

NORTHWESTERN UNIVERSITY
McCORMICK SCHOOL OF ENGINEERING

ECE NEWS



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Chairman's Message

Welcome to the Electrical and Computer Engineering Department of Northwestern University. The 2003-04 academic year was eventful. We recruited three new faculty members; several of our faculty won major awards; our faculty and students continued to perform outstanding research which resulted in numerous publications and research grants; we continued to support undergraduate research funded by grants from Motorola; and we hosted three speakers in the Motorola Distinguished Lecture Series. In the remainder of this message, I will elaborate on these accomplishments.

Faculty

During 2003-04, our 31 faculty members (17 full professors, seven associate professors, and seven assistant professors) included six chaired professors, four named professors of teaching excellence, nine faculty who have received NSF PYI / NYI / CAREER awards, eight IEEE Fellows, four Fellows of OSA, two APS Fellows, one ACM Fellow, one Fellow of AAAS, one Booth awardee, and one Terman awardee. Two of our emeritus faculty are members of the National Academy of Engineering.

We made significant progress toward our goal of recruiting and tenuring excellent faculty members. Two new faculty members joined our department as assistant professors in Sept. 2003: **Gokhan Memik** (Ph.D., UCLA, 2003) works in the computer architecture area; and **Seda Ogresci Memik** (Ph.D., UCLA, 2003) works in the area of CAD and system design.



Prith Banerjee

I am also delighted to inform everyone that Associate Professors **Selim Shahriar** and **Thrasos Pappas** have been granted tenure in our Department effective Sept. 1, 2004. We provide highlights of their research elsewhere in this issue.

During 2003-04, we recruited for faculty in computer architecture, networks / communications, and solid state. I am pleased to report that, after considering more than 360 applicants, we will be joined by three new faculty in Sept. 2004:

Dr. Russ Joseph (Ph.D., Princeton, 2004) will join us as an assistant professor in computer architecture; **Dr. Dongning Guo** (Ph.D., Princeton, 2004) will join us as an assistant professor in wireless communications; and **Dr. Hooman Mohseni** (Ph.D., Northwestern, 2001) will join us as an assistant professor in the solid-state area after three years with the Sarnoff Corporation.

Faculty Awards

Two of our assistant professors, **Robert Dick** and **Ying Wu**, received the NSF CAREER award for 2004, one of the most prestigious honors for junior faculty in the U.S. As part of this award, each will receive funding of \$400,000 over five years which can be used to support graduate students and other research expenses.

These awards bring the total number of recipients of the NSF CAREER (or its predecessors, the NSF Young Investigator and the NSF Presidential Young Investigator) awards in our Department to nine out of 31 faculty members. Other recipients of the NSF CAREER, PYI, and NYI awards include **Prith Banerjee**, **Randy Berry**, **Alok Choudhary**, **Randy Freeman**, **Seng-Tiong Ho**, **Yehea Ismail**, and **Hai Zhou**.

Professor **Peter Scheuermann** was elevated to the Fellow membership grade of IEEE "for contributions to logical and physical database design." This brings the total number of IEEE Fellows in our department to eight. Our other IEEE Fellows include **Prith Banerjee**, **Abe Haddad**, **Michael Honig**, **Aggelos Katsaggelos**, **Prem Kumar**, **Martin Plonus**, and **Allen Taflove**.

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Prof. **Manijeh Razeghi** was elected a Fellow of the Optical Society of America (OSA) for "pioneering work on opto-electronic quantum devices." This brings the number of OSA Fellows in our Department to four; the other three are **Seng-Tiong Ho**, **Prem Kumar**, and **Bruce Wessels**.

Prof. **Bruce Wessels** was elected a Fellow of the American Physical Society (APS) for "seminal contributions to understanding of defect structure and dopant behavior in epitaxial semiconductor and ferroelectric oxide thin films and heterostructures." **Prem Kumar** is our other APS Fellow.

In yet another major external recognition, Prof. **Prem Kumar** received the International Quantum Communication Award for 2004.

In the category of internal recognitions, Prof. **Larry Henschen** was appointed a 2004 Charles Deering McCormick Professor of Teaching Excellence of Northwestern University for a three-year term. Asst. Prof. **Robert Dick** received the Best Teacher Award from our ECE Department. Finally, Prof. **Allen Taflove** was named to Northwestern's Best Teachers list by the Associated Student Government.

Research Activity

During 2003-04, the ECE Department's research funding exceeded \$8 million. Our 31 faculty members continued to participate in a significant number of collaborative research proposals and projects.

Our faculty also continued to publish a large number of papers in prestigious journals and proceedings. During 2002-03, our faculty wrote 2 books, 10 book chapters, 87 journal papers, and 131 conference papers. In addition, our faculty edited two conference proceedings, were granted 10 U.S. patents, and gave 112 invited talks.

Furthermore, our faculty continued to transfer the results of their research to established companies such as Motorola and Intel, and to startup companies such as SixtySeven Kilohertz, Zienna, and NUCrypt.

On Oct. 24, 2003, our Department held the first ECE EXPO Day to share our research activities with other McCormick departments, Northwestern offices such as the Technology Transfer Program, and companies. After faculty briefings on their current research, graduate students conducted a poster session to provide the details. Overall, ECE EXPO Day was well attended and generated a great deal of interest in our Department's research.

Students

During 2003-04, the ECE Department was home to 217 undergraduates, of whom 129 were EE majors and 88 were CompE majors. Our Department thus operated with a student-to-faculty ratio of 7:1. We graduated 37 students with B.S. degrees in EE and 23 students with B.S. degrees in CompE. Our student academic quality continues to be excellent.

During 2003-04, we were also home to 120 graduate students of whom 100 were in the Ph.D. or M.S./Ph.D. programs and 20 students pursued the M.S. only. We granted 22 Ph.D. degrees and 13 M.S. degrees over the course of the year.

One of the most exciting developments again this year was the number of undergraduates engaged in research. Again, generous support from Motorola allowed us to offer stipends to 10 undergraduates. On June 4, 2004, Motorola hosted a poster session at its Schaumburg headquarters during which our Motorola-supported undergraduate and graduate students presented the results of their research efforts.

Student Placement

Our B.S. graduates accepted offers at a wide variety of companies including Accenture (2), BAE Systems, Bain and Co., Bank of America, Boeing, Boston Consulting, Braun Consulting, Computer Sciences Corp., Deloitte Consulting (2), Diamond Cluster Intl., Elexos, Ford, GCIB, Honda R&D, Jones Lang Lasalle, LEK Consulting (2), Louis Dreyfus, NASA, Northrop-Grumman (5), NU Medical School, Rush Hospital, and U.S. Space and Naval Warfare Systems (2).

Our Ph.D. graduates accepted positions at companies including Exelon, Magma, Marvel, Micron, Motorola, and

Unilever. Four are joining academia at University of Wisconsin-Madison, University of Nevada-Reno, University of Illinois-Chicago, and Ataturk University.

Distinguished Lectures

On Sept. 30, 2003, Dr. **Leslie Lamport** of Microsoft Research presented the year's first Motorola Distinguished Lecture titled "High-Level Specifications: Lessons from Industry." Prof. **Robert Brayton** of Berkeley presented the second Motorola Distinguished Lecture on May 17, 2004 titled "Sequential Synthesis." The last in the series was given on May 26, 2004 by Dr. **Federico Capasso** of Harvard titled "Where Micromechanics and Quantum Electrodynamics Meet: MEMS Based on Casimir Forces."

Industrial Interactions

During 2003-04, Motorola continued to support our Department through the Motorola Center for Communications Research, funded at \$600,000 per year. In addition, the Motorola Foundation provided us with \$100,000 to support undergraduate research, the Distinguished Lecture Series, and graduate recruiting.

Our ECE Advisory Board, composed of representatives from business and academia, met on May 14, 2004. The Board listened to presentations by our new faculty, met with Dean Birge and undergraduate and graduate students, and attended a graduate student poster session. The Department received the Board's feedback at day's end, and then faculty and guests joined the Board for dinner. We very much appreciate the Advisory Board's observations and guidance.

Farewell

This is my last Chairman's Message for the ECE News. I have accepted the position of Dean of the College of Engineering at the University of Illinois-Chicago, beginning Aug. 16, 2004. It has been a pleasure working at Northwestern for the past eight years. I am looking forward to my new challenges at UIC.

Best Regards,

Prith Banerjee

Walter P. Murphy Professor

Prof. Peter Scheuermann Elected IEEE Fellow



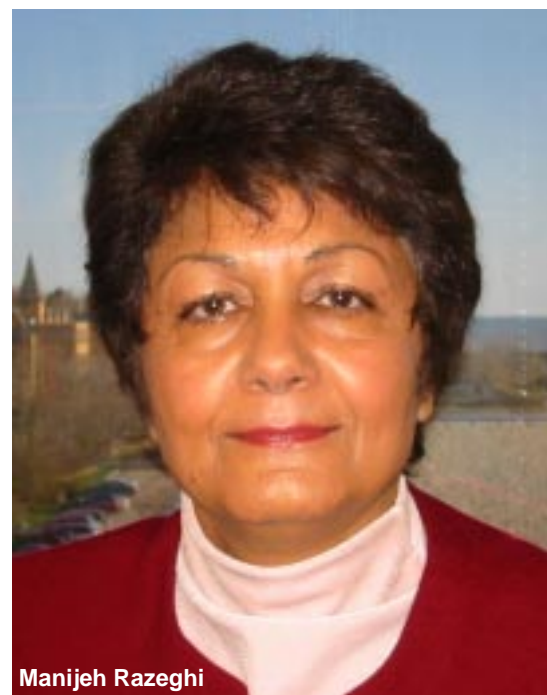
In recognition of his world leadership in the field of logical and physical database design, **Prof. Peter Scheuermann** has been elected an IEEE Fellow. His research covers the entire spectrum of physical database design including indexing, spatial storage structures, parallel I/O systems, and performance evaluation. In particular, he is one of the pioneers of the entity-relationship model used for conceptual database design. He has been credited with the development of several widely accepted multidimensional dynamic storage structures. His work on load balancing in disk arrays has had a major impact in the field and also has applicability to Web caching and replication.

Peter received his Ph.D. from the State University of New York at Stony Brook. During 1997-98, he was NSF Program Director for Computer Software Systems. He has been a visiting professor with the Free University of Amsterdam, Swiss Federal Institute of Technology, Technical University of Berlin, and INRIA, Paris. He was a member of the advisory board of ACM-SIGMOD, and the first chair of the ACM-SIGMOD Awards Committee. Recently, with collaborators from the University of Illinois-Chicago and Brown University, he was awarded a \$2-million NSF ITR grant for "Context-Aware Computing with Applications to Public Health Management." This explores the design of a system that automatically pushes relevant information about places or events of interest to mobile users as soon as it becomes available.

Prof. Manijeh Razeghi Elected Fellow of Optical Society of America

Prof. Manijeh Razeghi is a Walter P. Murphy Professor of Electrical and Computer Engineering and Director of the Center for Quantum Devices. A member of the Northwestern faculty since 1991, Dr. Razeghi is internationally recognized for her research in the field of compound semiconductor science and nanotechnology. She has been a pioneer in the development and implementation of major modern epitaxial techniques such as MOCVD, VPE, MBE, GasMBE, and MOMBE for the growth of entire compositional range of III-V compound semiconductors, heterostructures, quantum wells, superlattices, and other nanostructures for quantum electronic and photonic devices (with operating wavelengths from 200 nm to beyond 30 μm). She has authored or co-authored 9 books, 17 book chapters, and more than 1,000 papers. She holds 53 patents and has presented more than 500 invited and plenary talks. She is a Fellow of the Society of Photo-Optical Instrumentation Engineers (SPIE) and the Optical Society of America (OSA). Her OSA Fellow citation reads: "For pioneering work on optoelectronic quantum devices."

Prof. Razeghi received the Ph.D. and ES-Science Doctorate from the University of Paris, France. Prior to joining Northwestern, she was Head of the Exploratory Materials Lab of Thomson-CSF, Orsay, France.



Prof. Bruce Wessels Elected Fellow of American Physical Society



Prof. Bruce W. Wessels is a Walter P. Murphy Professor of Materials Science and Engineering and Electrical and Computer Engineering at Northwestern University. A member of the Northwestern faculty since 1977, Wessels is internationally recognized for his research on electronic and photonic materials. He has authored or co-authored 255 articles and five books, and has been awarded 13 U.S. patents. He has served as president of the professional engineering society for materials, TMS (The Minerals, Materials and Metals Society), and currently serves on the editorial board and as section editor of the *Journal of Electronic Materials*. He is a Fellow of ASMI and the American Physical Society (APS), and is active in several other professional societies in engineering and physics. His APS Fellow citation reads: “For seminal contributions to understanding of defect and dopant behavior in epitaxial semiconductor and ferroelectric oxide thin films and heterostructures.”

Prof. Wessels received his B.S. degree from the University of Pennsylvania, followed by the receipt of the Ph.D. degree in materials science from Massachusetts Institute of Technology. He was a member of the technical staff of the General Electric Research and Development Center prior to joining Northwestern.

Prof. Prem Kumar Receives the 5th International Quantum Communication Award

Prof. Prem Kumar was presented the 5th International Quantum Communication (QCM) Award at the 2004 Quantum Communication, Measurement, and Computing Conference (QCMCC) held at the University of Strathclyde, Glasgow, UK. This award is presented in conjunction with the QCMCC every two years, and is sponsored by Tamagawa University, Tokyo, Japan. It carries a cash prize of 500,000 Japanese yen.

The QCM Award was established in 1996 to recognize pioneering achievements in the field of quantum communications. Previous recipients have been: 2002 — David Deutsch (Oxford University), Ben Schumacher (Kenyon College), and Serge Haroche (Ecole Normale); 2000 — Paul Benioff (Argonne National Lab), David Wineland (NIST), and Chris Monroe (University of Michigan); 1998 — Peter Shor (AT&T Labs) and Jeff Kimble (Caltech); and 1996 — Charles Bennett (IBM), Carl Helstrom (University of Southern California), Alexander Holevo (Steklov Mathematical Institute), and Horace Yuen (Northwestern University).

Prof. Kumar is the SBC Professor of Information Technology in the McCormick School of Engineering for 2003-06, and is Director of the Center for Photonic Communication and Computing. He is a Fellow of the IEEE, a Fellow of the Optical Society of America (OSA), and a Fellow of the American Physical Society (APS).



Recently Promoted and Tenured ECE Faculty



Dr. Seng-Tiong Ho was promoted to the rank of full professor effective Jan. 1, 2004. He received B.S. degrees in physics and electrical engineering, and the M.S. degree in electrical engineering and computer science from MIT in 1984, and the Ph.D. degree in electrical engineering from MIT in 1989. From 1989 to 1991, he was a Member of the Technical Staff at AT&T Bell Laboratories, Murray Hill, New Jersey. Subsequently, in 1991, he joined our Department.

Prof. Ho received the NSF Research Initiation Award in 1992 and the NSF CAREER Award in 1995. In 1998, he was an invited lecturer to the Abdus Salam International Center for Theoretical Physics and Summer School Institut d'Etudes Scientifiques de Cargese. In 1999, he was elected a Fellow of the Optical Society of America. Prof. Ho's research interests involve nanoscale photonic devices (including lasers, micro-ring resonators, and photonic bandgap structures), optical communications, organic photonics, photonic materials research, heterogeneous photonics, ultrafast nonlinear photonics, and quantum optics.

Associate Professor Thrasos Pappas has been granted tenure in our Department effective Sept. 1, 2004. He received the B.S. degree in electrical engineering from MIT in 1979, the M.S. degree in electrical engineering and computer science from MIT in 1982, and the Ph.D. degree in electrical engineering and computer science from MIT in 1987. From 1987 to 1999, he was a Member of the Technical Staff at AT&T Bell Laboratories, Murray Hill, New Jersey. Subsequently, in 1999, he joined our Department.

Prof. Pappas has authored or co-authored approximately 50 journal papers and refereed conference publications, two book chapters, and seven edited proceedings. His research interests include image and video compression, perceptual models for image processing, model-based halftoning, image and video analysis, and multimedia signal processing.



Associate Professor Selim Shahriar has been granted tenure in our Department effective Sept. 1, 2004. Prof. Shahriar earned his Ph.D. degree in electrical engineering from MIT in 1992. Prior to joining our Department in 2001, he was a principal research scientist at the Research Laboratory of Electronics at MIT.

Prof. Shahriar has a long list of research accomplishments including the theoretical formulations and / or experimental demonstrations of novel means for laser cooling, atomic beam splitting, a protocol for a quantum Internet, laser-beam combining, five-dimensional optical data storage, room-temperature holographic optical memory, quantum computing, a semiconductor laser pumped optical phase conjugator, spatially broadband squeezed states, electromagnetically induced transparency in a solid, collective recoil induced gain, force rectification in a Λ -system atom, and slowed / stopped light. To date, this work has resulted in more than 50 journal papers, more than 70 conference papers, and the textbook *Optical Manipulation of Neutral Atoms*.



Two ECE Faculty Receive Prestigious NSF CAREER Awards



Robert Dick

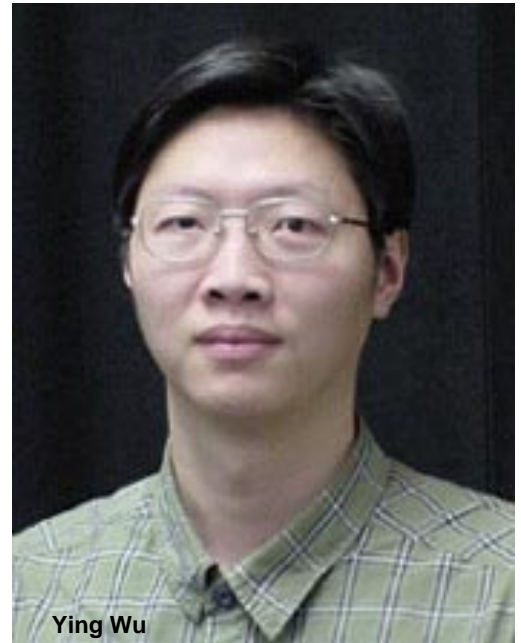
Asst. Prof. Robert Dick received his Ph.D. degree in electrical engineering in 2002 from Princeton University. His research focuses on the design and synthesis of embedded systems: computers within host devices where the host device itself is not generally considered to be a computer. For example, the computers within automobiles, personal communication devices, and medical equipment are embedded systems.

In his CAREER project, Robert aims to answer two main questions. First, how can operating systems and applications be redesigned to reduce the power consumption of embedded systems while maintaining equivalent perceived performance? Second, how should reliable, high-performance, low-power embedded systems, including those that are fully implemented on a single integrated circuit, be automatically designed?

Education is also essential in CAREER projects. Robert has introduced two new courses to the computer engineering and computer science curricula (Embedded Systems Design Automation and Introduction to Real-Time Systems). Further, he has updated two existing courses (Advanced Digital Logic Design and Introduction to Computer Engineering). This year, he won the ECE Department's Teacher of the Year Award.

Asst. Prof. Ying Wu received the B.S. from Huazhong University of Science and Technology, Wuhan, China, in 1994, the M.S. from Tsinghua University, Beijing, China, in 1997, and the Ph.D. in electrical and computer engineering from the University of Illinois at Urbana-Champaign in 2001, where he received the Robert T. Chien Award. His current research interests include computer vision, computer graphics, machine learning, multimedia, and human-computer interaction.

Prof. Wu's CAREER award supports his research on analyzing high-dimensional motion from video. This refers to complex motions with high degrees of freedom, including the articulation of the human body, the deformation of elastic shapes, and the multi-motion of multiple occluding targets. The goal of this research is to overcome the curse of dimensionality embedded in this challenging visual-inference problem by systematically pursuing a new distributed and collaborative approach that unifies various high-dimensional motions. This research will permit improved video surveillance by making possible fast and accurate human detection and tracking techniques, and will advance the state of knowledge of medical imaging and human-computer interactions.

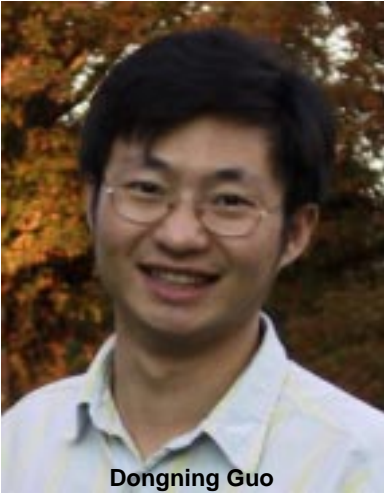


Ying Wu

Alumna Tenured and Promoted

ECE alumna **Dr. Susan Hagness** has been tenured and promoted to associate professor at the University of Wisconsin-Madison in the Department of Electrical and Computer Engineering. Dr. Hagness is a June 1998 Ph.D. graduate of our Department, mentored by **Prof. Allen Taflove**. Her research in early-stage breast cancer detection using novel ultrawideband microwave technology has been internationally recognized.

New Faculty for 2004-05



Dr. Dongning Guo received his B.Sc. degree in electrical engineering and information science from the University of Science and Technology of China in 1995 and did research there the following year. He received his M. Eng. degree from the National University of Singapore in 1999, and his Ph.D. in electrical engineering from Princeton University in 2004 under the supervision of Prof. Sergio Verdú. His dissertation was concerned with the design, analysis, and optimization of communication systems and networks.

Dr. Guo's research interests are in wireless communications, information theory, communication networks, and signal processing. He is the author of one book chapter, three journal articles, and 12 refereed conference publications. He received the Best Student Paper Award at the International Zurich Seminar on Broadband Communications in 2000 for his paper entitled "MMSE-based Parallel Interference Cancellation for Long-Code CDMA."

Dr. Russ Joseph received his B.S. in electrical and computer engineering with an additional major in computer science, with Carnegie Institute of Technology Honors and University Honors, from Carnegie Mellon University in 1999. He earned his M.A in 2001 and his Ph.D. in 2004 in electrical engineering at Princeton University. His dissertation, written under the supervision of Prof. Margaret Martonosi and entitled "Monitoring and Managing Microprocessor Power Variation: Techniques and Applications," showed how wavelet and Fourier analysis can isolate frequency-sensitive variations for dI/dt analysis.

Dr. Joseph's research interests are in computer architecture and power-aware computer systems including techniques for monitoring, characterizing, and optimizing performance and power consumption. He was the recipient of a Princeton University President's Fellowship and an IBM Graduate Fellowship during his graduate studies.



Dr. Hooman Mohseni received his B.S. in electrical engineering from Amirkabir University of Technology in 1993, his M.S. in electrical engineering from Sharif University of Technology in 1995, and his Ph.D. in electrical engineering from Northwestern University in 2001. His dissertation, entitled "Type-II InAs/GaSb Superlattices for Infrared Detectors," was completed under the supervision of Prof. Manijeh Razeghi. He has been a member of the technical staff at the Sarnoff Corporation since June 2001.

Dr. Mohseni's research interests lie in the design of novel quantum structures and micro- and nano-integration methods for advanced photonic and optoelectronic devices. He was the recipient of the ECE Department Best Thesis Award in 2001 and received the Best Student Paper Award at the International Semiconductor Device Research Symposium in 1999.



Prof. Larry Henschen Named C. D. McCormick Professor of Teaching Excellence

On May 27, 2004, at a ceremony in the Guild Lounge of Scott Hall, **Prof. Larry Henschen** was one of three Northwestern faculty named Charles Deering McCormick Professors of Teaching Excellence for three-year terms, beginning in the 2004-05 academic year. These awards recognize faculty “who have consistently demonstrated outstanding performance in the classroom” in Northwestern’s six undergraduate schools. All receive an annual salary supplement and serve as Fellows of the Searle Center for Teaching Excellence.



The C. D. McCormick professorships were established in 1991 with a \$10 million gift. Each year, three recipients are chosen from nominations of the undergraduate school deans. The nominations are reviewed by a student-faculty committee chaired by the Provost which evaluates letters from deans, faculty colleagues, and students.

In Larry’s case, his students describe his teaching as clear and passionate. They say he is able to explain the most difficult concepts in ways that made them accessible. They also say he’s precise and creates an atmosphere inside and outside the classroom in which students concentrate their efforts on learning while understanding the larger context of the topic. He recognizes that students come to his classes with different levels of preparation and he adjusts accordingly, giving every student a fair chance at succeeding. He makes the material interesting by including realistic examples along with humorous anecdotes that soften the mood of the class and make the classroom experience very enjoyable. They find him helpful outside the classroom, as well.

Previously, Larry has received the all-McCormick School teaching award and the Tau Beta Pi outstanding teacher award. A Ph.D. graduate of the University of Illinois at Urbana-Champaign, Larry is the author or co-author of more than 100 articles in the areas of automated reasoning, theorem proving, meta-reasoning, deductive databases, heterogeneous and distributed database systems, and visual aids for programming. He has directed nearly 70 Ph.D. students.

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