team has proposed a novel replicator mechanism that alleviates the effect of control dependencies whenever a branch instruction forms a small loop using replicator mechanisms to supply twice the number of loop instructions in the same cycle, thereby helping the back-end to extract higher ILP. Furthermore, the mechanism results in a significant reduction in the total number of IL1 accesses, leading to considerably reduced on-chip power consumption. Renaming logic in the front-end of the processor is also one of the largest contributors of peak temperatures on the chip, and so demands attention to reduce the power consumption. Analysis of characteristics of various benchmark programs reveals that the rename map table port bandwidth is highly underutilized for a significant portion of time. Based on the analysis, Dr. Sangriddy's team has proposed a novel technique to significantly reduce the number of ports in the rename map table. On going work in this area includes designing various architecture and circuit level techniques to reduce the power consumption in the front-end of the processor design.

FAULT TOLERANCE IN CHIP MULTIPROCESSORS (CMPS)

Technology scaling enables integration of a billion transistors on a single chip. An offshoot of these advances is the development of Chip Multiprocessor (CMP) architectures for improved system performance. However, this exponential increase in transistor count makes reliability an important issue in CMPs. Dr. Sangriddy's team has established that a fault in the critical components that are shared or common to multiple cores will be propagated to the larger amount of logic on the chip. Fault in such components is more contagious and vital to address than a fault in a component that is private in a core. This current project addresses the design problems of reliable common critical components in CMPs.

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Research Interests

- Physical Layer Communication Theory
- Interference Management and Synchronization
- Advanced Signal Processing Techniques for Wireless Communication Systems
- Cross-Layer Resource Optimization for Wireless Systems

Education

- Ph.D., Electrical Engineering, Rutgers University (1998)
- M.S., Electrical Engineering, Rutgers University (1995)
- B.Sc., Electrical and Electronics Engineering, Bangladesh University of Engineering & Technology (1991)

Professional Highlights

M. Saquib is an Assistant Professor in the Department of Electrical Engineering. He has previous industry experience working as a System Analyst at the Energy Research Corporation, Danbury, Connecticut from 1991 to 1992. After receiving his Ph.D. from Rutgers University, Dr. Saquib was a Graduate Research Assistant in the Wireless Information Networks Laboratory (WINLAB). From 1998 to 1999, he was with the Massachusetts Institute of Technology (MIT) Lincoln Laboratory, Massachusetts. In January 1999, he joined the Department of Electrical and Computer Engineering at Louisiana State University (LSU), where he was the Donald Ceil & Elaine T. Delaune Endowed Assistant Professor. As a researcher, Dr. Saquib's objective is to mathematically model practical problems and then perform analysis and simulations to gain insight into that problem. His goal as an educator is to teach students how to gain excitement from learning and doing research, not just directing them on a guided tour into abstraction and principles. Dr. Saquib is an associate editor of *IEEE Communications Letters* and *IEEE Transactions on Wireless Communications*.

FADE-RESISTANT TRANSMISSION

Time-varying multipath fading associated with the wireless link limits the capacity of a wireless system. To adapt to this adverse radio environment efficiently, two-code division multiple access (CDMA) based transmission systems are being investigated. In one of these systems, information symbols are transmitted simultaneously and in the other, information symbols are chip-interleaved before transmission. Both systems exploit temporal variations in the channels so efficiently that by using the estimated channel coefficients they are capable of outperforming the conventional system with perfect channel state information (CSI) at the receiver. Dr. Saquib's team has shown that both fade-resistant transmission systems exhibit identical performance when the system load is high. They have proven that given the fixed total transmitted energy, under the optimum energy allocation scheme, the chip-interleaved system allocates less energy to a pilot symbol, which leads it to allocate more energy to an information symbol than to its counterpart.

INTERFERENCE CANCELLATION FOR ADVANCED RANGE TELEMETRY

Interference from modulated carriers in adjacent channels increases the bit error rate of a modulated carrier and limits how closely modulated carriers can be "packed" in the frequency band assigned to aeronautical telemetry. An adaptive method that reduces (or even eliminates) this interference will allow range frequency managers to reduce the spacing between different modulated carriers and thus make more efficient use of the spectrum. Dr. Saquib's effort will explore the use of adaptive interference cancellation algorithms applied to advanced range telemetry (ARTM) Tier-0, Tier-1, and Tier-2 waveforms. Preliminary results with the use of a simple but computationally complex interference cancellation algorithm demonstrate that it is possible to decrease the spacing by almost 50% over the current recommendations which produce a corresponding increase in capacity of 90%. Since these algorithms can be quite complex, Dr. Saquib's goal is to identify adaptive algorithms capable of providing significant gains when used with telemetry waveforms but whose complexity is capable of data rates as high as 20 Mbits/sec.

REDUCED COMPLEXITY HYBRID RECEIVER

Recently, Dr. Saquib's team has defined a novel low-complexity receiver, namely, a hybrid receiver (HR) for the downlink of a multi-cell CDMA system with a transmit delay diversity transmission scheme. They have analyzed its performance and compared it with that of the conventional receiver (CR) and the decorrelating receiver (DR). They have proven that in a single-cell system the DR is the same as the conventional decorrelating receiver when all the orthogonal codes are in use. Dr. Saquib's numerical study has shown that the HR is more stable than the CR and the DR in terms of performance variation with respect to the system load under both known and estimated channel knowledge at the receiver.

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Research Interests

- Computer Networks
- Group Communication and IP Multicast
- Network Monitoring and Internet Measurements
- Network Security and Denial of Service Defense
- Energy Efficiency in Mobile Ad Hoc Networks

Education

- Ph.D., Computer Science, University of California, Santa Barbara (2002)
- M.S., Computer Science, University of California, Santa Barbara (1997)
- B.S., Computer Engineering, Middle East Technical University, Ankara, Turkey (1994)

"Providing Internet sites with an ability to implement stricter access control mechanisms to avoid attacks and/or controlling their effects on the sites is of utmost importance in this field."

Professional Highlights

Dr. Sarac is currently an Assistant Professor in the Department of Computer Science at UTD. Dr. Sarac's main research interests focus on computer networks, group communication and IP multicast, network monitoring and measurement, Internet topology measurements, Internet security with a focus on Denial of Service (DoS) defense and IP traceback, and energy efficiency issues in ad hoc networks. He is a member of both the ACM and IEEE.

SYSTEMS AND PROTOCOLS FOR MULTICAST NETWORK MONITORING AND MANAGEMENT

Dr. Sarac's research efforts have been in the development of systems and protocols for network monitoring and measurements. Specifically, he has developed an application layer monitoring system for multicast fault detection. Dr. Sarac has also developed multicast debugging tools to facilitate multicast management and support multicast deployment efforts in the Internet. Some of these protocols have been implemented by others and are being used to monitor and manage IP multicast services over the Internet. Currently, Dr. Sarac is working on introducing additional mechanisms to support multicast fault detection and isolation in the network. This work is funded by Cisco Systems through the Cisco Systems University Research Program.

INTERNET MEASUREMENTS

Dr. Sarac has performed research in Internet topology measurements. He has developed solutions to practical problems in building representative Internet topology maps that are used to model and study the topological characteristics of the Internet.

INTERNET SECURITY AND PRACTICAL DENIAL OF SERVICE (DoS) DEFENSE ON THE INTERNET

Dr. Sarac is currently working on developing practical solutions for DoS defense on the Internet. He is building a large-scale secure overlay network environment to provide DoS-resistant end-to-end communication services. He is also working on building practical and efficient algorithms for attack traceback.

ENERGY EFFICIENT BROADCAST ALGORITHMS

Dr. Sarac has been working on developing energy efficient broadcast algorithms for mobile ad hoc networks (MANETs).

Haim Schweitzer

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Research Interests

- Computer Vision
- Machine Learning
- Internet Technology
- Artificial Intelligence

Education

- Ph.D., Computer Science, Hebrew University, Israel (1986)
- B.S., Computer Science, Tel Aviv University, Israel (1982)

Professional Highlights

Dr. Schweitzer is an Associate Professor in the Department of Computer Science. His research interests include computer vision, Internet technologies, machine learning, and the investigation of aspects of Artificial Intelligence.

TECHNIQUES FOR REAL-TIME DETECTION OF SHAPES IN IMAGES

For objects and scenes in images and video, Dr. Schweitzer's research is being used to develop real-time face-detection technology. A U.S. Government Technical Support Working Group (TSWG), with the goal of designing systems to help combat terrorism, supports this project.

A BROWSER FOR VISUAL DATA

Supported by the Texas Advanced Technology Program (ATP), Dr. Schweitzer is researching methods to improve multimedia Internet browser technology.

CONTENT-BASED INDEXING OF IMAGES AND VIDEO

This research enables a user to search large image and video repositories for images/video containing particular information. The Texas ATP provides funding for this research.

MOTION ESTIMATION IN DIGITAL VIDEO

Dr. Schweitzer's research has been supported by the National Science Foundation (NSF) with the goal of developing techniques for improving video compression technology.

Dr. Schweitzer's recently published works exemplify the above research.

- **Interactive Browsing of Visual Content on the Internet**, with T. Yoshizawa, the *Journal of Internet Technology*, 7(1), 2006
- **Long-Term Learning of Semantic Grouping from Relevance-Feedback**, with T. Yoshizawa, the *Proceedings of the 6th ACM SIGMM International Workshop on Multimedia Information Retrieval*, 2004
- **Very Fast Template Matching**, with J. W. Bell and F. Wu, the *Proceedings of the 2002 European Conference on Computer Vision, Lecture Notes in Computer Science No. 2353*, Springer-Verlag, 2002
- **Template Matching Approach to Content-Based Image Indexing by Low Dimensional Euclidean Embedding**, the *Proceedings of the International Conference on Computer Vision Volume 2*, IEEE Computer Society Press, 2001

Carl Sechen

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Research Interests

- Digital Integrated Circuit (IC) Cell Sizing and Cell Selection for Global Power Minimization
- High-Speed, Energy Efficient Digital Signal Processing (DSP) Block Design
- High-Speed, Energy Efficient Arithmetic Block Design (Adders, Multipliers, Dividers) and Control Logic Block Design
- Area-Efficient Static Random Access Memory (SRAM) Design
- Soft-Error Tolerant Digital IC Design (including SRAMs)

Education

- Ph.D., Electrical Engineering, University of California, Berkeley (1986)
- M.S., Electrical Engineering, Massachusetts Institute of Technology (1977)
- B.S., Electrical Engineering, University of Minnesota (1975)

Professional Highlights

Dr. Sechen, an IEEE Fellow, is a Professor in the Department of Electrical Engineering. His research specialty is in the design and computer-aided design of high-speed, low-power, and reliable digital integrated circuits (ICs). He currently has ongoing projects in high-speed, energy-efficient digital signal processor (DSP) block design, arithmetic block design, control logic block design, and in area-efficient and reliable static random access memory (SRAM) design. Dr. Sechen has developed self-calibrating differential output prediction logic (DOPL) and a much greater energy efficient synthesis approach for DSP blocks. A key part of his research is the study of cell sizing or cell selection (from a fixed cell library) for global power minimization and yield maximization while meeting a strict leakage power constraint. The Microelectronics Advanced Research Corporation (MARCO) Focus Center Research Program, Honeywell, and the National Science Foundation (NSF) currently fund Dr. Sechen's research work.

OPTIMAL POWER MINIMIZATION

Dr. Sechen's team is developing a completely automated digital IC design flow that fully minimizes energy consumption for a user-specified level of performance, delay, or throughput. It also features single-pass timing closure using a unique variable die routing approach, coupled with an energy-optimal cell library. Central to the design flow is an efficient and optimal gate sizer that traces out the complete energy vs. delay curve for a possibly very large logic block in one step. The optimal transistor sizer includes leakage power control and channel length (or threshold voltage) selection. The team has developed an efficient and accurate gate sizing tool that employs a novel piecewise convex delay model that handles both rise and fall delays for static complementary metal-oxide-semiconductor (CMOS) gates. This delay model is used in a new version of a gate-sizing tool called Forge, which not only exhibits optimality, but efficiently produces the area versus delay trade-off curve for a block in one step.

MORE AREA-EFFICIENT AND RELIABLE SRAMS

Dr. Sechen's team have developed a new all-nMOS SRAM memory cell (MC) that is 24% smaller than a standard 6T MC. The new MC features reduced leakage with lower overall power. Access times are similar to the standard 6T memory cell. The team has also developed much greater area-efficient SRAMs by borrowing ideas from dynamic random access memory (DRAM) technology. Dr. Sechen is also studying soft-error rate (SER) hardened SRAMs. This particular focus is a single-event transient (SET) and single-event upset (SEU) hardness. The team's hardened-by-design SRAM mitigates SEUs and SETs in any portion of its circuitry, not just the memory cells.

HIGH-THROUGHPUT, LOW-OVERHEAD ASYNCHRONOUS LOGIC DESIGN FLOW

Dr. Sechen's team is developing a flexible asynchronous logic technique that can provide very high throughput at one extreme and a low power GALS (globally asynchronous, locally synchronous) approach at the other. This basis for this research is a locally clocked dynamic logic (LCDL) that has demonstrated the highest throughputs ever reported.

Edwin Sha

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Research Interests

- Embedded Systems
- Computer and Network Security
- Parallel Architectures and Systems
- DSP Architectures
- Parallel Programming

Education

- Ph.D., Computer Science, Princeton University (1992)
- M.S., Computer Science, Princeton University (1991)
- B.S., Computer Science, National Taiwan University, Taiwan (1986)

"I am proud to be part of UTD's engineering program because we aim high, work hard, and dare to explore. 'Fearless Engineering' is what our engineering is about: the attitude to fearlessly explore new ideas and techniques for improving human society in general."

Professional Highlights

Dr. Edwin Sha has published more than 200 research papers in refereed international conferences and premier journals. He has served on the program committees of numerous conferences and as editor of many journals, including several *IEEE Transactions*. Dr. Sha received the Oak Ridge Association Junior Faculty Enhancement Award, the Notre Dame CSE Teaching Award, a National Science Foundation (NSF) CAREER Award, an NSF Information Technology Research (ITR) grant, and a Microsoft Trustworthy Curriculum Award. He currently serves as the technical program chair for many international conferences. Dr. Sha's research has been supported by the NSF (CAREER, ITR, EIA, IIS), Texas Instruments, AT&T, Texas Advanced Research Program (ARP), and Microsoft.

TIMING OPTIMIZATION AND PARALLELIZATION FOR EMBEDDED APPLICATIONS

Real time optimization is the one of the most critical properties for an embedded system. In general, the scheduling problem is in computational complexity theory, an NP-hard (Non-deterministic Polynomial-time hard) problem. Dr. Sha has found that this scheduling problem becomes polynomial-time solvable for multi-dimensional (MD) data flow graphs. His results show that any uniform nested loop can be transformed and parallelized such that the codes in the loop body are executed in a fully parallel way. This is a fundamental result and that can be applied to applications executed on Very Long Instruction Word (VLIW) (such as TI 320C6K) or superscalar types of Very Large-Scale Integration (VLSI) architectures.

MEMORY MINIMIZATION FOR EMBEDDED SYSTEMS

Although embedded processors can have multiple on-chip memory banks to speed up memory accesses, the capacity of these on-chip modules are severely limited due to chip size, cost, and power considerations. Dr. Sha's research has developed code size reduction techniques that can be generally applied to various kinds of processors such as Intel's strongARM, TI's TMS320Cx, Motolora's StarCore, Philip's TriMedia, and the IA64. This achievement represents the processor types without predicate register, with binary predicate register, with conditional counter register, and with special hardware support for software pipelining, respectively. Dr. Sha's experimental results show that 60% of code size reduction can be achieved by applying his technique on Digital Signal Processor (DSP) benchmarks.

SCHEDULING FOR LOW POWER

In the software arena, Dr. Sha has made significant contributions on power minimization. Minimizing power consumption is a major concern for most embedded systems, and therefore must be considered throughout the system as a whole. His research demonstrates that scheduling can make a major contribution toward saving dynamic power consumption while the program is running. He has developed algorithms considering both control step assignment and functional unit binding in scheduling. Compared with standard scheduling algorithms, Dr. Sha has found that the average improvement by using his algorithm is 42.08%. This improvement is valuable because it does not sacrifice timing performance.

I. Hal Sudborough

Founders Professor of Computer Science

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Research Interests

- Design and Analysis of Algorithms for Networks, Computational Biology, Large Matrix Computations, Circuit Layout and Fault Detection Problems, Sorting and Routing
- Security Issues (Cryptography, Secure Protocols, Key Maintenance for Dynamic Secure Multicast Groups)
- Feasibility and Infeasibility of Efficient Computations for Problems Arising in Industry and Government
- Network Survivability Analysis and Design
- Image Processing

Education

- Ph.D., Computer Science, Pennsylvania State University (1971)
- M.S., Mathematics, California State University at Hayward (1967)
- B.S., Mathematics, California Polytechnic State University (1966)

"The biggest challenge in Computer Science is to understand what makes a computational task difficult. Specifically, we need better techniques to differentiate between computationally feasible and infeasible problems. This will require quantum leaps in our understanding. For those problems that are feasible, a continuing challenge is to find the algorithms and data structures that allow the most efficient solution."

Professional Highlights

Dr. Sudborough's research is directed toward improving methods to analyze the inherent combinatorial and mathematical complexities of natural real-world problems. Among his research areas are telecommunication networks, parallel computation networks, efficient parallel (and sequential) algorithms, the structure of complexity classes, picture processing, automata and formal languages, and graph and network algorithms, especially embedding and layout problems. Dr. Sudborough also studies combinatorial problems such as sorting by prefix reversals and computational biology.

Dr. Sudborough's industry accomplishments include:

- **The Design and Analysis of Logical Data Structures for the Efficient Management of Encryption Keys to Support Secure Network Management**, James Madison University.
- **Automated Semiconductor Defect Management**, the Texas Advanced Research Program.
- **Design of Optimal Survivable Networks**, Alcatel Network Systems.

Dr. Sudborough's recently published work includes:

- **Efficient Algorithms for Batch Rekeying Operations in Secure Multicast**, with M. H. Heydari, and L. Morales, from the *Proceedings of the 39th Hawaii International Conference on System Sciences* (HICSS-39), 2006
- **A Faster and Simpler 2-Approximation Algorithm for Block Sorting**, with W.W. Bein, L. Larmore and L. Morales, from the *Proceedings of the 15th International Symposium on Fundamentals of Computation Theory (FCT) 2005*, August 2005.
- **The Sequential Sum Problem and Performance Bounds on the Greedy Algorithm for the On-line Steiner Problem**, with Z. Miller, M. Perkel, and D. Pritikin, from *Networks*, 45 (3), 2005
- **Combinatorial Optimization of Multicast Key Management**, with L. Morales, M. H. Heydari and M. J. Eltoweissy, from the *Journal of Network and Systems Management, special issue on Security and Management*, Kluwer, New York, 2004
- **Embedding a Complete Binary Tree into a 3-Dimensional Grid**, with W. Bein, L. Larmore, and C. Shields, from the *Journal of Interconnection Networks* 5 (2), 2004
- **Block Sorting is Hard** with Wolfgang Bein, Larry Larmore, and Sharom Latifi, from the *International Journal of Foundations of Computer Science*, 14 (3), 2003

Lakshman S. Tamil

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Research Interests

- Sensor Networks
- Radio Frequency Identification (RFID)
- Optical Switching and Routing
- Nanophotonics

Education

- Ph.D., Electrical Engineering, University of Rhode Island (1989)
- M.S., Mathematics, University of Rhode Island (1989)
- M.Tech., Microwave and Optical Communication Engineering, Indian Institute of Technology (1983)
- B.E., Electronics and Communication Engineering, Maduari Kamaraj University (1981)

"Engineering is an all-encompassing field where you need not just the theory but a gamut of talents and skills that help you to dream, design, analyze, build and deploy complex systems that no man or woman has done before. Modern-day engineers are expected to possess not only engineering knowledge but also the knowledge to manage time, money, and people while being socially responsible."

Professional Highlights

Dr. Lakshman Tamil is a Professor in the Department of Electrical Engineering and is Director of UTD's Broadband Communications Laboratory. He founded Yotta Networks, Inc., a high-tech startup company that designed and marketed terabit-switching platforms. As CEO and CTO of a 100+ person strong company, he was responsible for product planning, fundraising, team building and company governance. Dr. Tamil has managed and directed research on advanced optical networks at Alcatel's Corporate Research Center and was recognized for his leadership in the initial design and planning of "TIPOR", the first industrial demonstration of an all-optical IP router. He co-invented a type of multi-channel multipoint distribution service (MMDS system)—a precursor to Wi-Max—that formed the core technology for Spike Technology, Inc., a telecommunication startup that successfully developed and marketed MMDS turnkey systems. Dr. Tamil has been a consultant to the Naval Research Laboratories, Raytheon, Alcatel, Spike Technologies, and Electrospace in the areas of optical and wireless communication. Dr. Tamil has contributed to more than 100 research publications and directed more than ten doctoral dissertations.

Among Dr. Tamil's many recently published work are:

- **Multi-Terabit Hybrid Photonic Switching and Routing**, with A. Fumagalli, from APOC-2005, Shanghai, China, 2005, published in *Proceedings of SPIE International Society of Optical Engineering*
- **On Optical Burst Switching and Self-Similar Traffic**, with A. Ge, and F. Callegati, from *IEEE Communications Letters*, vol. 4, no. 3, 2000.
- **Optical IP Routers: Design and Performance Issues under Self-Similar Traffic**, with F. Masetti, T. McDermott, G. Castanon, A. Ge and L. Tančevski, from *Journal of High Speed Networks*, Vol. 8, No. 1, 1999
- **Non-Degenerate Buffers: An Approach for Building Large Optical Memories**, with L. Tančevski and F. Callegati, from *IEEE Photonics Technology Letters*, 1999
- **Coverage Prediction for Cellular Networks from Limited Signal Strength Measurements**, with K. Manoj, and P. Bernardin, in *Proceedings of the Ninth IEEE International Symposium on Personal Indoor and Mobile Radio Communications* (PIMRC '98), 1998
- **Optical Wavelength Division Multiplexing for Broadband Trunking of RF Channels to Remote Antennas**, with J.R. Cleveland, in *Proceedings of MILCOM '97,* vol. 2, 1997
- **Effect of Noise in Optically-Fed Phased Array Antennas for CDMA Wireless Networks**, with T. Landolsi and W.P. Osborne, in Proceedings of the *IEEE International Conference on Personal Wireless Communications*, 1997
- **Analysis of Nonlinear Periodic Dielectric Media Using the Finite-Difference Method with Absorbing Boundary Conditions**, with Y. Yu, and C. D. Cantrell, from the *Journal of the Optical Society of America A*, vol. 13, no. 1, 1996

Bhavani Thuraisingham

Professor, Computer Science

Director, Cyber Security Research Center

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Research Interests

- Information Security
- Data Management and Data Mining
- Knowledge Management and Semantic Web
- Distributed and Real-time Systems

Education

- M.S., Computer Science, University of Minnesota (1984)
- Ph.D., Theory of Computation and Computability Theory, University of Wales, UK (1979)
- M.Sc., Mathematical Logic and Foundations of Computer Science, University of Bristol, UK (1977)
- B.S., Pure Mathematics, Applied Mathematics and Physics, University of Ceylon (1975)

"At UTD, one can accomplish many things as there are no barriers placed in front of you. UTD truly has very high academic standards and yet it fully encourages entrepreneurship."

Professional Highlights

Dr. Thuraisingham is a Professor in the Department of Computer Science and is the Director of UTD's Cybersecurity Research Center. Prior to joining UTD, she was a program director for three years at the National Science Foundation (NSF) in Arlington, VA and was the founder of the NSF's Data and Applications Security program. Dr. Thuraisingham worked for the MITRE Corporation in Bedford, MA, between January 1989 and October 2004, where she held various positions including department head in data and information management and chief scientist in data management. She worked in the computer industry in Minneapolis, MN for over five years and served as an Adjunct Professor of Computer Science and a member of the graduate faculty at the University of Minnesota. Dr. Thuraisingham's research interests are in the area of information security and data management. She has published more than 300 research papers, including more than 70 journals articles, and she holds three patents. She has written seven books concerning data management, data mining, and data security. She has delivered more than 30 keynote addresses at data management and security conferences, including conferences at the White House Office of Science and Technology Policy and at the United Nations. Dr. Thuraisingham is a Fellow of the IEEE, a Fellow of the American Association for the Advancement of Science (AAAS), a Fellow of the British Computer Society (BCS) and received the IEEE's 1997 Technical Achievement Award for her research in information security.

RESEARCH MANAGEMENT

As department head at MITRE, Dr. Thuraisingham managed 28 staff members for four years. Research in her department focused in four areas: multimedia data management, data mining, interoperable databases, and distributed objects. Dr. Thuraisingham managed MITRE's internal research in information management for three years. She managed fifteen academic research projects for the CIA. Between 1999 and 2001, Dr. Thuraisingham was chief scientist/engineer in data management and was responsible for the research as well as providing research direction for more than two hundred staff members at MITRE's Air Force Center.

RESEARCH CONTRACTS/GRANTS

At MITRE, Dr. Thuraisingham initiated and led several research projects for various sponsors including the U.S. Navy (secure distributed databases, secure objects, inference problems), the Army (inference problems, security constraint processing), the Air Force (secure distributed databases and real-time databases/middleware), and the National Security Agency (secure federated databases, designing secure systems and applications). At UTD, Dr. Thuraisingham has been awarded grants from the Air Force Office of Scientific Research and Raytheon Corporation.

Murat Torlak

Associate Professor, Electrical Engineering

Director, Wireless Information Systems Laboratory (WISLAB)

Co-Director, UTD-SMU WSTEC Antenna Measurement Laboratory

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Research Interests

- Optimizing Radio Link Protocols over Wireless Links
- Experimental Evaluation of Multiple Antenna Algorithms
- Multiple Antenna Testbed Development
- Multiple Antenna Channel Modeling
- Radio Resource Management in Multiple Antenna Systems
- Real-Time Signal Processing

"I always look for mutual collaboration. Collaboration is the key to addressing challenges in electrical engineering and information sciences research today."

Education

- Ph.D., Electrical and Computer Engineering, The University of Texas at Austin (1999)
- M.S., Electrical and Computer Engineering, The University of Texas at Austin (1995)
- B.S., Electrical and Electronics Engineering, Hacettepe University, Ankara, Turkey (1992)

Professional Highlights

Dr. Torlak is an Assistant Professor in the Department of Electrical Engineering and is the founder and Director of UTD's Wireless Information Systems Laboratory (WISLAB). Dr. Torlak's research specialty is the design of smart antenna systems for wireless communications. He has finished building a 2.4 GHz smart antenna testbed for propagation studies and algorithm validation. Dr. Torlak's expertise is in adaptive signal processing, array signal processing, real-time DSP algorithms, implementation for wireless communications systems, and wireless propagation. He is currently working on smart antennas for wireless sensor networks, multiple antenna channel modeling, end-to-end simulation emerging wireless (WiMAX, 4G) systems, and Persona Data Assistant (PDA)-based real-time signal processing for cochlear implants.

EXPERIMENTAL MULTIPLE ANTENNA RESEARCH

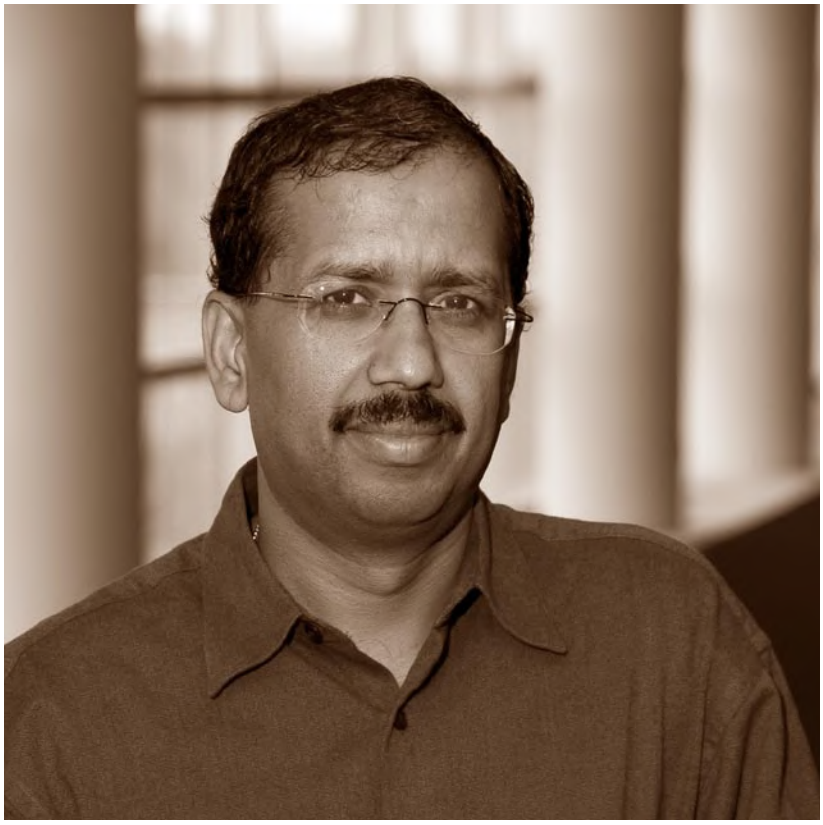
Dr. Torlak's group has developed a multiple antenna testbed to experimentally verify multiple antenna algorithms and to study multiple antenna channel propagation models. Emerging wireless technologies such as WiMAX, 3G, and 4G will support up to four antennas. Therefore, space-time coding methods have been an active research area in the search for the optimum combination of rate, diversity, and decoding simplicity. In this research, Dr. Torlak's group has studied performance of four antenna space-time block coding methods due to a moving terminal in typical indoor settings. His group has determined technical challenges for implementing space-time codes in indoor wireless channels at the 2.4 ISM (industrial, scientific, and medical) radio band.

OPPORTUNISM IN WIRELESS MULTIPLE ANTENNA COMMUNICATIONS

Dr. Torlak's research team has proposed novel beamforming methods for opportunistic multiple antenna systems. Beamforming at the transmitter can be used to introduce artificial temporal fading to ensure multi-user diversity in a wireless network. Because feedback is required, the effects of quantized signal-to noise (SNR) feedback on the system performance is under investigation. In this research, a method for setting quantization levels in a downlink multi-user system with opportunistic beamforming has been devised. Based on the feedback information, channel estimation methods have been proposed to improve transmit beamforming. Extensions to Orthogonal Frequency-Division Multiplexing (OFDM) systems have also been proposed.

PDA-BASED REAL-TIME SIGNAL PROCESSING

Dr. Torlak collaborates with Drs. Philip Loizou, Nasser Kehtarnavaz, Hoi Lee, and Anu Sharm to accelerate research in cochlear implants at all fronts including animal studies, clinical applications, and basic science. Hardware, such as Digital Signal Processing (DSP) chips, is continuously evolving and becoming progressively faster and smaller in size. Designing an implant research processor that is centered on a specific hardware platform would limit research flexibility and would constrain the capabilities of the research processor to the capabilities of the existing hardware. For that reason, the group opted for a research platform that is more software driven while being nearly hardware independent. Changing the software to accommodate new technologies is much easier than replacing the hardware. Looking beyond the scope of the three-year project on what the future holds for cochlear implants, this research group has proposed the use of PDAs as research processors for cochlear implants and will continue their development of PDA-based real-time signal processing functions for cochlear implants.



S. (Venky) Venkatesan

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Research Interests

- Wireless Networks (Sensor Networks, Cognitive Radio Networks and Cellular Networks)
- Mobile Ad hoc Networks (MANETs)
- Vehicular Ad hoc Networks (VANETs)
- Distributed Algorithms
- Telecommunication Networks
- Mobile Computing
- Fault Tolerance

Education

- Ph.D., Computer Science, University of Pittsburgh (1988)
- M.S., Computer Science, University of Pittsburgh (1985)
- M.Tech., Indian Institute of Technology, Madras (1983)
- B.Tech., Indian Institute of Technology, Madras (1981)

"UTD is a great place to work; its location has the atmosphere of small town and, at the same time, is surrounded by 750 high tech companies."

Professional Highlights

Dr. Venkatesan (Venky) is currently an Associate Professor in the Department of Computer Science. His research interests include wireless networks, such as Cognitive Radio (CR) networks, mobile ad hoc networks, and 3rd generation cellular networks, as well as sensors and sensor networks, fault tolerance, distributed algorithms, telecommunication networks, mobile computing and network security and forensics. Venky's research has been funded by Rockwell Collins, studying the simulation of large scale mobile ad hoc networks; ETRI, Korea, for 3G-WLAN handover studies; the Crane Company and Crystal Technologies for research concerning sensors and sensor networks; Sabre Holdings, Asier Technology Corporation (US Navy funded work on security in wireless networks), and Williams-Pyro for a study on standard based sensor networks funded by the National Institute of Standards and Technology (NIST). His other funding sources have included the National Science Foundation (NSF), the Texas Advanced Technology Program, Texas Instruments, Alcatel Network Systems, and Raytheon.

SENSOR NETWORKS

Venky is investigating the development of protocols for interoperability between sensors and monitoring stations. He is researching the development of Medium Access Control (MAC) and routing protocols for energy efficiency and network longevity in the ZigBee Alliance. Also, cross-layer optimization strategies are under development, as well as techniques for Quality of Service (QoS) differentiation at the MAC layer.

MOBILE AD HOC NETWORKS (MANETS)

Venky has developed algorithms for backbone creation and maintenance and resource allocation. Maintaining routes when topology changes dynamically is part of this development. Large scale simulation of mobile ad hoc networks using commercial simulation products for the network centric warfare is an on-going investigation.

FAST HANDOFF IN 3G-WLAN ENVIRONMENTS

Current research work in this area includes the development of techniques for fast handover in hybrid Universal Mobile Telecommunications System-Wireless LAN (UMTS-WLAN) networks where the user can move from one network to the other without noticing the switchover. This research is focusing on enabling users to use less expensive (or free) WLAN connections when possible.

SECURITY IN COLLABORATIVE WIRELESS NETWORKS

Venky has worked on authentication protocols for a collaborative environment in low bandwidth mobile wireless networks. Algorithms for fault-tolerant multicasting in mobile wireless networks are under development.

ADAPTIVE VIDEO TRANSMISSION OVER MANETS

The wireless links and the paths between a server and a client undergo constant changes in a Mobile Ad hoc NETwork (MANET), resulting in wide variation in the end-to-end effective bandwidth between the source and the destination. The goal of this research is to design, develop, and demonstrate adaptive algorithms for optimal delivery of MPEG video on MANETs by estimating the end-to-end bandwidth and constantly changing important parameters of MPEG coding.

DISTRIBUTED ALGORITHMS FOR COGNITIVE RADIO NETWORKS

One of the important problems in an ad hoc network of cognitive radios is the layer-2 auto configuration where the nodes find their neighbors and a common channel to communicate on. Next, using a common channel, finding a time slot assignment for the nodes so that each communication link is "covered" at least once is crucial for establishing communication among nodes. Variations of these problems can be solved using simple and efficient distributed algorithms. Venky is working with two Ph.D. students on these problems.

TOOLS FOR DIGITAL FORENSICS

This research involves the development of software tools for digital forensics. The work includes efficient methods for non-intrusive disk check-pointing strategies to collect digital evidence and running diagnostics on captured disks and recreating deleted files, even after they have been erased by writing over them many times. These tools have been developed and are currently available on request.

FAULT TOLERANCE AT THE NETWORK LEVEL

Venky has investigated methods to provide fault-tolerance in a unified way for an IP (Internet Protocol) based network. Currently, his team can make nodes fault-tolerant if they use TCP as the transport protocol. New methods are being developed to facilitate fast development of High Availability (HA) application programs.

T. R. Viswanathan

Professor (Research), Electrical Engineering

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Research Interests

- Circuits and Systems
- Analog and Digital Signal Processing Systems on Silicon
- Integrated Circuits for Biomedical Applications

Education

- Ph.D., Electrical Engineering, University of Saskatchewan, Canada (1964)
- M.S., Electrical Engineering, University of Saskatchewan, Canada (1961)
- B.S., Electrical Communications Engineering, Indian Institute of Science (1959)
- B.S., Physics, University of Madras, India (1956)

Professional Highlights

Dr. Viswanathan is currently a Research Professor at UTD. His research work is in the general area of circuits and systems and, in particular, it is about realizing analog and digital signal processing systems on silicon. The motivation behind his study is to reduce power (or energy), to improve performance and, most importantly, to reduce cost.

Dr. Viswanathan works closely with industry to identify the circuits and systems issues that require investigation. Graduate students perform much of the groundwork in terms of simulation studies at the school, while the actual fabrication of the integrated System-on-Chip (SoC) is accomplished by industry. The chip is tested at the school or at the collaborating industry partner depending upon the complexity of the test system required. Smaller projects are undertaken at the subsystem or building block level. Typical examples of this work are interface circuits like analog-to-digital or digital-to-analog converters, phase-lock-loops, and reference sources. At the system level, they are radio transmitters and receivers for wireless communications and biomedical instrumentation.

Dr. Viswanathan is a Fellow of IEEE, a recipient of the CAS Darlington Award, the Jack Kilby Award for the Outstanding Student Paper of the Year (2000), and the IEEE Third Millennium Medal.

Texas Instruments, Silicon Laboratories, Agere Systems, Intersil, and Conexant support Dr. Viswanathan's research at UTD.

Robert M. Wallace

Professor, Electrical Engineering & Physics

Professor, Materials Science and Engineering

Director, UTD's Cleanroom Research Laboratory

Director, UTD's Electronic Materials Laboratory

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Research Interests

- High-k Gate Dielectrics
- Metal Gate Electrodes
- Surface and Interface Reactions
- Impurity Diffusion
- Low Temperature Processing
- Processing on Flexible Substrates
- Materials Surface and Thin Film Characterization

Education

- Ph.D., Physics, University of Pittsburgh (1988)
- M.S., Physics, University of Pittsburgh (1984)
- B.S., Physics and Mathematics, University of Pittsburgh (1982)

Professional Highlights

Dr. Wallace is a Professor in the Departments of Electrical Engineering and Physics at UTD. After receiving his Ph.D. in Physics at the University of Pittsburgh in 1988, Dr. Wallace was a postdoctoral research associate in chemistry at the Pittsburgh Surface Science Center. In 1990, he joined Texas Instruments' Central Research Laboratories as a Member of the Technical Staff (MTS) in the Materials Characterization Branch of the Materials Science Laboratory, and was elected as a Senior MTS in 1996. In 1997, Dr. Wallace was appointed manager of the Advanced Technology branch, which focused on advanced device concepts and the associated material integration issues. In 1999, he joined the faculty at the University of North Texas as a Professor of Materials Science and director of the Laboratory for Electronic Materials and Devices. Dr. Wallace serves as the Director of UTD's Cleanroom Research Laboratory and the Electronic Materials Laboratory.

Dr. Wallace has more than 75 published works in peer-reviewed journals and 60 US and international patents. A review on high-k gate dielectrics—which he co-authored—was recently recognized by the Semiconductor Research Corporation as one of the most influential research publications in a field with more than 1100 citations. Dr. Wallace is a senior member of the IEEE, a member of the Applied Surface Science and the Electronic Materials and Processing Divisions in the American Vacuum Society (AVS), a member of the Electrochemical Society, and a member of the Materials Research Society. Dr. Wallace's research interests include materials and integration issues for advanced devices including gate dielectrics, gate electrodes as well as materials for display technologies.

CLEANROOM RESEARCH LABORATORY

UTD's Cleanroom Research Laboratory is a facility having filtered, vertical laminar flow air and is fully equipped with versatile semiconductor process research equipment assembled for the purpose of supporting university research in the fields of microelectronics, electronic materials, nanotechnology, microelectromechanical system (MEMS) technologies, lithography, optics, and other areas requiring a particle-free environment. The Cleanroom Research Laboratory, physically located at and managed by the Erik Jonsson School of Engineering & Computer Science, is a cross-disciplinary center. A university-wide advisory committee, composed of members from diverse fields, provides the Director of the facility with information on the needs and desires associated with faculty research. The laboratory offers an excellent location for various technical organizations and companies to carry out research activities. Facilities for device fabrication and characterization with a range of equipment, such as the e-beam lithography, plasma etch, deposition and clean, chemical vapor deposition, wet chemical processes, thermal processes, and surface analysis tools are in place. An external user agreement must be completed and approved for access.

ELECTRONIC MATERIALS FOR ULTRA-LARGE-SCALE INTEGRATION (ULSI)

Dr. Wallace's research in the Electronic Materials Laboratory examines prospective materials candidates that will enable the scaling of integrated circuits into the nano-electronic regime. Using *in-situ* deposition and characterization techniques, the materials and electrical properties of the heart of ULSI circuits, such as transistors, are studied from the nanometer level. The Semiconductor Research Corporation supports this research.

Yuke Wang

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Research Interests

- Java, XML, .Net, Web Technology
- Internet Appliances, Internet Applications
- 3G Wireless Communication
- Application-Specific Internet Circuit (ASIC) Design
- DSP Processors and Algorithms

Education

- Ph.D., Computer Science, University of Saskatchewan, Canada (1996)
- M.Sc., Mathematics, University of Saskatchewan, Canada (1992)
- B.Sc., Mathematics, University of Science and Technology of China, Hefei, China (1989)

Professional Highlights

Dr. Yuke Wang is an Associate Professor in the Department of Computer Science. He has held visiting Assistant Professor positions at Stanford University, the University of California, Berkeley, the University of Maryland at College Park, and the University of Minnesota. Dr. Wang has served as the editor for five international journals including *IEEE Transactions on VLSI, IEEE Transactions on Circuits and Systems-II*, the *Journal of Applied Signal Processing*, the *International Journal of Parallel and Distributed Systems & Networks*, and the *Journal of Circuits, Signals, and Systems*. Dr. Wang's research works focuses on the design and implementation of high-performance network, communications, and digital signal processing systems. He has a strong research interest in Web technology for various platforms.

WEB TECHNOLOGY

As the Web has become an increasing part of our daily lives, Dr. Wang's research interest in various aspects of Web technologies for different mobile devices has grown. He is interested in page design, programming Web applications efficiently, adapting the Web to different devices such as mobile devices, and security issues. He is particularly interested in exploring the application of Web technologies to many different real life applications.

EMBEDDED PROCESSORS (DSP PROCESSOR, NETWORK PROCESSOR, SECURITY PROCESSOR) BASED IMPLEMENTATION

Dr. Wang's team has accomplished extensive research work on the design and optimization of Digital Signal Processor (DSP) based implementation, including fast Fourier transform (FFT), the Viterbi decoder, and the Turbo decoder that are used as essential components in Wireless LAN, 3G wireless systems, digital television, and digital radio systems. They have improved the RSA public key cryptography algorithm functions, which can be applied to secure all kinds of communication networks. Dr. Wang's team has also performed research work in network processor and security processor-based implementations.

WIRELESS QUALITY OF SERVICE (QoS) AND NETWORK QUALITY OF SERVICE

Dr. Wang is performing research into the development of effective QoS schemes for various network topologies and multimedia traffics, which have scalability properties and can guarantee reliable QoS. His team is examining the applicability of QoS mechanisms for both intra-domain and inter-domain network states.

W. Eric Wong

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Research Interests

- Reducing the Cost of Software Production while Improving Software Dependability, Reliability, and Quality
- Software Testing, Reliability, Metrics, and Quality of Service (QoS) at the Application and Architecture/Design Level
- Applying Research Results to Real Life, Large, Complicated Software Systems
- Technology Transfer to Industry

Education

- Ph.D., Computer Science, Purdue University, Indiana (1993)
- M.S., Computer Science, Purdue University, Indiana (1991)
- B.S., Computer Science, Eastern Michigan University (1988)

"A good teaching style should have at least the following four elements: encouraging active participation, fostering teamwork as well as independent thinking, guiding students to the solution rather than giving the solution, and emphasizing creativity to help students apply the knowledge acquired in class to real-life problems. Achieving these goals requires mutual understanding and full collaboration between the teacher and the student. I believe it is crucial to establish a set of fundamental rules respected by the teacher and the student: professionalism, a willingness to learn, courteousness, and punctuality."

Professional Highlights

Dr. Wong is an Associate Professor in the Department of Computer Science. Prior to joining UTD, he was with Telcordia Technologies (formerly Bellcore) as a Senior Research Scientist and also as the Project Manager in charge of the Initiative for Dependable Telecom Software Development. Dr. Wong was a recipient of the Quality Assurance Special Achievement Award from the Johnson Space Center in 1997 and he received a certificate from the Georgia Tech Mid-Management Certified Program in 2001. Dr. Wong's research focus is on the development of technology to help practitioners produce high quality software at a low cost. He has deep experience in applying his research results to real-life industry projects. Since 2002, Dr. Wong—as PI or as Co-PI—has received more than $1 million dollars in external research funding from such organizations as NASA, the Avaya Research Labs (formerly part of Lucent Bell Labs), and Texas Instruments. Dr. Wong has served as Program Chair and Program Committee Member for many international conferences on software engineering. He has also served as Guest Editor of the *Journal of Systems and Software (JSS)*, *Software Practice and Experience (SPE)*, the *International Journal of Software Engineering and Knowledge Engineering (IJSEKE)*, and the *Journal of Software Testing, Verification & Reliability (STVR)*.

A TESTING FRAMEWORK FOR REPRODUCIBLE EXECUTION AND RACE CONDITION DETECTION IN REAL-TIME EMBEDDED SYSTEMS

In many NASA exploration missions, embedded software systems perform the controlling functions of physical devices subject to real-time constraints. These systems often consist of concurrent threads and exhibit non-deterministic behavior, which makes verification of temporal behavior a great challenge. In this project, Dr. Wong and his students have developed a testing framework for system-level testing in a temporal domain while addressing two major issues: reproducible execution and race condition detection. This framework enables points-of-control and observation during testing execution. With automated test sequence generation and result evaluation, variant scenarios derived from prefixed test sequences will be used to exercise different execution paths such that the software quality for critical applications can be ensured. The Office of Safety and Mission Assurance (OSMA) at NASA has provided funding for this research.

A COMPREHENSIVE FRAMEWORK FOR TESTING AND ANALYZING SOFTWARE APPLICATIONS

This framework provides an integrated solution of analysis, testing, debugging, and maintenance of Java, C, and C++ applications to improve the software development process and produce more reliable software. It supports applications running on Unix/Linux, Windows, and on embedded systems such as Symbian/OMAP and vxWorks. Avaya Research Labs and Texas Instruments fund this research.

AN INTEGRATED SOLUTION FOR EFFECTIVE TEST GENERATION BASED ON FUNCTIONAL SPECIFICATIONS AND SAFETY REQUIREMENTS

Software safety is critical to many systems. However, the verification of consistency between implementation and functional specifications does not provide complete safety assurance. The uniqueness of Dr. Wong's research approach includes the ability to integrate failure conditions from a safety analysis into functional specifications—which makes it possible to enhance specification-based test generation for safety verification—and the minimal cut set coverage criterion by which the test generator will produce at least one test sequence for each minimal cut set. The generated tests can exercise all failure paths to determine whether or not failures are absent from the target implementation. These results will significantly improve safety assurance.

Weili (Lily) Wu

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Research Interests

- Data Management and Data Communication
- Data Mining
- Distributed Database Systems

Education

- Ph.D., Computer Science and Engineering, University of Minnesota (2002)
- M.S., Computer Science and Engineering, University of Minnesota (1997)
- B.S., Mechanical Engineering, Liaoning Technical University, China (1989)

Professional Highlights

Dr. Wu is an Assistant Professor in the Department of Computer Science. Her major research interests are data management and data communication, especially regarding spatial databases with applications in geographic information systems and bioinformatics, distributed databases in Internet systems, and wireless database systems with connection to wireless communication devices. Advances in technology, such as high performance networks and parallel architectures, as well as the increasing demand for new applications—like data mining and multimedia—have triggered her research in distributed database systems. Dr. Wu is pursuing the issues that are centered around such distributed database system issues as computing performance, data mining, data warehousing, and optimal I/O and minimized communication costs.

SPATIAL DATA MINING

Dr. Wu's current work on spatial data mining has focused on predicting location problems. Her team has developed Predicting Locations Using Map Similarity (PLUMS), a new framework for supervised spatial data mining problems. PLUMS searches the space of solutions using a map-similarity measure, which is more appropriate in the context of spatial data. It has been shown that compared to state-of-the-art spatial statistics approaches such as the Spatial Autoregression Model (SAR) model, PLUMS achieves comparable accuracy at a fraction of the computational cost. Furthermore, PLUMS provides a general framework for specializing other data mining techniques for mining spatial data. Dr. Wu's team has exploited different classification approaches for modeling spatial context, such as spatial autocorrelation, in the framework of spatial data mining and compared and contrasted Markov Random Fields (MRFs) and SARs using a common probabilistic framework. The team has observed an interesting relationship between classical models that do not consider spatial dependence and modern approaches that explicitly model spatial context. Theoretical results using a probabilistic framework as well as experimental results validating the comparison between SAR and MRF have both been demonstrated.

DATA REPLICATION

Dr. Wu's research work concentrates on the optimization problem of data replicas. Data replication is an important research topic in those distributed database systems that are built in a computer network with a certain topological structure. Dr. Wu's team has presented a sufficient and necessary condition for the optimality of a placement of an odd number of data replicas in a ring network with a majority voting protocol. As a corollary, her team has developed a theoretical proof of a recent conjecture that uniformly distributing placement is optimal. The team has presented a simple and efficient algorithm to find optimal placements in a tree network with a majority voting protocol.

BIOLOGICAL DATA MANAGEMENT

Dr. Wu's research work with biological applications focuses on the group testing problem. Her team developed efficient algorithms focusing on constructions of pooling design with a simplicial complex, decoding problems for error-correcting pooling design, and defining error-tolerant properties of DNA screening. This research has generated several new algorithms, some of which improve on the performance and accuracy of previous algorithms.

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Research Interests

- Distributed and Parallel Systems
- Fault-Tolerant, Secure, Survivable, and Adaptive Systems
- Web Services and Web Technologies
- Quality Assessment and Composition in Component-based Systems
- Applying AI Techniques in Software Development

Education

- Ph.D., Computer Science, University of Houston, TX (1992)
- M.S., Computer Science, University of Houston, TX (1986)
- B.S., Physics, Tsinghua University, Taiwan (1979)

"Building innovative techniques and tools for developing adaptive, efficient, reliable, available, secure, safe, and accurate systems requires the same from the builders – the qualities of fearless engineers."

Professional Highlights

Dr. Yen is an Associate Professor in the Department of Computer Science. Her research interests include parallel and distributed systems, fault-tolerant computing, secure and survivable systems, self-stabilizing algorithms, grid and peer-to-peer computing, embedded system development techniques and tools, component-based design of distributed adaptive systems, and multimedia systems. She had published more than 120 technical papers in these research areas and received many research awards from the National Science Foundation (NSF), the Department of Defense (DoD), NASA, and several industry companies.

COMPONENT-BASED QoS-DRIVEN SYNTHESIS OF EMBEDDED SOFTWARE

Funded by NASA, this project develops techniques and tools to meet the challenges in achieving adaptive Integrated System Health Management (ISHM) systems. Embedded systems are becoming highly complex and increasingly being used in critical applications and ISHM techniques have been developed to ensure the proper operation of these systems. However, some ISHM systems are relatively complex and may consume a significant amount of resources. In some situations, activating a full-scale ISHM system may cause resource contention and prevents the target system from timely completion of critical tasks. It is therefore imperative to introduce the notion of adaptivity into ISHM systems. In this project, issues such as effective ISHM system analysis and decision-making, system reconfiguration, and dynamic composition of ISHM system components are addressed.

I-Ling Yen continued

ISSUES AND SOLUTIONS FOR DATA INTEGRITY ASSURANCE

This DoD project seeks to develop techniques and tools to manage data provenance and assure both data quality and integrity. Meta-data for data provenance management, quality specification, and integrity coding are currently being defined. Techniques and tools for data quality inference and efficient integrity coding for structured data are also being developed.

RAPID SYNTHESIS OF ADAPTIVE REAL-TIME SYSTEMS

In this NSF project, Dr. Yen is investigating component-based techniques for developing embedded software systems to significantly reduce development time and cost. Her research direction includes ontology-based repository, code pattern-based component composition, composition analysis, and composition optimization. Dr. Yen's team has developed advanced component storage and retrieval methods and tools, efficient composition analysis techniques to select the most suitable components with optimal configurations to meet Quality of Service (QoS) objectives.

GRAPHICAL AND MULTI-MODAL PROXY SYSTEM

Funded by Alcatel, this research focuses on the development of intelligent, user-centric Session Initiation Protocol (SIP) middleware. Dr. Yen's research includes the investigation of intelligent servers and advanced middleware to support scalable and dependable multi-media services, design architectures, interfaces, and middleware support for sophisticated multi-user multi-media collaborative systems, and defining standards for SIP middleware and architecture.

Kang Zhang

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Research Interests

- Visual Languages
- Software Engineering
- Visual Design
- Data Mining

Education

- Ph.D., Computer Science, University of Brighton, UK (1990)
- B.Eng., Computer Engineering, University of Electronic Science and Technology, Chengdu, China (1982)

"My artistic sense and skilled techniques in visual arts will motivate me for innovative computer visualization in the years to come."

Professional Highlights

Dr. Zhang is a Professor in the Department of Computer Science and is Director of UTD's Visual Computing Lab. He is an affiliated faculty member of the Geographic Information Systems (GIS) program and Computer Engineering program. Dr. Zhang was a computer-aided design (CAD) software engineer at the East-China Research Institute of Computer Technology, Shanghai in the early 1980s, and then held academic positions in the UK and in Australia from 1986 to 1999. His current research interests are in visual languages, software engineering, visual design, and data mining. He is a Senior Member of the IEEE and was General Chair of the 2005 IEEE Symposium on Visual Languages and Human-Centric Computing, and is the Program Chair of the 18th International Conference on Software Engineering and Knowledge Engineering, 2006.

SPATIAL GRAPH GRAMMARS AND THEIR APPLICATIONS

The Reserved Graph Grammar (RGG) is a general graph grammar formalism that expresses a wide range of visual languages. This project investigates an extension to RGG with the capability of spatial specification, called SGG. Graph transformation satisfying the spatial specification will be performed in the process of parsing. The RGG with spatial specification can be applied to various of applications, such as mathematical expression recognition, Web transformation, multimedia authoring and presentation, and software engineering.

GRAPH TRANSFORMATION FOR MODEL-DRIVEN ARCHITECTURES

Unified Modeling Language (UML) has been a standard modeling language; however, it remains semi-formal without precise semantics. Based on the event-driven spatial graph grammar and transformation formalisms, Dr. Zhang's team has been working on the behavioral semantics of UML objects and state diagrams with composite states. The process of dynamic reconfiguration in object diagrams is realized through a sequence of graph transformations. Instead of manually defining a graph grammar to specify the state hierarchy, the team automatically derives the graph grammar from a state machine, and thereby eases the effort in specifying the behavioral semantics. Through automatically-derived graph grammar, the parsing and generation processes interpret the state transition. The automation mechanism for generating graph grammars and their validation and recognition capability populates the automated design of model-driven architectures. Integrating the behavioral semantics of state diagrams with dynamic reconfiguration using graph transformations enables a direct execution of a system model. According to the specified semantics, the visual language generation methodology can automatically generate various virtual modeling machines, which can interpret different UML models through graph transformations. Such a language generation capability naturally supports meta modeling, apart from allowing UML models to continuously evolve and encouraging the reuse of existing models.

VISUALLY SPECIFYING AND TRANSFORMING WEB INTERCHANGING DOCUMENTS

Funded by the National Science Foundation (NSF) Information Technology Research (ITR) Grant, this project takes advantage of the conciseness and expressiveness of the graph grammar formalism in specifying Extensible Markup Language (XML) structures and transformations from one structure to another. The graph grammar formalism with spatial extension can be used to transform desktop Web presentations to suit small screen mobile devices such as Personal Digital Assistants (PDAs). The work is underway for applying SGG to the transformation of Web page structures and Web graphics to suit PDA devices. Dr. Zhang's team has performed the translation of XML pages to Wireless Markup Language (WML) cards through three steps: (1) transforming the original XML file into a host graph automatically or using a Web graph constructed using a graph editor; (2) using the SGG to transform the layout of host graph into a presentation suitable for multiple small pages; and (3) generating the equivalent WML document. Dr. Zhang's team has proposed a unified framework to manage model-based information on the Web in a hierarchical structure. The framework allows models, schemas, and data instances to be represented explicitly and uniformly and implements a set of prototype tools for users to identify meta-primitives at the meta-model level, to define a model or schema by specifying a set of graph grammar rules and to draw the structure of data instances. These features promote a wide scope of Web-related applications, such as information exchange between different organizations, and integration of data coming from heterogeneous information sources.

DISCOVERY OF DENSE CLUSTERS IN NOISY SPATIAL DATA

Dr. Zhang's team is researching a spatial clustering tool, called FAÇADE (the Fast and Automatic Clustering Approach to Data Engineering). This tool can discover clusters of different sizes, shapes, and densities in noisy spatial data. Compared with the existing clustering methods, FAÇADE has several advantages: it separates true data and noise more effectively; most steps of FAÇADE are automatic; and it requires only $O(n \log n)$ time. 2D and 3D visualizations are used in FAÇADE to assist parameter selection and result evaluation. Further information on FAÇADE is available at http://viscomp.utdallas.edu/FACADE.

Youtao Zhang

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Research Interests

- Secure System Design
- Program Analysis and Profiling
- Compiler Optimization
- Computer Architecture

Education

- Ph.D., Computer Science, University of Arizona (2002)
- M.Eng., Computer Science, Nanjing University, China (1996)
- B.S., Computer Science, Nanjing University, China (1993)

Professional Highlights

Dr. Zhang is currently an Assistant Professor in the Department of Computer Science. Prior to joining UTD, he was on the faculty of the University of Pittsburgh and was a research assistant at the University of Arizona. Dr. Zhang's research interests include program analysis, profiling and code optimization, computer architecture, embedded systems, and compiler optimization. He received the National Science Foundation (NSF) CAREER Award in 2005, the Most Distinguished Paper Award at the IEEE/ACM International Conference on Software Engineering in 2003, and the Most Original Paper Award at the International Conference on Parallel Processing in October 2003. Dr. Zhang is a PC Member and Web Chair of the ACM/IEEE International Symposium on Code Generation and Optimization in 2005, a PC Member of the International Association of Science and Technology for Development (IASTED) International Conference on Parallel and Distributed Computing and Networks (PDCN) in 2005 and 2006. He is a member of both the ACM and the IEEE.

PROGRAM PROFILING AND OPTIMIZATION

Advances in program profiling techniques have led to advances in compiler optimization techniques, and vice versa. Dr. Zhang's dissertation research made contributions in the areas of program profiling as well as profile guided optimizations. He designed and evaluated a new compressed representation for profile data such that profile guided optimizations can benefit from it. A type-based value profiling technique was also developed such that new data compression techniques can be designed to exploit value redundancy present in program data.

CACHE AND MEMORY DESIGNS

Dr. Zhang's research on cache designs focused on exploiting dynamic value locality for improving performance and reducing power consumption using two approaches: exploiting dynamic frequent values, and employing effective data compression techniques. A spectrum of different programs have been studied and a dynamic frequent value locality has been discovered. This phenomenon can be widely used for different cache designs. Further research served to improve program performance, study the bit representation of dynamic values and frequently appeared pointers and small values that can be effectively compressed at runtime, and common-prefix and narrow-data compression techniques have been designed. Dr. Zhang's recent work has proposed a new procedure level offset assignment algorithm compared to previously proposed techniques, reduces both static and dynamic addressing instruction counts.

DYNAMIC SLICING

At runtime, dynamic slicing generates a subset of executed statements that contribute to the values of interested variables. This is an effective tool for program analysis, program understanding and debugging. High resource demands however, especially the demand for large main memory storage, have become the major obstacle for its practical application. Dr. Zhang's research in dynamic slicing focuses on the design and implementation of practical dynamic slicing algorithms. His team has made contributions on both backward and forward slicing algorithms and have designed and studied three precise backward dynamic slicing algorithms – full preprocessing (FP), no preprocessing (NP), and limited preprocessing (LP). The algorithms differ in the relative timing of constructing the dynamic data dependence graph and its traversal for computing requested dynamic slices. Dr. Zhang's experiments have shown that the LP algorithm is a fast and practical precise slicing algorithm. His team has also analyzed the characteristics of dynamic slices and identified properties that enable space efficient representation of a set of dynamic slices. It has been demonstrated that by using reduced ordered binary decision diagrams (roBDDs) to represent a set of dynamic slices, the space and time requirements of maintaining dynamic slices are greatly reduced. Dr. Zhang's team has shown that that the performance of the roBDD-based forward algorithms compares favorably with the performance of the best backward algorithm.

Si-Qing Zheng

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Research Interests

- Algorithm Design and Analysis
- Combinatorial Optimization
- Parallel and Distributed Processing
- Interconnection and Switching Networks, and Network Switches and Routers
- High-Performance Computer and Network Architectures
- Optical Networks
- Hardware/Software Co-Design in Real-Time and Embedded Systems
- Circuits and Systems

Education

- Ph.D., Electrical and Computer Engineering, University of California, Santa Barbara (1987)
- M.S., Mathematical Sciences (Major: Computer Science), The University of Texas at Dallas (1982)
- B.S., Electrical Engineering, Jilin University, China (1973)

"There is no dispute that the boundaries between different science and engineering fields have become more and more blurred. Many interdisciplinary fields have gained recognition and new interdisciplinary fields will continue to emerge. In order to face future challenges, engineers should be equipped with knowledge in related areas. A fearless engineer must clearly realize this and not be afraid of learning required knowledge in different but related fields."

Professional Highlights

Dr. Zheng's research has an interdisciplinary flavor, encompassing numerous areas in computer science, computer engineering and telecommunications engineering. He has been investigating various aspects of computing and communications including algorithms (sequential, parallel, and distributed), protocols, hardware, software, system architectures, reliability, performance evaluation, resources optimization, implementation feasibility, and applications. Dr. Zheng's goal is to make important contributions to both fundamental research, and design and implementation in the field of high-performance computing and communications. Dr. Zheng has published more than 200 technical papers and has served as chairman of numerous international conferences and editor of several professional journals. He has participated in computer system, control system, and communication system design projects. Dr. Zheng was a consultant for several hi-tech companies and holds numerous patents.

FUTURE INTERNET ARCHITECTURE

The Internet faces many challenges and there are currently two paths to be taken in addressing these challenges. The first is the incremental adaptation by introducing point-solutions of narrow scope to address new vulnerabilities and opportunities as they occur. The second is to create a new Internet architecture that addresses the new challenges on the horizon. Dr. Zheng's group believes that it is necessary to address the challenges faced by the Internet by designing a new Internet architecture. Dr. Zheng has proposed a new reconfigurable dense wavelength-division multiplexing (DWDM) optical network architecture to migrate—to evolve—the current Internet to one that is more scalable, robust, secure and efficient. His team is investigating many aspects of this type of network architecture.

SWITCH AND ROUTER ARCHITECTURES

Switches and/or routers determine the performance of a network. Dr. Zheng is investigating the structures, functionalities, cost/performance trade-offs of large-scale non-blocking electrical and photonic switching fabrics and router architectures.

ALGORITHM-STRUCTURED HARDWARE DESIGN

In real-time and embedded systems, time-critical tasks must be carried out by specially designed hardware components based on feasible hardware-algorithms, rather than the central processing unit (CPU). Dr. Zheng is conducting hardware and algorithm co-design for application-specific functional units in high-performance real-time and embedded computing and communication systems.

OPTIMIZATIONS

Dr. Zheng has been conducting fundamental, theoretical investigations on the optimality of solutions to various abstract problems arising from efficient computing and communications. Optimality has been measured by consideration of resources used and, depending on the problem definitions, the problems have been given well-defined constraints, leading to difficulty. Dr. Zheng's research in this aspect is focused on finding lower bounds and upper bounds. When finding optimal solutions is not feasible in practice, he attempts to find near optimal solutions using approximation or heuristics.

Dian Zhou

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Research Interests

- Mixed-Signal Very Large-Scale Integration (VLSI) Circuits
- High Performance VLSI Physical Design
- Application-Specific Integrated Circuits (ASICs) and Systems-on-Chip (SoCs)
- VLSI Computer-Aided Design (CAD)
- Analog Circuit Modeling and Simulation

Education

- Ph.D., Electrical and Computer Engineering, University of Illinois (1990)
- M.S., Electrical Engineering, Fudan University, China (1985)
- B.S., Physics, Fudan University, China (1982)

Professional Highlights

Dr. Dian Zhou is a Professor in the Department of Electrical Engineering where he teaches courses concerning special topics in digital systems, the physical design of high speed VLSI, ASIC design, and algorithms for VLSI design automation. After receiving his Ph.D. in Electrical and Computer Engineering from the University of Illinois, Dr. Zhou joined the University of North Carolina at Charlotte as an Assistant Professor, where he then became an Associate Professor in 1995. His research interests include high-speed VLSI systems, CAD tools, mixed-signal integrated circuits (ICs), and algorithms.

Dr. Zhou received the Research Initiation Award from the National Science Foundation (NSF) in 1991, the IEEE Circuits and Systems and Society Darlington Award in 1993, and the NSF Young Investigator Award in 1994. He also served as a panel member of the NSF CAREER Award in 1996. Dr. Zhou was a Guest Editor for the *International Journal of Custom-Chip Design, Simulation and Testing*, and was an Associate Editor for the *IEEE Transactions On Circuits and Systems*. He received the Chinese NSF Overseas Outstanding Young Scientist Award in 2000 and was a Chinese Yangzi River Scholar in 2003.

Dr. Zhou's recent publications include:

- **A Fast Wavelet Collocation Method for High-Speed Circuit Simulation**, with W. Cai, in *IEEE Transactions on Circuits and Systems I: Fundamental Theory and Applications*, Volume 46, Number 8, 1999
- **An Adaptive Wavelet Method for Nonlinear Circuit Simulation**, with W. Zhang, in *IEEE Transactions on Circuits and Systems I: Fundamental Theory and Applications*, Volume 46, Number 8, 1999