The ITTC Vision

To be a world-class center excelling in strategic research, development, and transfer of viable communications and information technologies.

HISTORY

The University of Kansas's Information and Telecommunication Technology Center (ITTC) was formed in autumn of 1996 with the merger of two established organizations which have had a history of dedicated teaching, research, and service. The merger included the internationally-esteemed Telecommunications and Information Sciences Laboratory (TISL) and the Center for Excellence in Computer Aided Systems Engineering (CECASE).

Both Centers had been an integral part of the University of Kansas for several years, although as separate entities. TISL, associated with the Department of Electrical Engineering and Computer Science, had concentrated for the past thirteen years on creating state-of-the-art telecommunications and information sciences research. CECASE, a seven-year-old Center supported by the Kansas Technology Enterprise Corporation (KTEC), applied the technical expertise of its staff and faculty in systems and software engineering, and systems management, to help Kansas companies solve problems in information and communication technology areas. Considering the background, research focus, and interest in promoting the use of new technologies, the merger between these centers was propitious. The University realized that one world-class center could better serve its academic, research, and service missions. ITTC brings together a strong team to support State, Industry, and Federal initiatives by leveraging the resources of the University of Kansas to enhance graduate education, research, development, and transfer of viable information and communication technologies.

The merger began late in the summer of 1996, when Dr. Julian ("J") Holtzman stepped down as CECASE's director after seven years. Dr. Holtzman, instrumental in nurturing CECASE through its formative years, championed the Center's mission of achieving substantial and sustainable economic growth for Kansas's businesses through technology transfer from university-based research. Dr. Carl Locke, Dean of the School of Engineering, served as Interim Director until December, when the University named Dr. Sam Shanmugan, SW Bell Distinguished Professor of Electrical Engineering and Computer Science, Director of the newly formed "ITTC." Dr. Shanmugan was well acquainted with both TISL and CECASE, since he was instrumental in the founding of both units: Dr. Shanmugan helped found TISL in 1983; and he wrote the proposal for CECASE, which KTEC funded in 1989.

Other members of the Center's leadership team are

- Dr. Gary Minden, Chief Technologist;
- Dr. Victor Frost (previously the Director of TISL), Dan F. Servey Distinguished Professor of Electrical Engineering and Computer Science, Executive Director for Research; and
- Mr. Tim Johnson (previously the Associate Director of CECASE), Executive Director for Operations and Applied Technology.

The goals and objectives of the Center for 1997 were to

- unify and promote KU's expertise in the area of information and telecommunication technologies;
- increase the visibility of the new enterprise through marketing;
- increase ITTC's funding base (Federal and Industry);
- continue strong support for technology transfer, assistance, and commercialization.

With the merger and resulting restructuring, ITTC is now positioned well to lead in the critical area of information and communication technologies. This Annual Report verifies the fulfillment of ITTC's objectives for Fiscal Year 1997 (FY97) and demonstrates the sound basis for the continuation of its activities throughout Fiscal Year 1998 (FY98) and well into the future.

TABLE OF CONTENTS

Vision . . . . . Inside Front Cover

History 1

Director's Statement 3

Introduction and Overview 4-7

Research Laboratories 8-13

Technology Transfer 14-15

Executive Staff 16-19

Operations & Applied Technology Staff 20-23

Affiliated Faculty 24-42

Advisory Board 43

Research Highlights 44-65

Five-Year Project Listing 66-69

Affiliated Faculty Publications 70-83

ITTC Annual Report for FY97 (1 July 1996 - 30 June 1997).
Published September 1997.

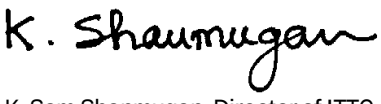
Director's Statement

During the last half of this century, we have seen an explosive growth in information and telecommunication technologies, triggered by the invention of the transistor and resulting advances in microelectronics, developments in lightwave and wireless communications and high-speed networking, and more recently the evolution of databases and software for information management. The University of Kansas has made significant contributions to these areas through its graduate programs in the Electrical Engineering and Computer Science Department, and research conducted at the Information and Telecommunication Technology Center (ITTC) and its predecessors. This report documents the recent research activities at ITTC and provides a glimpse of where ITTC is heading in the future.

The report begins with a brief history of ITTC, which was formed last year through the merger of the Telecommunication and Information Sciences Laboratory (TISL) and the Center for Computer Aided Systems Engineering (CECASE)—both of which have a long record of significant research and successful technology transfer. As can be seen from the details contained in this report, the pooling of synergistic and complementary talents that were present in TISL and CECASE has produced a strong research center in ITTC, which has an impressive array of accomplishments during its first year of operation as a combined entity. ITTC has already demonstrated the potential to become a world-class research center in information and telecommunication technologies—a goal that we are aggressively pursuing.

The accomplishments of ITTC during the past year were due to the tireless efforts of our faculty, staff, and students and the strong support of our sponsors. I want to thank everyone affiliated with the Center for their hard work and support, and I am looking forward to working with all of you to help ITTC reach its goals.

As we approach the new millennium, we are in the middle of the so-called "Information Revolution." While the Industrial Revolution that reached its peak during the last half of this millennium has relieved us from the tedium of much hard and repetitive physical labor, the Information Revolution that has just begun has the potential to complement and enhance the intellectual capabilities of the human race. All of us at ITTC are excited about being able to contribute to the advancement of the enabling technologies of the Information Age.



K. Sam Shanmugan, Director of ITTC

Introduction and Overview

Information and telecommunication technology is one of seven national critical technology areas and has been emphasized as having high opportunity and capacity within the State of Kansas. (Kansas' telecommunications industry has reported annual sales of thirteen billion dollars, and an employee count of nearly fifty-three thousand.) Information and telecommunication technologies are changing the way the world functions. ITTC develops technologies that have application not only in the telecommunications industry itself but also in biomedical, educational, agricultural, and financial information systems. Diverse industries—from small spin-off companies to major industry, State, and Federal supporters—can use ITTC's enabling technology base, and can benefit from ITTC's research, development, and technology transfer activities.

Technology Focus

With resources in faculty, staff, and students at the University of Kansas, the Center is developing new technologies for the telecommunication and information sciences industry. The Center has broad support from industry, Federal, and State programs; and research projects often result in investment-grade technologies. ITTC is organized into four technical areas, which allows the Center to take advantage of opportunities for funding in its affiliated faculty's areas of interest:

- Intelligent Systems and Information Management
  This group focuses on the use of advanced, intelligent methodologies as applied to solving problems in information identification, retrieval, analysis, and fusion. Dr. Costas Tsatsoulis coordinates the efforts of faculty and students in this area.
- Lightwave Communication Systems
  This group explores new lightwave technologies in order to increase the capacity and reliability of commercial lightwave communication networks. Drs. Ken Demarest and Chris Allen lead the faculty and student efforts in this area.
- Networking and Distributed Systems
  This group develops innovative networking and system technologies, and seeks to understand their behavior and to improve performance. Dr. Joe Evans leads the faculty and students in this area.
- Wireless Communications and Digital Signal Processing
  This group investigates software radio signal processing algorithms, adaptive beamforming, spread spectrum, and code division multiple access communications. Faculty and student efforts in this area are lead by Dr. Glenn Prescott.

(See Research Laboratories section for further information on research in these technical areas.)

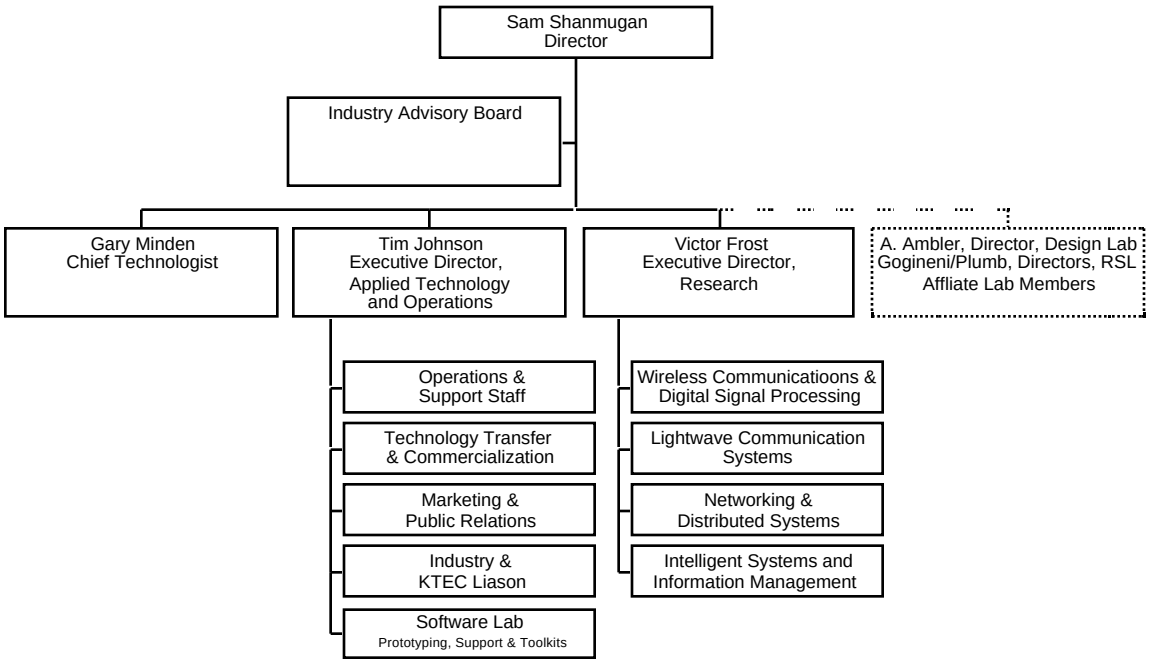
Affiliated Labs

In addition to the four technical areas named above, ITTC is affiliated with two other KU research laboratories: DesignLab, and the Radar Systems and Remote Sensing Laboratory (RSL). Faculty associated with both DesignLab and RSL work with ITTC when faculty interests overlap.

Organization

ITTC was built upon the related efforts and strengths of the University faculty, staff, and students and continually seeks opportunities to leverage the Center's expertise with industry and Federal agencies.

ITTC R/D&C Organization



ITTC is composed of approximately twelve staff, eighteen faculty, and over seventy students (see the Affiliated Faculty and Staff sections).

As a result of the merger of CECASE and TISL, ITTC has formed a new Advisory Board for FY98. Members are leaders from nationally-known information and telecommunications companies as well as from past boards that advised CECASE (see the Advisory Board listing on page 43).

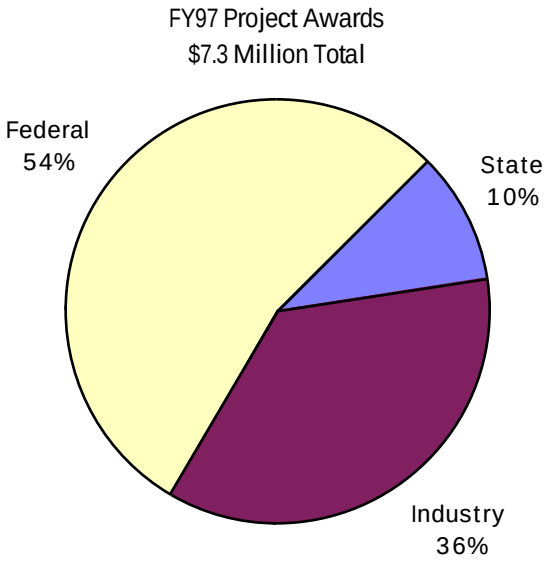
FY97 Accomplishments

Since the merger, ITTC has a new image, a focused vision, and a strong management team. The Center met or exceeded FY97 performance goals for its start-up phase, as shown in the following table:

FY97 Performance

Key Indicators	Goal *	Actual
R/D&C Industry Awards	$ 250,000	$ 2,636,000
R/D&C Federal Awards	$ 1,500,000	$ 3,971,000
R/D&C State Awards	$ 577,000	$ 728,000
Total Awards	$ 2,327,000	$ 7,335,000
Technologies Commercialized-KS	4	4
Licenses Awarded	4	5
License Fees/Royalties	$ 1,000	$ 45,458
New Companies Formed	1	1

* Goals established prior to merger



During FY97, ITTC faculty won several multi-year research awards, and funding surpassed its goal by $5 million. Approximately 36% of ITTC's research and development awards ($2.64 million) came from industry. With additional Federal awards of $3.97 million, and Kansas' funding of $728 thousand, the total is $7.3 million.

Technology Transfer

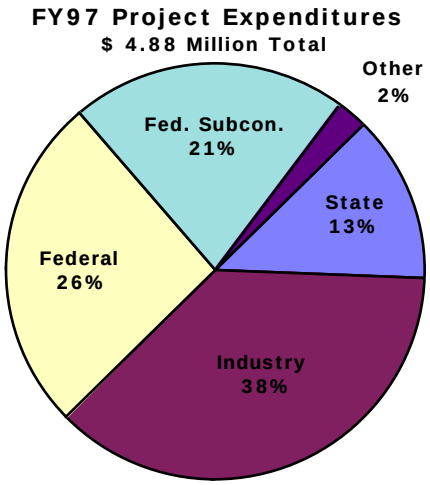
From licenses, and industry investment in technology development, ITTC received $45,500 in FY97; and during the year five ITTC-developed technologies were successfully transferred out of research (see Technology Transfer section, pages 14-15). Four of the five transferred technologies supported Kansas industry and resulted in new commercial products. These licensed technologies have a long-term potential to produce substantial royalties to ITTC, to the University, and to the technology inventors.

The Center continues to assist companies in patenting any intellectual property which results from industry-funded research, to help form new companies, and to solicit the support of Kansas companies in the development of new technologies.

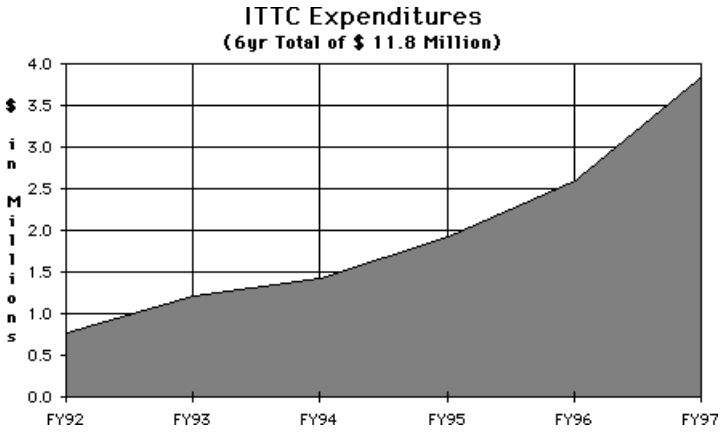
ITTC has partnered with both local industry and nationally recognized universities and agencies to obtain funds for key cutting-edge research projects in its core technology areas.

Expenditures

During FY97, 38% of ITTC's expended funds came from industry ($1.8 million). In addition, ITTC spent $2.3 million of Federal funds, of which $1.04 million were from research subcontracts that ITTC manages. The State support for FY96, $643 thousand, is 13% of ITTC funds (see pie chart at right).



The progress of ITTC can be illustrated by the expenditure trends shown in the following chart. (Note that the year's expenditures before FY97 are cumulative results for TISL and CECASE combined.)



Future Directions

ITTC will continue to focus on critical technologies to establish major laboratories with an emphasis on research, and technology development and transfer. Near-term goals for the Center are to establish a solid funding base for all research areas. This will be accomplished by identifying and attracting key "anchor" projects plus a number of additional industry-funded projects.

ITTC's long-term vision is to

- be recognized as a world-class center,
- build resources for the four key technology areas to $2 million per year,
- develop a new key technology area,
- become an National Science Foundation designated Engineering Research Center by the year 2000.

The challenge is to plan for success and manage it with adequate infrastructure support. With success, ITTC will continue to demonstrate its relevance within Kansas.

RESEARCH LABORATORIES

Overview

ITTC is structured to focus on information and communication technologies. The productivity of information workers is significantly enhanced by advances in communications, computer, and information technology. Focusing on advancing the state of the art in telecommunications and information sciences will speed the evolution of our information-based economy and society. The information infrastructure is composed of bitways, ices, and applications. Bitways carry information in the form of analog or digital signals. eneric services—e.g., voice, data and video—are supported by bitways, while applications are constructed using communications services. Research in ITTC has been structured to ects of the information infrastructure.

oment of future bitways for the information infrastructure is occurring in ITTC's Wireless and al Processing and Lightwave Communication Laboratories. Fundamental research in the t of all-digital radios and advanced wireless systems is supported by the Department of D) Advanced Research Projects Agency (ARPA), the US Air Force, and others, to develop tems that take advantage of the Center's expertise in networks, digital radios, propagation, ling, and antennas. The Lightwave Communication Laboratory is using support from Sprint, and Lucent Technologies to focus research in lightwave communications systems. The these investigations is to identify and investigate the issues necessary to integrate high- ronic and lightwave devices to support leading-edge communications services. The on how to migrate from the existing network to a system that dynamically uses lightwave provide optimal information transport for a variety of services. Research is addressing how e the capability offered by optical communications with techniques such as wavelength- ltiplexing (WDM), solitons, and coherent modulation. These methods offer viable s to utilizing the 25,000 billion bits /sec capacity of a single fiber.

king and Distributed Systems Laboratory is conducting several multi-year projects to v methods to control and manage communications networks, including signaling and test esearch efforts are also directed toward evaluating the performance of high-speed, wide- ks using theoretical analysis, measurements, and simulation. A hardware infrastructure to earch in advanced high-speed networking exists within ITTC. Using these facilities, the olved in three national scale networking testbeds. The Multidimensional Applications and network Consortium (MAGIC), funded for another three years, will continue to investigate ciated with distributed computing and communications over wide-area, high-speed networks. The ACTS ATM Internetwork is a testbed connecting eight DoD sites by terrestrial fiber and the other sites via a 622 Mb/s satellite link. The satellite earth station is connected to MAGIC and is located at Sprint in Overland Park, Kansas. The SPrint Applied Research parTners Advanced Network (SPARTAN) is an ATM testbed between research institutions including Digital, SRI, Xerox, and the Sprint Advanced Technology Laboratory in the San Francisco Bay area.

The Center's Intelligent Systems and Information Management Laboratory is involved in research on advanced network-based applications as well as information retrieval, analysis, and fusion. Access and database technologies, developed in conjunction with faculty in the School of Education, allowed kindergarten through twelfth grade school teachers to share material. The data base is located in ITTC facilities, and the access technology is in use by over 100 schools. ITTC researchers have also developed digital video library technology, which improves the usability of such libraries by allowing direct, easy access to vast quantities of information. An advanced information retrieval system for the Internet has also been a result of the research conducted by the Intelligent Systems and Information Management Laboratory.

The synergy of research efforts in ITTC's research laboratories is producing advances in information and communication technologies.

Laboratory Facilities

ITTC enjoys state-of-the-art facilities to perform the research and development of technologies that will form the next generation of communications systems. These facilities include a high-speed networking lab with a 2.4 Gb/s SONET connection; DSP and digital radio lab; integrated, diverse networking environment; and a leading-edge lightwave research lab. Complementing the hardware facilities, the Center uses some of the best-in-class design and development tools, such as BONeS Designer® and Signal Processing Workstation (SPW).

As much of the work which ITTC does requires the development of new software, ITTC uses CORBA, C++, Java, and Lisp among others, to ensure that we use industry-established solutions to smooth the technology transfer process.

ITTC facilities are categorized into four research areas, described in more detail below. In addition to the research function of the Center, great emphasis is placed on realizing the commercial potential of the technologies and expertise developed. Therefore, many of the software and hardware facilities that are in use in research are also used in the technology transfer function of the Center.

Intelligent Systems and Information Management (ISIM)

multiagent Development Tools : CORBA, C++, ACCS.

Information Retrieval and Web Tools: KUIR Information Retrieval Library.

Data Mining Tools: SNOB, Cobweb, ID3, C4.5, statistical analysis packages.

Artificial Intelligence Development Tools and Languages: Lisp, CLOS, CLIPS, Prolog, GBB, OPS, MEM-1.

Image Processing and Computer Vision Tools: KUIM Image Processing Library.

Lightwave Communication Systems (LCS)

The Lightwave Laboratory is equipped with modern lightwave equipment: 12Gb/s BERT; optical spectrum analyzer; OTDR; tunable source and filters; modulators; photodetectors; polarization analyzer; etc.

Commercial WDM (multiple wavelengths carrying 2.4 Gb/s per wavelength) systems (complete with 360 km of fiber), have been installed for systems level testing.

Networking and Distributed Systems (NDS)

Extensive high-speed networking infrastructure: connected to high-speed wide area networks; MAGIC backbone connection at 2.4 Gb/s; AAI testbeds for coast-to-coast experimentation; wide variety of switches and network interfaces.

Hardware and software design experience—developed: 622 Mb/s ATM switch hardware; network testing and measurement tools; network simulation and modeling tools; early web applications and servers; integrated wireless, mobile systems with fixed networks.

BONeS Designer®, SPW.

Wireless Communications and Digital Signal Processing (WDSP)

To enable the rapid development of leading edge technologies, the Wireless Communications and DSP lab uses High speed oscilloscopes; Arbitrary function generators; Sun Workstations; Logic Analyzers; Network Analyzers; Spectrum Analyzers; Field Programmable Circuit Cards (APTIX); DSP Rapid Prototyping System; a variety of DSP platforms and evaluation boards; IS-95 CDMA facility.

Intelligent Systems and Information Management (ISIM) Laboratory

The Intelligent Systems and Information Management Laboratory (ISIML) studies theoretical and application issues of Artificial Intelligence, Intelligent Agents, Information Retrieval from Distributed and Heterogeneous Sources, and Data Mining. Most of our applications are related to information retrieval, presentation, and management.

Researchers in the ISIML work on theoretical and practical issues of the automatic characterization of the contents of information sources, intelligent query routing, softbots, information fusion and visualization, video indexing, discovery of knowledge in very large databases, learning of user profiles, collaborative patterns of information-seeking agents, and anticipation of the user's information needs in a dynamic, distributed-data environment.

Principle areas of concentration are Artificial Intelligence, Information Retrieval, Intelligent Agents, Data Mining, Digital and Video Libraries, Knowledge-Based Systems, Information Presentation, and Image Processing and Computer Vision.

The resources available to this Lab include multiagent Development Tools (CORBA, C++, ACCS), Information Retrieval and Web Tools (KUIR Information Retrieval Library), Data Mining Tools (SNOB, Cobweb, ID3, C4.5, statistical analysis packages), Artificial Intelligence Development Tools and Languages (Lisp, CLOS, CLIPS, Prolog, GBB, OPS, MEM-1), and Image Processing and Computer Vision Tools (KUIM Image Processing Library).

In 1997 the ISIML started participating in a large DARPA project in agent-based information dissemination, spun off a small company to market Web search tools, and licensed a content-based video-indexing and retrieval tool to industry.

Future work includes a new NSF program to investigate cooperative agents for conceptual search of the Web, a new NRL program to analyze satellite images, and increased interactions with industry—including Sprint and Lucent, where some of the ISIML students spent summer internships.

Lightwave Communication Systems (LCS) Laboratory

The mission of the Lightwave Communications Systems Laboratory (LCSL) is to explore new lightwave technologies and determine their impact on future optical communication networks.

These lightwave technologies are examined from two points of view. The first is the photonic properties of lightwave technologies, including issues such as cost, speed, and reliability. The second is the impact of these technologies on the network flexibility and protocols of existing optical networks. By merging these two points of view, the LCSL evaluates these new technologies from the standpoint of total network performance, including both the hardware and networking aspects of these systems.

The LCSL boasts a state-of-the-art measurement facility that is capable of examining device and network characteristics of state-of-the-art optical components and networks. It also contains an analytical modeling facility, capable of performing numerical component and network performance studies. Technologies that are currently under investigation by the LCSL include wavelength division mutiplexing (WDM), high-speed, time-domain multiplexing (TDM), and photonic switching.

The principle areas of concentration are lightwave systems, wavelength division multiplexing (WDM), performance prediction of lightwave systems, solitons, and polarization-mode dispersion (PMD).

The LCSL is equipped with modern lightwave equipment: 12Gb/s BERT, optical spectrum analyzer, OTDR, tunable source and filters, modulators, photodetectors, polarization analyzer, etc.

Commercial WDM systems (complete with 360 km of fiber) have been installed for systems level testing.

Recent accomplishments include fiber-link software capable of modeling all major filter non-linearities and polarization characteristics.

Near-term future activities will focus on increasing the capacity utilization of long-distance lightwave communications networks through a variety of schemes, and evaluating the impact of these approaches on network robustness. We envision longer-term activities to focus on all optical network architectures and related issues. Given the rapid rate of development in this flourishing field, the future, while uncertain, will definitely be exciting.

Networking and Distributed Systems (NDS) Laboratory

The Networking & Distributed Systems Laboratory (NDSL) performs research on innovative high-performance networks and systems with a particular emphasis on the areas of performance measurement, modeling, and improvement; network control and signaling; and integration of lightwave and wireless technologies into systems. The NDSL engages in experimental studies, enabled by its unique interconnection to several wide-area testbeds, as well as analytical and simulation work on the behavior of networks and systems, focusing on performance and scalability issues. Work on the control of networks includes the development of active networks, off-board signaling platforms, and other innovative control and signaling architectures. With the support of other ITTC laboratories, NDSL develops strategies and implementations for the integration of both lightwave and wireless technologies into system-level solutions. In the course of NDSL investigations, both hardware and software implementations are developed, designed, and tested in prototype networks.

The principal areas of concentration are distributed performance measurement and modeling (tools, analysis techniques, and simulation models, and accurate performance prediction), network control and management systems (self-configuring networks, signaling systems, and protocols), integration of wireless networks (architectures and protocols, reliability and robustness, ubiquitous and ad-hoc systems), high-capacity network systems (study, implementation, and integration of multiple network types at multiple levels; and integration of optical networking systems), and distributed network services (active networking, routing, and management and control functions).

The resources available to the NDSL include extensive, high-speed networking infra-structure (connected to high-speed, wide-area networks; MAGIC backbone connection at 2.4 Gb/s; AAI testbeds for coast-to-coast experimentation; and a wide variety of switches and network interfaces); hardware and software design experience, both (1) developed (622 Mb/s ATM switch hardware, network testing and measurement tools, network simulation and modeling tools, and early Web applications and servers), and (2) working (integrated wireless, mobile systems with fixed networks; and BONeS Designer® and SPW).

Since the laboratory was founded in early 1997, we have completed several initial demonstrations for the MAGIC-II program which illustrate the utility of active networking. Other accomplishments include the final testing of the NetSpec performance testing tool on the AAI testbed, and integration of this package into the MAGIC-II distributed systems environment. Development and evaluation of adaptive protocols for wireless networks have been completed, including new algorithms for predictive reconfiguration management and control of rapidly deployable wireless networks.

Future work includes continuing the DARPA funded MAGIC-II program. This project involves the integration of wireless systems into the MAGIC gigabit testbed environment. Active networks are another area of interest and will be used as the approach for the MAGIC-II wireless integration efforts. Other future work will focus on the integration of optical systems into flexible network architectures.

Wireless Communications and Digital Signal Processing (WDSP) Laboratory

The mission of the Wireless Communications and DSP Laboratory is to advance ıtal knowledge in the area of wireless radio through investigation and mplementation of digital communication systems using state-of-the-art radio-frequency (RF) and DSP technology.

ss and DSP Lab is established to serve as a focal point for collaborative ı wireless communications and the innovative application of signal technology to wireless radio and radar. The emphasis of this Laboratory is on the actual implementation, test, and measurement of wireless communication systems. The goal of the Laboratory is to become a center of excellence in the design and implementation of radio and high-speed digital systems in order to serve as a resource to support researchers who are investigating fundamental issues in communications and information theory. The Lab's immediate and ongoing objective is to develop and maintain an expertise in RF and high-speed digital design, and the application of advanced DSP technology to the implementation of wireless radio systems.

The principal areas of concentration are software radio systems, radio system implementation (analog and digital), RF system design, communication and radar applications of DSP, smart antennas, communication system simulation and analysis, spread spectrum systems (commercial and military), wireless CDMA, and FPGA applications for DSP.

The resources available to this Lab include an array of state-of-the-art RF test equipment, including high-speed oscilloscopes, arbitrary waveform generators, computer workstations, logic analyzers, network analyzers, and spectrum analyzers. We also have the hardware and software necessary to design special purpose digital hardware, such as Field Programmable Circuit Cards (APTIX), DSP Rapid Prototyping System, and a variety of DSP platforms and evaluation boards. Numerous software development tools are also available, including PC board development systems, simulation and mathematical computation software, and RF development software systems. We also have an operational Lucent IS-95 CDMA facility to support our research in CDMA.

Since the Laboratory was founded in early 1997, we have completed implementation and testing of a 1.2 GHz software radio receiver system and a digital beamforming transmitter system in support of the DARPA funded Rapidly Deployable Radio Network (RDRN) Program. We have also completed design and implementation of a high-speed FFT and digital notch filter on a field-programmable gate array.

Future work includes a new DARPA-funded program investigating adaptive computer systems. This program will require us to implement computing systems—especially real-time DSP processing systems—using field-programmable hardware. We are also currently developing a RF channel simulator for indoor wireless communication systems.

Technology Transfer

ITTC has had excellent results from its technology transfer activities, many of which started as projects within CECASE. Cathy Ambler, the Center's Assistant Director for Technology Transfer, has worked with companies, CRINC, faculty, and staff to help transfer the technologies developed within ITTC from the University to the commercial sector. During FY97 ITTC has licensed five technologies resulting in approximately $45,000 in initial licensing returns to the University.

New technologies come from various opportunities:

- industry or federally sponsored research agreements,
- direct company assistance,
- research and ideas from KU faculty, staff, and students (with commercial potential).

These opportunities are supported by KU's Center for Research, Incorporated (CRINC), a foundation that manages the University's sponsored research and license agreements. ITTC-developed technologies frequently produce a license agreement with a company. These agreements often include sponsored research support, cost sharing, royalty arrangements, or sometimes equity positions. Each technology is managed to find the best "win-win" solutions for those involved. Current FY97 agreements range from 3-11% return of gross revenues and are capped at a total return of $1.5 million.

FY97 Technology Transfer Highlights:

Piranha (Credit Union Teller Modules): This software project provided a state-of-the-art, intelligent, PC-based graphical environment for credit-union teller workstations. The software improved client side access to an existing database server and was developed in partnership with a Kansas company. The software, licensed to the company by ITTC, was key to the company's plans of updating their product line and creating a competitive advantage for their products.

Mercury (Remote Therapist Support System): This was a joint development effort with a company located in Topeka, KS. The TCP/IP network-based client/server software system allows a physical therapist to communicate with a patient database located on a server. The license allows the firm to market the product and retain some rights for the product's future development. The company has attracted significant outside investment.

Helios: ITTC helped further the development of computer-based hemispherical modules (HEMIVIEW) and toolbox (HELIOTOOLS) in FY97. The technology was licensed in early 1996 to a Kansas spin-off company. The company has successfully established a relationship with another to market and sell the software internationally and has produced some initial license income and research funding for ITTC.

KTRAC: KTRAC directly supports Kansas Technology Enterprise Corporation's need to track economic development information. ITTC used its core funds to develop this technology and completed and licensed KTRAC, version one, to a Kansas start-up company which is part of the Kansas Innovation Center (KIC). ITTC is developing a related technology (Phoenix) which will provide ITTC with an Intranet application for tracking internal projects and intellectual property via the World-Wide-Web.

KICIN: During FY96, ITTC developed the Kansas Integrated Commercialization Information Network (KICIN) to support a "one-stop shopping" source for economic development information within the State of Kansas. During FY97, ITTC has maintained and provided KTEC additional support in moving KICIN to the Information Network of Kansas (INK), which will be done in early FY98.

Following are examples of technologies which developed out of active project research at ITTC. Each of these now has a license with a commercial entity. (See the Research Highlights section for full project descriptions.)

ProFusion: This project involved the development and licensing of a meta-search engine for the World Wide Web (WWW). The resulting technology has been spun out into a start-up company for commercialization, with the company paying directly for further development and making future royalty payments to ITTC.

Formulate: Research into developing a programming language manageable by the end user to best support programming of potentially sophisticated problems, this project has made significant progress in implementation, with project completion expected during the first quarter of FY98. A license agreement is in place with Ambler Software Engineering, a Kansas company.

VISION: This project has successfully been licensed with ITTC support to be completed during the fourth quarter of FY97. This project has resulted in a very successful technology which has had multiple parties interested in licensing and is currently licensed to a company. Further technology development is expected, with the licensing company sponsoring future development within ITTC.

Method and Apparatus for Controlling an Optical Signal: A patent was filed on an invention related to the control of optical signals using birefringence to modify the output of an optical coupler. The method provides for the control in a polarization independent manner using the birefringence. The concept can be used in optical switching and modulation.

ATM Reference Traffic System (ARTS): A patent was applied for relating to the ATM Reference Traffic System (ARTS) based on innovative ways of testing ATM network performance using inexpensive commodity hardware. Specifically, ARTS is built as an application on top of the KU Real-Time patches to Linux, a public domain UNIX clone, and is capable of producing and recording ATM packet level traffic with microsecond accuracy.

Executive Staff

K. Sam Shanmugan
Director

K. Sam Shanmugan received the B.E. degree from Madras University, India in 1964, the M.E. degree from the Indian Institute of Science, Bangalore, India in 1966, and the Ph.D. degree from Oklahoma State University, Stillwater, in 1970, all in electrical engineering.

From 1970 to 1973 Dr. Shanmugan was as a Postdoctoral Fellow at Oklahoma State University, Stillwater, and the University of Kansas Center for Research, Inc., Lawrence, Kansas, where he worked on problems in pattern recognition, image processing and modeling and analysis of communications systems. From 1973 to 1978, he was with the Department of Electrical Engineering at Wichita State University, Wichita, Kansas, where he taught and conducted research in systems theory, communication systems, and image processing. From 1978 to 1980 he was a Visiting Scientist at Bell Laboratories, Holmdel, NJ, where he worked on problems in the modeling and analysis of satellite communication systems. Dr. Shanmugan joined the faculty of the University of Kansas in 1980, where he is currently the Southwestern Bell Distinguished Professor of Electrical and Computer Engineering and the Director of the Information and Telecommunication Technology Center. His current interests are in the areas of wireless communications and computer-aided modeling and analysis of communication systems. Dr. Shanmugan has published a number of articles in the above areas and is the author of three books: Digital and Analog Communication Systems (Wiley, 1979), Random Signals: Detection Estimation and Data Analysis (Wiley, 1988), and Simulation of Communication Systems (Plenum Press, 1992).

From 1985 to 1995 Dr. Shanmugan also served in a number of leadership positions in the industry: as President of STA*R Corporation (1985-88), Senior Vice President of Comdisco Systems (1988-93), General Manager of the Alta Group of Cadence Design Systems (1984-85), and Chief Technical Officer of Systems and Networks. During this time he led the development and commercialization of modeling and simulation software for the design of communication systems (BOSS-Block Oriented Systems Simulator) and networks (BONeS-Block Oriented Network Simulator).

Dr. Shanmugan is a Fellow of the IEEE. He was an Editor of the IEEE Transactions on Communications, chaired the first IEEE workshop on Computer-Aided Modeling and Analysis of Communications Systems, and served as the Chairman of the IEEE Communications Society's Subcommittee on Computer-Aided Modeling, Analysis and Design of Communication Systems. He received the Outstanding Young Engineering Faculty Award in 1979 from the Society of Automotive Engineers. He also received the Henry E. Gould, the AMOCO Foundation, and the Burlington Northern Awards for Outstanding Teaching, and the Higuchi Award for Outstanding Research from the University of Kansas.

(See also Dr. Shanmugan's listing in the Affiliated Faculty section.)

Victor S. Frost
Executive Director for Research

Dr. Victor S. Frost is currently the Executive Director for Research for ITTC. Dr. Frost has been involved in research for numerous corporations, including Sprint, NCR, BNR, NEC, Telesat Canada, AT&T, McDonnell Douglas, DEC, and COMDISCO Systems. His research has also been sponsored by Government agencies, including, NSF, DARPA, Rome Labs, and NASA. From 1987 to 1996 Dr. Frost was Director of the Telecommunications and Information Sciences Laboratory (TISL). He has published over 38 journal articles. He has served as a Guest Editor for the IEEE Communications Magazine (March 1994 and August 1997) and the IEEE Journal on Selected Areas in Communications (May 1995) and is currently an Associate Editor for the IEEE Communications Letters and the ACM Transactions on Simulation and Modeling of Computer Systems. His current research interests are in the areas of integrated communication networks, high-speed networks, communications system analysis, and simulation. He is currently involved in research on the MAGIC and AAI high-speed, wide-area testbeds.

Dr. Frost received a Presidential Young Investigator Award from the National Science Foundation in 1984, an Air Force Summer Faculty Fellowship, a Ralph R. Teetor Educational Award from the Society of Automotive Engineers, and the Miller Professional Development Awards for Engineering Research and Service in 1986 and 1991, respectively. He is a member of Eta Kappa Nu and Tau Beta Pi and a senior member of the IEEE. He served as Chairman of the Kansas City section of the IEEE Communications Society from June 1991 to December 1992. He has also served on State of Kansas NSF EPSCoR, and DoD DEPSCoR committees, as well as the Kansas Inc. Telecommunications Task Force. He is a member of the Board of Trustees for the University of Kansas Center for Research Inc. and the Self Fellowship program.

Dr. Frost received the B.S., M.S., and Ph.D. degrees from the University of Kansas, Lawrence in 1977, 1978, and 1982, respectively. In 1982 he joined the faculty of the University of Kansas, where he is currently the Dan F. Servey Distinguished Professor of Electrical Engineering and Computer Science.

(See also Dr. Frost's listing in the Affiliated Faculty section.)

Tim Johnson
Executive Director for Operations and Applied Technology

Timouthy W. Johnson received the B.S. from Memphis State University in 1982 and the M.S. in 1985 and passed the Ph.D. Preliminary Exam in 1987 while attending Kansas State University—all in electrical engineering.

Mr. Johnson has over fourteen years of experience in the management and design of engineering and software projects. He has conducted, presented, and supervised research in communications and digital signal processing during the last ten years, resulting in four refereed journal publications, over ten presentations, and ten technical articles and reports. In 1982 and 1983 Mr. Johnson was a Senior Associate Division Engineer for Distribution Systems with the Kansas Power and Light Co. in Topeka, Kansas, where his duties included the field supervision of projects. While obtaining his Master's degree (1984 to 1985), Mr. Johnson taught undergraduate electrical engineering lecture courses and was a lab instructor, lab assistant, and academic advisor. In 1986 Mr. Johnson was an Engineer performing defense satellite communication system research for Computer Sciences Corporation in Falls Church, VA. His work emphasized performance estimates for spread spectrum systems. From 1986 to 1989, Mr. Johnson was an instructor of Electrical Engineering at Kansas State University in Manhattan, Kansas, while working towards a Ph.D. He worked for several years on funded research for Motorola, Inc., Government Electronics Group. He conducted research, taught engineering courses, and was an academic advisor. From 1989 to 1990, Mr. Johnson was an Assistant Professor of Electrical Engineering at the University of Wyoming in Laramie, WY. There Mr. Johnson conducted signal processing research, supervised MS graduate students, and taught engineering courses. He was also the faculty advisor for the IEEE Student branch that was the Denver Section Student Branch of the Year.

In August 1991, Mr. Johnson joined the Center for Excellence in Computer-Aided Systems Engineering (CECASE) at the University of Kansas, where, until November 1993, he was an Associate Research Engineer who supervised research and commercialization efforts. His duties included supervision and operation of the Rapid Prototyping Facility for DSP and communications. He also provided assistance and consultation to the Kansas business community. Mr. Johnson later became the Associate Director of CECASE from December 1993 to August 1996, and was responsible for management of internal Center operations. He served as the Executive Director of CECASE from September 1996 until formation of the Information and Telecommunication Technology Center (ITTC) in December 1996. In addition, from November 1994 to September 1996, Mr. Johnson was a Vice President of Lawrence Applied Research Corporation (LARC) in Lawrence, KS. LARC performs research, development, and education in communications systems design and performance, communications engineering, information systems engineering, and DSP. In addition, Mr. Johnson is a member of the Board of Directors of Data Discovery, Inc. (DDI) of Overland Park, KS. DDI was founded to automate information discovery.

Mr. Johnson also serves on the Kansas Innovation Center's (KIC) operations committee, Silicon Prairie's Information Technology committee, and KTEC's Telecommunication committee. Mr. Johnson is an IEEE member whose professional memberships include the Order of the Engineer, IEEE Communications Society, IEEE Signal Processing Society, IEEE Engineering Management Society and the IEEE Computer Society.

Gary J. Minden
Chief Technologist

Dr. Gary J. Minden is Chief Technologist for ITTC, and Associate Professor of Electrical and Computer Engineering at KU. He received the B.S.E.E. degree in 1973 and the Ph.D. degree in 1982, both from the University of Kansas.

From 1971 through 1978 Dr. Minden was a Research Engineer at the University of Kansas Center for Research, Inc. During that period he worked on problems in the areas of image processing systems, multi-processor computer systems, and general systems theory. From 1978 to 1980 he was a Vice President of CHILD, Inc., where he was a co-designer of the LIGHT-50 computer graphic terminal. In August of 1981 he joined the University of Kansas Department of Electrical Engineering as an Assistant Professor. During 1983-1989 he lead the implementation of a new Computer Engineering degree program within the Electrical and Computer Engineering Department.

In 1991 Dr. Minden completed a sabbatical at Digital's System Research Center, working on gigabit local area networks. He is a Principal Investigator on the MAGIC gigabit testbed and the Rapidly Deployable Radio Network (RDRN) at ITTC. From June 1994 through June 1996, he was on leave at the Defense Advanced Research Projects Agency (DARPA) Information Technology Office. He served as a Program Manager in the area of high performance networking systems. While at DARPA he formulated and initiated a new research program in Active Networking.

Dr. Minden's research interests are in the area of large-scale distributed systems, which encompasses high performance networks, computing systems, and distributed software systems. Dr. Minden is a member of the Institute of Electrical and Electronic Engineers and the Association of Computing Machinery.

(See also Dr. Minden's listing in the Affiliated Faculty section.)

Operations & Applied Technology Staff

Cathy Ambler
Assistant Director for Technology Transfer

Cathy Ambler has been with ITTC since KTEC funded it as CECASE in 1989. Dr. Ambler has a Ph.D. in American Studies and Master's in Museum Administration. She assisted Director Julian Holtzman, now retired, during the first years of the Center's start-up.

Dr. Ambler is in charge of Technology Transfer for ITTC and assists the University's engineering faculty and staff in identifying research projects or ideas that might be useful in the commercial or public sector. Though historically universities and corporations have not been strong partners, it is Dr. Ambler's conviction that the benefits of such cooperative relationships are clear: researchers identify and solve real-world problems, and companies gain innovative technologies that allow them to remain competitive in a world marketplace.

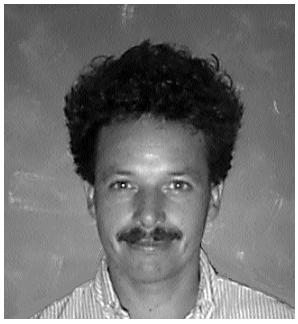
With federal laws now in place that encourage university/business relationships, Dr. Ambler encourages and helps both groups to find common ground for a "push" of technology out of the university and a "pull in" of technology needs from businesses.

Juan Cuadra-Sola
Systems/Software Engineer

Juan joined the Center as a graduate student, working part time for CECASE as a system/network administrator. He received his BS degree in Computer Engineering from the University of Kansas in 1991, and his Master's degree in Electrical Engineering in May 1994. His Master's research focused on the application of artificial Intelligence to automated design. On July 1, 1994, Juan became part of the Center's permanent staff as a system administrator and software engineer.

As a Systems/Software Engineer with ITTC, Juan heads the team which maintains and enhances all of the Center's computer and information systems. Juan's main research interests include artificial intelligence, networking, and software engineering.

Daniel DePardo
RF Electronics Engineer



Dan joined the U.S. Army in 1979. He studied at the U.S. Army Intelligence Center, and graduated from the Aerial Surveillance Sensors School, in addition to studying electronic engineering at the University of Arizona. During his tours of duty, he was responsible for support of the various airborne surveillance systems and also provided technical support for the U.S. Army's Electronic Proving Ground, testing a variety of ECM (Electronic Counter Measure) systems.

After his discharge from the Military, Dan worked with a variety of defense electronics organizations and was deeply involved in the design of subassemblies of many currently operational weapons and detection systems.

Dan came to Kansas as an engineering contractor; and after the completion of the project, he accepted a position on the University of Kansas Electrical Engineering and Computer Science Department staff. Due to his involvement with the research efforts of the EECS faculty, Dan was invited to join ITTC, where his primary responsibility is to provide technical support for the ITTC Wireless Communications and Digital Signal Processing laboratories.

Dan's specific areas of expertise include SAW delay line and filter design, photolithograpy techniques, clean room procedures, hybrid circuitry design, environmental testing techniques, Mil-spec soldering and assembly, surface mount component technology, RFI (radio frequency interference) and EMI (electro-magnetic interference) suppression techniques, and radio frequency and microwave components, circuitry, and systems.

His current research interests include the RF electronic hardware section of the DARPA Rapidly Deployable Radio Network (RDRN) and the development of three-dimensional display technologies.

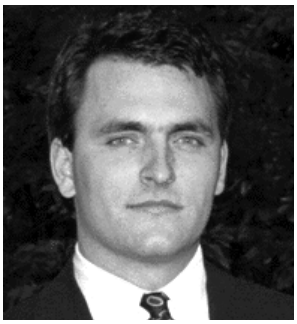
Xiaojun “Harry” Fang
Associate Research Engineer

Xiaojun ("Harry") Fang received his M.S. degrees in Electro-optic Instrumentation and Electrical Engineering in 1988 and 1994, from Dalian University of Technology and Virginia Tech, respectively; and his Ph.D. degree in Electrical Engineering from Virginia Tech in February 1996. He joined ITTC in March 1996. He is currently working on wavelength-division-multiplexing high capacity fiber telecommunication systems, soliton-based systems, high-speed photonic switching, and all-optical-networking. He has published about thirty technical papers and holds six patents/patent disclosures. Dr. Fang is a senior member of IEEE.

Mohan Kambhammettu
Assistant Research Engineer

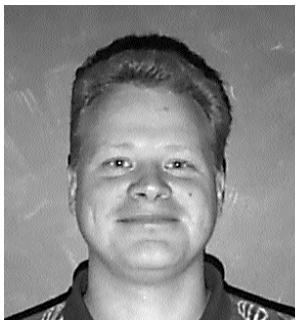
Mohan has been a Research Engineer with ITTC (TISL) since 1995. His research interests include Wireless ATM Networks, Rapid Prototyping, Software Radios, and VHDL synthesis. His current projects include Rapidly Deployable Radio Network (RDRN) funded by the Information Technology Office (ITO) of the Advanced Research Projects Agency (ARPA), and Rapid Prototyping for DSP funded by the Rome Labs. Mohan received his M.S. degree in Electrical Engineering from KU in 1995; his thesis addressed the design and implementation of a real-time algorithm to correct radar signals for Remote Sensing Applications. In 1992 and 1993 Mohan was a software engineer developing application packages on VAX/VMS platform using SQL, DECFORMS, and COBOL at Larsen and Toubro Ltd., one of the top companies in India. He received his B.E. in Electronics and Communications Engineering from Anna University, Madras, India, in 1992.

Craig Sparks
Senior Project Engineer



Craig received his B.S.E.E. at the university of Kansas in Spring 1994 and his M.S.E.E. at KU two years later. His graduate work was in designing and building wireless radios in a project called Rapidly Deployable Radio Networks (RDRN). His areas of expertise include Radio Frequency (RF) and wireless digital communications system design. Craig then worked in the Wireless Local Area Network (WLAN) industry as an RF design engineer before returning to KU in June 1997 to take the position of Senior Project Engineer for the newly formed Information and Telecommunication Technology Center (ITTC). Craig is responsible for the design of a second phase of the RDRN project in addition to overseeing the engineering efforts for all of ITTC's wireless communication projects.

Scott Woodward
Systems Engineer



Scott Woodward joined CECASE as an undergraduate/graduate student in 1992. After graduation in 1994, Scott became a full-time staff engineer with CECASE, concentrating on systems engineering research, requirements specification/systems design, and project management. Since the CECASE-TISL merger which formed ITTC, Scott has concentrated on project management and business development. Scott received both his Bachelor's and Master's degrees in Electrical Engineering from the University of Kansas.

Peggy Williams
Secretary for Research

Peggy joined ITTC in March 1997 and is the ITTC secretarial office's key resource person for research-related documents and functions. In the past she has held positions with the NSF EPSCoR program; Merck & Co., Inc.; CRINC administrative offices; and KU. Peggy's time outside ITTC is filled with raising her five young children.

Wendy Prescott
Student Office Assistant

Wendy joined CECASE in late December 1993 and currently fills the position of student assistant with ITTC. Her duties include assisting administrative staff in various clerical and data processing tasks. She has five years' experience in administrative assistant duties at office supply stores. Wendy is a student at the University of Kansas, working toward her bachelor's degree in Geography.

Nancy Hanson
Office Mgr./Secretary for Operations

Nancy joined CECASE in January 1993 after several years as secretary with another KU Center for Research, Inc., laboratory. At ITTC she coordinates office procedures, handles purchasing records, and manages page-layout/ graphics/ copy editing functions for the Center. Nancy has a B.A. degree from Washburn University, Topeka, and major interests in languages, arts, and the interaction of human cultures with the rest of nature.

Affiliated Faculty

Chris Allen

Assistant Professor, The University of Kansas, 1994–present;

Allied Signal, Kansas City, 1990-1994;

Sandia National Laboratories, New Mexico 1984-1990.

Education

Ph.D. in Electrical Engineering, University of Kansas, Lawrence, 1984.

M.S. in Electrical Engineering, University of Kansas, Lawrence, 1982.

B.S. in Electrical Engineering, University of Kansas, Lawrence, 1980.

Teaching

Electronic circuits,
Fiber optic communication systems,
High frequency circuit design.

Research Interests

High-speed digital technologies and applications,
Fiber optic communication systems,
Lightwave/photonics systems and devices,
Microwave remote sensing,
Synthetic aperture,
Radar design and analysis.

Recent Publications/Presentations

X. Fang, H. Ji, C.T. Allen, K. Demarest, L. Pelz, "A Compound High-Order Polarization-Independent Birefringence Filter Using Sagnac Interferometers," IEEE Photonics Technology Letters, 9(4), 1997, pp. 458-460.

X. Fang, K. Demarest, H. Ji, C.T. Allen, L. Pelz, "A Sub-Nanosecond Polarization-Independent Tunable Filter/Wavelength Router Using a Sagnac Interferometer," accepted (1997) for publication in IEEE Photonics Technology Letters.

X. Fang, H. Ji, L. Pelz, K. Demarest, C.T. Allen, "A DC to Multigigabit/s Polarization-Independent Modulator Based on Sagnac Interferometer," submitted (1997) to IEEE Journal of Lightwave Technology.

C.T. Allen, "Measuring Glacier and Ice Sheet Thickness in Greenland with an Airborne Radio Echosounder," University of Kansas Physics and Astronomy Department Colloquium, November 4, 1996.

Z. Huang, C. Leuschen, C.T. Allen, and R. Plumb, "GPR Simulations of a Buried Concrete Wall for Allied Signal," RSL Technical Report 11910-1, November 1996.

C.T. Allen, "Radar Sounding of Greenland Outlet Glaciers," XXVth General Assembly of the International Union of Radio Science (URSI), Lille, France, September 5, 1996.

C.T. Allen, "Radar Sounding of Glaciers in Greenland," Proceedings of the 1996 International Geoscience and Remote Sensing Symposium (IGARSS '96), Lincoln, NE, May 27-31, 1996.

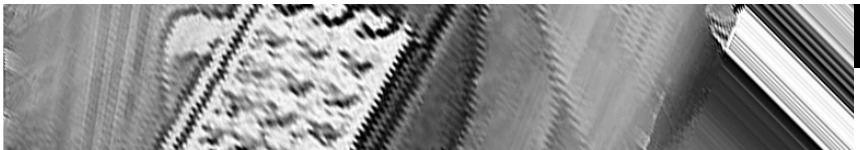
T. Chuah, S. Gogineni, C.T. Allen, and B. Wohletz, "Radar Thickness Measurements over the Southern Part of the Greenland Ice Sheet," RSL Technical Report 10470-2, April 1996.

Professional Affiliations

IEEE,
Silicon Prairie Information Technology Group.

Honors and Awards

Eta Kappa Nu,
Phi Kappa Phi,
Tau Beta Pi.



Swapan Chakrabarti

Associate Professor, The University of Kansas, 1992–present;

Assistant Professor, The University of Kansas, 1986–1992.

Education

Ph.D. in Electrical Engineering, University of Nebraska-Lincoln, 1986.

M.S. in Computational Physics, University of Nebraska-Lincoln, 1982.

M.Sc. in Physics and Electronics (specialization), Calcutta University, India, 1978.

B.Sc. in Physics, Honors, Calcutta University, India, 1976.

Teaching

Digital logic design,
Algorithmic problem solving,
Microcomputer applications,
Computer architecture,
Digital signal processing-I,
Graphics in engineering research,
Computer vision,
Digital signal processing-II (adaptive systems, neural networks, fuzzy systems).

Research Interests

Applications of neural networks and fuzzy systems,
Radar image classification,
Speech signal processing,
Spectrum estimation,
Design of true 3D display system.

Recent Publications/Presentations

S. Chakrabarti, P. Kannagaratnam, and P. Gogineni, "Model-Based Technique for Super Resolution and Enhanced Target Characterization Using a Step-Frequency Radar: A Simulation Study," Proceedings of the 1996 International Geoscience and Remote Sensing Symposium (IGARSS '96), Lincoln, NE, 1996, Vol. 3, May 27-31, pp. 1867-1869.

H. Moradi, S. Chakrabarti, and P. Gogineni, "Learning about Antenna Patterns Using 3D Computer Graphics," in Computer-Aided Electromagnetic Education (CAEME) Software Book, Vol. II, Salt Lake City: University of Utah Dept. of Electrical Engineering, 1995.

S. Chakrabarti, N. Bindal, and K. Theagharajan, "Robust Target Classification Using ANN," IEEE Transactions on Neural Networks, Vol. 6, No. 3, May 1995, pp. 760-766.

Professional Affiliations

IEEE.

Honors and Awards

Honorary member, Golden Key National Honor Society, 1996;
Ned N. Fleming Teaching Award for Outstanding Classroom Teaching, 1992.

Kenneth R. Demarest

Professor, The University of Kansas, 1996–present;

Associate Professor, The University of Kansas, 1987–1996;

Assistant Professor, The University of Kansas, 1984–1987;

Assistant Professor, Lafayette College, 1979–1984;

NASA-ASEE Fellow, NASA Langley Research Center, 1983 and 1984;

Member of Technical Staff, Bell Telephone Laboratories, 1982.

Education

Ph.D., Ohio State University, 1976.

M.S.E.E., Ohio State University, 1976.

B.S.E.E., John Brown University, 1974.

Teaching

Circuits,
Fiber optic engineering,
Electromagnetics,
Microwave systems,
Noise reduction in electrical systems,
Antennas,
Radar engineering,
Laser engineering.

Research Interests

Computational electromagnetic techniques,
Lightwave systems.

Recent Publications/Presentations

X. Fang, H. Ji, C.T. Allen, K. Demarest, L. Pelz, "A Compound High-Order Polarization-Independent Birefringence Filter Using Sagnac Interferometers," IEEE Photonics Technology Letters, 9(4), 1997, pp. 458-460.

X. Fang, K. Demarest, H. Ji, C.T. Allen, L. Pelz, "A Sub-Nanosecond Polarization-Independent Tunable Filter/Wavelength Router Using a Sagnac Interferometer," accepted (1997) for publication in IEEE Photonics Technology Letters.

X. Fang, H. Ji, L. Pelz, K. Demarest, C.T. Allen, "A DC to Multigigabit/s Polarization-Independent Modulator Based on Sagnac Interferometer," submitted (1997) to IEEE Journal of Lightwave Technology.

K. Demarest, "Waveguides", Handbook of Electronics (ed. J. Whitaker), CRC Press, 1996, pp. 259-268.

P. Chaturvedi, R. Plumb, Z. Huang, K. Demarest, "Three-Dimensional Electromagnetic Imaging of Dielectric Scatterers," Journal of Electromagnetic Waves and Applications, Vol. 10, No. 7, 1996, pp. 955-972.

Z. Huang, K. Demarest, R. Plumb, "A Novel Technique of Modeling GPR Antennas," Proceedings of theSixth International Conference on Ground-Penetrating Radar, GPR '96, Sendai, Japan, October 1996, pp. 57-60.

K. Demarest, Z. Huang, R. Plumb, "An FDTD Near- to-Far-Zone Transformation for Scatterers Buried in Stratified Grounds," IEEE AP-S Transactions, Vol. AP-44, No. 8, August 1996, pp.1150-1157.

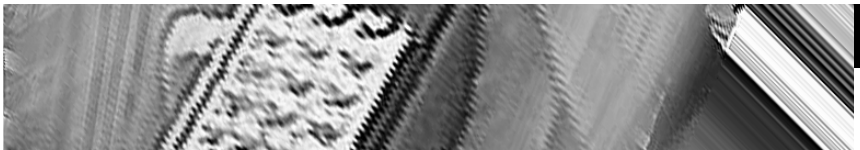
Z. Huang, K. Demarest, R. Plumb, "Ground-Penetrating Radar Antenna Modeling," IGARSS '95 Digest, Lincoln, Nebraska, May 27-31, 1996, pp. 778-780.

Professional Affiliations

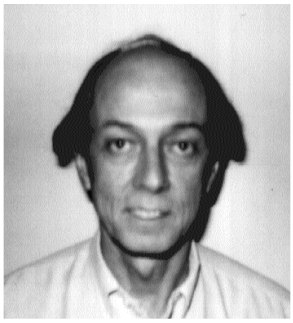
Electromagnetic Fields (EMF) Advisory Committee, IEEE, Kansas Electric Utilities Research Program (KEURP), URSI Commission B.

Honors and Awards

Eta Kappa Nu.



Tyrone E. Duncan



Professor, Mathematics, The University of Kansas, 1979-present;

Associate Professor, Mathematics, The University of Kansas, 1974-1978;

Associate Professor, Applied Mathematics & Statistics, State University of New York, Stony Brook;

Assistant Professor, Aerospace Engineering, University of Michigan, 1967-1971;

Visiting Scholar & Research Fellow, Division of Applied Sciences, Harvard University, 1979-1980;

Gastprofessor, Institut fur Angewandte Mathematic und Informatik, Universitat Bonn, 1978-1979;

Consultant, RAND Corporation, 1964.

Education

Ph.D., Electrical Engineering, Stanford University, 1967.

M.S., Electrical Engineering, Stanford University, 1964.

B.E.E., Rensselaer Polytechnic Institute.

Teaching

Stochastics of mathematical finance,
Stochastic analysis and its applications,
Stochastic adaptive control of linear partial differential equations,
Applied mathematics seminar,
Differential equations,
Probability theory.

Research Interests

Explicitly solvable stochastic control problems,
Stochastic control of distributed parameter systems,
Stochastic adaptive control of linear and nonlinear systems,
Mathematics of finance and stochastic modeling,
Mathematics and telecommunication,
Math education.

Recent Publications/Presentations

T. Duncan, B. Pasik-Duncan, L. Stettner, "Discretized Maximum Likelihood Estimates for Adaptive Control of Ergodic Markov Models," to appear in SIAM J. Control Optim.

T. Duncan, "Identification and Control of a Stochastic Manufacturing System with Noisy Demand," Lec. Appl. Math., Amer. Math. Soc., 1997, 33:83-88.

T. Duncan, L. Guo, B. Pasik-Duncan, "Adaptive Continuous Time Linear Quadratic Gaussian Control," submitted (1997) to IEEE Transactions Autom. Control.

T. Duncan, B. Pasik-Duncan, "Stochastic Adaptive Control," The Controls Handbook (ed. W.S. Levine), CRC Press, 1127-1136, 1996.

Joseph B. Evans

Associate Professor, The University of Kansas, 1994–present;

Assistant Professor, The University of Kansas, 1989-1994;

Post-doctoral position, AT&T Bell Laboratories, 1988-1989.

Education

Ph.D., Princeton University, 1989.

M.S., Princeton University, 1986.

M.S.E., Princeton University, 1984.

B.S.E.E., Lafayette College, 1983.

Teaching

Networking implementation,
DSP implementation,
Computer systems design I & II,
Integrated circuit design,
VLSI,
Electronics,
Programming,
Electrical engineering projects.

Research Interests

High speed (gigabit) networks,
Mobile and wireless systems,
Signal processing.

Recent Publications/Presentations

S. F. Bush, J.B. Evans, V. S. Frost, "Mobile ATM Buffer Capacity Analysis," ACM/Baltzer Mobile Networks and Nomadic Applications (NOMAD): Topical Journal on Mobility of Systems, Users, Data and Computing, Vol. 1, No.1, 1996 .

A. Kulkarni, G. Minden, V. Frost, and J. Evans, "An Active Network Architecture for ATM WANs," Third International Workshop on Mobile Multimedia Communications, Princeton, NJ, Sept. 25-27, 1996.

G.Y. Lazarou, V.S. Frost, J.B. Evans, D. Niehaus, "Using Measurements to Validate Simulation Models of TCP/IP over High Speed ATM Wide Area Networks," Proceedings of IEEE International Conference on Communications (ICC '96), Dallas, TX, June 1996.

J. Evans, D. Niehaus, D. Petr, V. Frost, G. Minden, B. Ewy, "A 622 Mb/s LAN/WAN Gateway and Experiences with Wide Area ATM Networking," IEEE Network, Vol. 10, No. 3, May/June 1996, pp. 40-48.

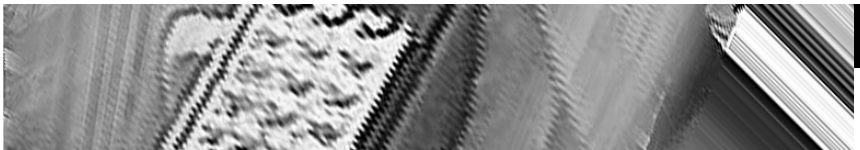
J.B. Evans, "VLSI Implementation of Digital Filters," in Circuit and Filter Handbook, section 16.5, CRC Press, 1995 .

Professional Affiliations

ACM, ASEE, IEEE, IEEE Computer Society, DSP Technical Committee.

Honors and Awards

Eta Kappa Nu;
Tau Beta Pi;
Miller Award for Research, 1996;
AT&T Bell Laboratories Ph.D. Scholarship, 1984–1988;
Garden State Graduate Fellowship, 1983–1987.



Victor S. Frost

Dan F. Servey Distinguished Professor, The University of Kansas, 1997-present;

Professor, The University of Kansas, 1992–1997;

Executive Director, Research, Information and Telecommunications Technology Center, 1987–present;

Director, Telecommunication and Information Sciences Laboratory (TISL),1987–1996;

Associate Professor, The University of Kansas, 1986–1992;

Associate Director, TISL, 1986–1987;

Assistant Professor, The University of Kansas, 1982–1986;

Member of Technical Staff at AT&T Information Systems Laboratory, Summer 1985;

United States Air Force Summer Faculty Fellow at Rome Labs;

Visiting Scientist, German Aerospace Research Establishment Institute for High Frequency, West Germany, 1981;

President, ST*AR Corporation, 1979–1981.

Education

Ph.D., Electrical Engineering, The University of Kansas, 1982.

M.S., Electrical Engineering, The University of Kansas, 1978.

B.S., Electrical Engineering, The University of Kansas, 1977.

Teaching

Communication networks and systems.

Research Interests

Communication networks and systems.

Recent Publications/Presentations

V.S. Frost, B. Melamed, "Modeling and Simulation of Telecommunications Networks," The Froehlich/Kent Encyclopedia of Telecommunications (ed. Fritz E. Froehlich, Allen Kent, Carolyn M. Hall), Marcel Dekker, Inc., New York, Vol. 11, 1996.

D.W. Petr, V.S. Frost, T. Kelley, C. Braun, and A. Demirjis, "Cell Loss Quality of Service in an Integrated Traffic ATM Network," International Journal of Communications Systems, Vol. 9, 1996, pp. 97-104.

S.F. Bush, J.B. Evans, V.S. Frost, "Mobile ATM Buffer Capacity Analysis," ACM-Baltzer Mobile Networks and Nomadic Applications (NOMAD): Topical Journal on Mobility of Systems, Users, Data and Computing, Vol. 1, No. 1, 1996.

J.B. Evans, D. Niehaus, D.W. Petr, V.S. Frost, G.J. Minden, B. Ewy, "A 622 Mb/s LAN/WAN Gateway and Experiences with ATM Networking," IEEE Network Magazine, Vol. 10, No 3, May/June 1996, pp 40-48.

H. Zhu, V.S. Frost, "In-Service Monitoring for Cell Loss Quality of Service Violations in ATM Networks," IEEE/ACM Transactions on Networking, Vol. 4, No. 2, April 1996.

Professional Affiliations

IEEE, Kansas City Area Silicon Prairie Technology Association.

Honors and Awards

Eta Kappa Nu;
Sigma Xi;
Tau Beta Pi;
National Electrical Engineering Honor Society;
National Engineering Honor Society;
Dan F. Servey Distinguished Professor of Electrical Engineering and Computer Science, 1996;
Keynote Address, 18th Biennial Symposium on Communications, Kingston, Ontario;
1991 Miller Award for Distinguished Service to Engineering;
1986 Miller Award for Distinguished Service to Engineering Research;
National Science Foundation Presidential Young Investigator Award, 1984;
Society of Automotive Engineers Ralph R. Teetor Educational Award, 1984.

John M. Gauch

Associate Professor, The University of Kansas, 1996 - present;

Assistant Professor, The University of Kansas, 1993–1996;

Assistant Professor, Northeastern University, 1989–1993.

Education

Ph.D. in Computer Science, University of North Carolina at Chapel Hill, 1989.

M.Sc. in Computer Science, Queen's University at Kingston, Ontario, 1982.

Honours B.Sc. in Computer Science, Queen's University at Kingston, Ontario, 1981.

Teaching

Algorithmic problem solving,
Structured programming,
Computer vision,
Image processing,
Computer graphics,
Digital image processing.

Research Interests

Computer Vision (video segmentation, motion analysis, deformable models, multiscale analysis, shape description),
Image Processing (segmentation, contrast enhancement, color image processing),
Computer Graphics (volume visualization, graphical user interfaces).

Recent Publications/Presentations

J. M. Gauch, "Image Segmentation and Analysis via Multiscale Gradient Watersheds," IEEE Trans. on Image Processing, 1996.

S. E. Gauch, W. Li, J. M. Gauch, "The VISION Digital Video Library," Information Processing and Management, 1996.

H.H. Pien, J.M. Gauch, "A Variational Approach to Multi-Sensor Fusion of Images," Applied Intelligence, Vol. 5, No. 3, July 1995, pp.217-235.

J. Lai, J.M. Gauch, J.D. Crisman, "Computing Optical Flow in Color Image Sequences," Innovation and Technology in Biology and Medicine (special issue on motion analysis in biomedical images), Vol. 15, No. 3, 1994.

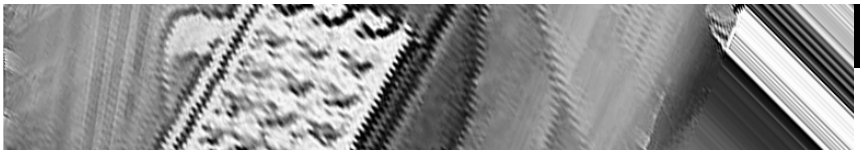
J.M. Gauch, "Multiresolution Image Shape Description," Springer Series in Perceptual Engineering (series ed. Ramesh C. Jain), New York: Springer-Verlag, 1992.

Professional Affiliations

ACM, IEEE Computer Society, SPIE.

Honors and Awards

Francois Erbsman award for the best paper by a young investigator at the 10th Information Processing in Medical Imaging Conference in Utrecht, June 1987.



Susan Gauch

Assistant Professor, The University of Kansas, 1993–present;

Senior Research Scientist, Northeastern University, 1991–1993;

Visiting Assistant Professor, Wellesley College, 1989–1991.

Education

Ph.D. in Computer Science, University of North Carolina at Chapel Hill, 1990.

M.Sc. in Computer Science, Queen's University at Kingston, Ontario, Canada, 1982.

Honours B.Sc. in Mathematics & Computer Science, Queen's University at Kingston, Ontario, Canada, 1981.

Teaching

Algorithmic problem solving,
Structured programming,
Information retrieval,
Software engineering,
Intelligent agents.

Research Interests

Full-text information retrieval,
Multimedia databases,
Intelligent search agents,
Searching the World Wide Web,
Corpus Linguistics.

Recent Publications/Presentations

S. Gauch, J. Wang, "Corpus Analysis for TREC-5 Query Expansion," TREC-5: The 5th Annual Text Retrieval Conf., Gaithersburg, MD, November 1996.

S. Gauch, G. Wang, "Information Fusion with ProFusion," WebNet '96: The First World Conference of the Web Society, San Francisco, CA, October 1996, pp. 174-179.

S. Gauch, G. Wang, M. Gomez, "ProFusion: Intelligent Fusion from Multiple, Distributed Search Engines," Journal of Universal Computer Science, Vol. 2 (9), September 1996 (invited paper).

W. Li, S. Gauch, J. Gauch, K.M. Pua, "VISION: A Digital Video Library," ACM Digital Libraries '96, March 1996, pp. 19-27.

C. Deniau, M. Swink, R. Aust, J. Evans, S. Gauch, J. Miller, D. Niehaus, "The UNITE Project: Distributed Delivery and Contribution of Multimedia Objects over the Internet," Proceedings of INET'95: The 5th Annual Conference of the Internet Society, Honolulu, HI, June 1995, pp. 91-99.

Professional Affiliations

ACM, ACM/SIGIR, ASIS, IEEE, IEEE Computer Society, Silicon Prairie Information Technology Group.

Honors and Awards

ONR Fellowship, 1988;
NF Dupris Prize in Mathematics, 1978;
Project Engineer, The University of Kansas Center for Research, 1973–1979.

Gary J. Minden

Associate Professor, The University of Kansas, 1987–present;

Program Manager, Advanced Research Project Agency (ARPA),1994 -1996 (on leave of absence from University of Kansas);

Visiting Engineer, Digital Equipment Corporation System Research Center, Palo Alto, California, 1991;

Assistant Professor, The University of Kansas, 1981–1987;

Visiting Engineer, TRW, Inc., Redondo Beach, California, Summer 1982;

V.P. Systems Architecture, CHILD, Inc., Ann Arbor, MI, 1975–1981;

Project Engineer, The University of Kansas Center for Research, 1973–1979.

Education

Ph.D. Electrical Engineering, The University of Kansas, 1982.

B.S. Electrical Engineering, The University of Kansas, 1973.

Teaching

Digital systems design,
Computer architecture,
Software engineering II,
Computer engineering system design.

Research Interests

Digital systems,
Microprocessors,
Artificial intelligence.

Recent Publications/Presentations

A. Kulkarni, G. Minden, V. Frost, J. Evans, "An Active Network Architecture for ATM WANs," Proceedings, IEEE Third International Workshop on Mobile Multimedia Communications, Princeton, NJ, September 25-27, 1996.

J.B. Evans, V.S. Frost, D. Niehaus, D.W. Petr, G.J. Minden, B.J. Ewy, "MAGIC Testbed Results," IEEE Hot Interconnects Conference, Stanford, California, August 14-16, 1996.

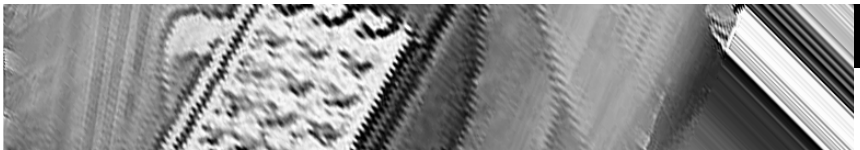
J. Evans, D. Niehaus, D. Petr, V. Frost, G. Minden, B. Ewy, "A 622 Mb/s LAN/ WAN Gateway and Experiences with Wide Area ATM Networking," IEEE Networking, Vol. 1, No. 3, May 1996.

Professional Affiliations

ACM, IEEE, Computer Professionals for Social Responsibilities.

Honors and Awards

Eta Kappa Nu.



Douglas Niehaus

Assistant Professor, The University of Kansas, 1993–present;

Senior Software Engineer, Convergent Technologies, 1986–1987;

Member of Technical Staff, AT&T Bell Laboratories, AT&T Information Systems, 1981–1986.

Education

Ph.D., Computer Science, University of Massachusetts, 1994.

M.S., Computer, Information and Control Engineering, University of Michigan, 1981.

B.S., Computer Science, Northwestern University, 1980.

Teaching

Real time & multimedia systems,
Operating systems,
Software engineering,
Distributed systems.

Research Interests

Real-time and conventional distributed systems,
Operating systems,
Programming environments,
High performance networking.

Recent Publications/Presentations

A. Kaushal, S. Shumate, R. Hill, D. Niehaus, V. Sirkay, B. Edwards, “Performance Benchmarking of ATM Signaling Softwre,” Proceedings of the OpenSig Workshop, Columbia University, October 1996.

J.B. Evans, V.S. Frost, D. Niehaus, R. Jonkman, L. Dasilva, B. Lee, G. Lazarou, "AAI ATM WAN Performance Tools, Experiments, and Results," 1996 DARPA Workshop on Wide-Area ATM Performance, Lawrence, Kansas, June 19-20, 1996.

G.Y. Lazarou, V.S. Frost, J.B. Evans, D. Niehaus, “Using Measurements to Validate Simulation Models of TCP/IP over High Speed ATM Wide Area Networks,” Proceedings of IEEE International Conference on Communications (ICC ‘96), Dallas, TX, June 1996.

Professional Affiliations

ACM, ACM/SIGOPS, ACM/SIGPLAN, ACM/SIGARCH.

Honors and Awards

Tau Beta Pi.

Karen J. Nordheden

Assistant Professor, The University of Kansas, 1994–present;

Senior Process Engineer, Electronics Laboratory, Martin Marietta Corporation, Syracuse, New York, 1993-1994;

Senior Process Engineer, Electronics Lab, General Electric, Syracuse, New York, 1990-1993;

Process Engineer, Electronics Lab, General Electric, Syracuse, New York, 1988-1990.

Education

Ph.D. in Electrical Engineering, University of Illinois at Urbana, 1988.

M.S. in Electrical Engineering, University of Illinois at Urbana, 1984.

B.S. in Physics, Michigan State University, 1980.

Teaching

Semiconductor device fabrication, Electrical devices, Properties of materials.

Research Interests

Plasma processing of semiconductors, Lightwave technology.

Recent Publications/Presentations

L.W. Yang, J.J. Komiak, M.Y. Kao, D.E. Houston, D.P. Smith, K.J. Nordheden, "E-Beam Re-Aligned HBTs and a New Broadband MMIC Power Amplifier Using Bathtub as Heat Sink," IEEE IEDM Tech. Digest, San Francisco, CA, December 11-14, 1994, pp. 203-206.

L.W. Yang, J.J. Komiak, D.P. Smith, M.Y. Kao, R.S. Brozovich, K.J. Nordheden, D.R. Helms, D.E. Houston, F.R. Bardsley, "Manufacturing Technology for High Performance HBT Linear Power Amplifiers," IEEE GaAs Symp. Tech. Digest, Philadelphia, PA, October 16-19, 1994, pp. 127-130.

L.W. Yang, P. Ho, J.J. Komiak, R.S. Brozovich, K.J. Nordheden, M.Y. Kao, D.P. Smith, D.E. Houston, D.R. Helms, "Manufacturing Technology for Fabrication of High Performance AlGaAs/GaAs HBTs and Broadband MMIC Amplifiers," GaAs Manufacturing Conference (MANTECH), Las Vegas, NV, May 1994.

P.C. Chao, M.Y. Kao, K. Nordheden and A.W. Swanson, "HEMT Degradation in Hydrogen Gas," IEEE Electron Device Lett., Vol. 15, No. 5, 1994, pp. 151-153.

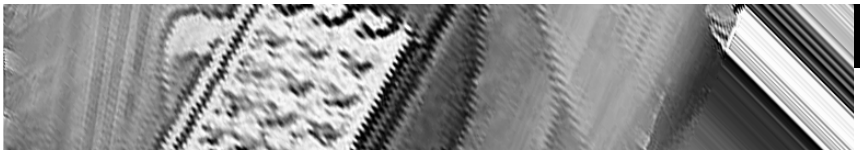
V.S. Wang, R.J. Matyi, and K.J Nordheden, "Triple Crystal X-Ray Diffraction Analysis of Reactive Ion Etched Galluim Arsenide," Journal of Applied Physics, Vol. 75, No. 8, 1994, p. 3835.

Professional Affiliations

IEEE, American Vacuum Society (AVS), American Physical Society (APS), Materials Research Society (MRS).

Honors and Awards

Eta Kappa Nu,
Golden Key,
Phi Kappa Phi,
Tau Beta Pi.



Bozenna Pasik-Duncan

Professor, Mathematics,
The University of Kansas, 1993–present;

Associate Professor, Mathematics,
The University of Kansas, 1989-1993;

Assistant Professor, Mathematics,
The University of Kansas, 1987-1989;

Instructor, Mathematics Department,
The University of Kansas, 1984-1987;

Assistant Professor, Mathematics,
Warsaw School of Economics,
1978-1984.

Education

Habilitation Doctorate Degree (the highest European degree), Department of Mathematics, Warsaw School of Economics, 1986.

Ph.D., Department of Mathematics, Warsaw School of Economics, 1978

Diploma, the 2 year Pedigogical Program, Warsaw School of Economics, 1976.

M.Sc., Department of Mathematics, Warsaw University.

Teaching

Stochastic adaptive control;
Statistics of stochastic processes;
Continuous time adaptive control;
Optimization theory;
Dynamical systems;
Stochastic processes,
Honors calculus I, II, III;
Stochastic adaptive control seminar.

Research Interests

Stochastic adaptive control of distributed parameter systems,
Stochastic adaptive control of partially observed systems and computational aspects of stochastic control,
Mathematics education at elementary schools,
Mathematics education for women in science and engineering.

Recent Publications/Presentations

B. Pasik-Duncan, "Stochastic Adaptive Control," to appear in IMA Volumes in Mathematics and its Applications, Springer-Verlag.

B. Pasik-Duncan, T. Duncan, L. Stettner, "On Adaptive Control of Discrete Time Markov Processes by the Method of Large Deviations," submitted to SIAM J. Control Optim., 1997.

B. Pasik-Duncan, H.F. Chen, T. Duncan, "A Stochastic Approximation Algorithm with Random Differences," Proc. IFAC 1996 World Congress, San Francisco.

B. Pasik-Duncan, T. Duncan, P. Mandl, "Numerical Differentiation and Parameter Estimation in Higher Order Stochastic Systems," Proc. 33rd Conf. on Decision and Control, Orlando, 1994, 1666-1671.

Professional Affiliations

IEEE Control Systems Society,
Associate Editor of IEEE Transactions on Automatic Control from 1990-1994,
Appointed member of the Board of Governors of IEEE Control System Society from 1991-199, current chair of the standing committees on Assistance of Engineers at Risk and "Women in Control," Associate Editor-at-Large of IEEE Transactions on Automatic Control, member of the Board of Governors of the IEEE Control Systems Society, Vice President of the IEEE Control Systems Society.

Honors and Awards

NSF Career Advancement Award,
Excellence in Teaching Award from the Ministry of Higher Education and Sciences in Poland,
Several Chancellor's Awards from the Warsaw School of Economics,
IREX Scholar to US in 1982,
USA coordinator of Polish Mathematicians,
SIAM Master Program Committee,
Kemper Fellowship for Teaching Excellence and Advising in Public Outreach.

David W. Petr

Associate Professor, The University of Kansas, 1995–Present;

Assistant Professor, The University of Kansas, 1990–1995;

Member of Technical Staff, AT&T Bell Laboratories, 1977–1986.

Education

Ph.D.E.E., The University of Kansas, 1990, Honors

M.S.E.E., Stanford University, 1978

B.S.E.E., Southern Methodist University, 1976, Highest Honors

Teaching

Circuits,
Communication systems,
Integrated telecommunication networks,
Optimization with applications,
Random signals,
Signal analysis.

Research Interests

Communication networks (packet switching, congestion control, traffic integration, performance analysis),
Optimization (dynamic programming),
Digital signal processing (speech coding),
Adaptive Systems.

Recent Publications/Presentations

J. Keimig, D.W. Petr, "Effects of Search Depth and Schedule Placement on WRR Schedules," Technical Report TISL-11230-02, December 1996.

K. Liu, H. Zhu, D.W. Petr, V.S. Frost, C. Braun, W.L. Edwards, "Design and Analysis of a Bandwidth Management Framework for ATM-Based Broadband ISDN," Proceedings of the IEEE International Conference on Communications (ICC), June 1996, pp. 1712-1716.

Q. Hu, D.W. Petr, C. Braun, "Self-Tuning Fuzzy Traffic Rate Controller for ATM Networks," Proceedings of the IEEE International Conference on Communications (ICC), June 1996, pp. 424-428.

J.B. Evans, D. Niehaus, D.W. Petr, V.S. Frost, G.J. Minden, B.J. Ewy, "A 622 Mb/s LAN/WAN Gateway and Experiences with Wide Area ATM Networking," IEEE Network, Vol. 10, No. 3, May/June 1996, pp. 40-48.

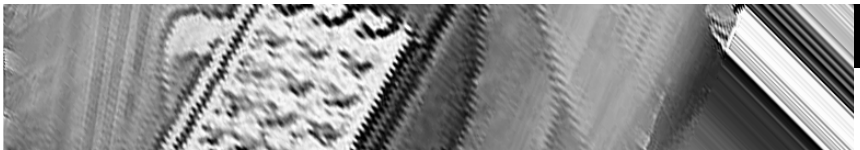
D.W. Petr, V.S. Frost, C. Braun, T.G. Kelley, A. Demirtjis, "Cell Loss Quality of Service in an Integrated Traffic ATM Network," International Journal of Communication Systems, Vol. 9, No. 2, March-April 1996, pp. 97-104.

Professional Affiliations

IEEE (senior member), American Society for Engineering Education (ASEE).

Honors and Awards

Eta Kappa Nu;
Sigma Xi Honor Society;
Tau Beta Pi;
IEEE Frank A. Cowan Scholarship for Graduate Study in Communications (1987–1988);
University of Kansas Center for Research, Graduate Fellowship (1987–1989);
International Communications Association Scholarship for Graduate Study in Communications (1987–1989);
AT&T Bell Laboratories nominee for Eta Kappa Nu Outstanding Young Electrical Engineer (1984).



Glenn E. Prescott

Associate Professor, The University of Kansas, 1989–present;

Assistant Professor, Air Force Institute of Technology, 1984–1989;

Adjunct Associate Professor, Wright State University, 1987–1988;

Adjunct Assistant Professor, Wright State University, 1984–1987.

Education

Ph.D., Electrical Engineering, Georgia Tech, 1984.

M.S., Electrical Engineering, University of Missouri, 1977.

B.E., Electrical Engineering, Georgia Tech, 1974.

Teaching

Digital signal processing,
Digital communications,
Electronic design,
Modulation and coding,
Linear systems.

Research Interests

Digital signal applications for communications and radar;
Digital communications;
Military radio systems;
Low probability of intercept communications;
Time-frequency signal analysis.

Recent Publications/Presentations

G. Prescott, H. Chakravarthula, S. Sivaprakasam, T. Johnson, "Multiprocessor Implementation of a Real-Time CELP Algorithm," USAF Rome Laboratory Technical Report, RL-TR-96-174, November 1996.

T. Farrell and G. Prescott, "Detection and Extraction of Features of LPI Signal Features Using Quadrature Mirror Filter Banks," AFOSR Final Technical Report, AFOSR Grant #F49620-93-1-0404, October 1996.

T. Farrell, G. Prescott, "A Quadrature Mirror Filter Hopped Spread Spectrum System," 1996 Military Communications Conference, McLean, VA, October 1996, pp. 21-24.

T. Farrell, G. Prescott, "Detection of Fast Frequency Hop Signals with Quadrature Mirror Filter Banks," 1996 International Conference on Acoustics, Speech and Signal Processing (ICASSP-96), May 1996.

R.F. Mills, G. E. Prescott, "A Comparison of Various Radiometer Detection Models," IEEE Transactions on Aerospace and Electronic Systems, January 1996.

Professional Affiliations

IEEE (senior member), American Society for Engineering Education, Armed Forces Communications Electronics Association, American Radio Relay League, Air Force Association, Air Force Sergents Association.

Honors and Awards

Eta Kappa Nu, Delta Xi Chapter;
AFOSR Summer Faculty Research Fellowship, USAF Rome Laboratory, Griffiss AFB, NY, 1 June - 31 July 1996;
R&D Peer Review member, Wright-Patterson AFB, Ohio, 1993;
Outstanding Instructor of the Year, 1987.

Paul Rich

Associate Professor, The University of Kansas, 1996-present;
Assistant Professor,The University of Kansas, 1991-1996;
Postdoctoral Fellow, National Science Foundation, 1990-1992;
Postdoctoral Fellow, Stanford University, 1988-1990;
Postdoctoral Fellow, Los Alamos National Laboratory, 1986-1988.

Education

Ph.D., Biology, Harvard University, 1985.

M.A., Biology, Harvard University, 1981.

B.A., Biology & Environmental Studies, University of California at Santa Cruz, 1979.

Teaching

Principles of environmental studies,
Field work in environmental studies,
Field ecology,
Principles of ecology,
Advanced ecology,
Advanced workstation geographical information systems (ARC/INFO and GRID on SUN Sparc 2),
Conservation and wildlife biology,
Advanced topics in conservation biology.

Research Interests

Canopy architecture of boreal forests: using hemispherical photography for study of radiative transport and leaf area index,
Large-scale conservation biology (Brunca Region of Costa Rica),
Geographical information system (GIS) database (Brunca Region, Costa Rica),
Three-dimensional architecture of plant canopies,
National Geospatial Data Clearing-house (NGDC) Node for geospatial data concerning biological resources (Central America),
GIS-based biophysical models of habitat,
Integrative solar radiation models,
Database management system (DBMS) and geographic information system (GIS) facilities (Kansas Ecological Reserves, KER),
Long-term population and community ecology in an experimentally fragmented landscape.

Recent Publications/Presentations

P.M. Rich, N.M. Holbrook, N. Luttinger, "Leaf Development and Crown Geometry of Two Iriarteoid Palms." American Journal of Botany, 1995, 82:328-336.

P.M. Rich, W.A. Hetrick, S.C. Saving, "Modeling Topographic Influences on Solar Radiation: a Manual for the SOLARFLUX Model," Los Alamos National Laboratory Report LA-12989-M, 1995.

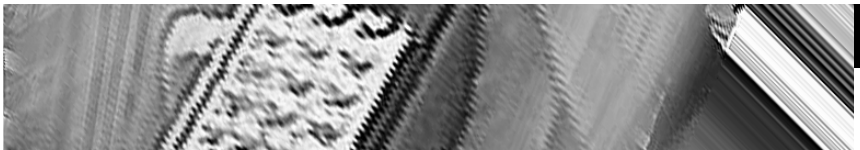
P.M. Rich, D.A. Clark, D.B. Clark, S.F. Oberbauer, "Long-Term Study of Solar Radiation Regimes in a Tropical Wet Forest Using Quantum Sensors and Hemispherical Photography, Agricultural and Forest Meteorology, 1993, 65:107-127.

Professional Affiliations

American Society for Photogrammetry and Remote Sensing, Association for Tropical Biology, Botanical Society of America, Ecological Society of America, North American Association for Environmental Education, Palm Society, Sigma Xi, Society for Conservation Biology, Society for the Study of Evolution.

Honors and Awards

Commended by KU Department of Systematics & Ecology for role as chair of Long-Range Planning Committee (1994); nominated for NSF Presidential Faculty Fellowship (1992); NSF Postdoctoral Fellowship (1990-92); Stanford University Postdoctoral Fellowship (1988-90); Los Alamos Postdoctoral Fellowship (1986-88); Smithsonian Postdoctoral Fellowship (1986, declined); Jessie Noyes Fellowship through the Organization for Tropical Studies (1984-87); Smithsonian Tropical Research Institute Graduate Fellowship (1985-86); NSF Dissertation Improvement Grant (1984-85); Fulbright Fellowship (1983-85); Organization for Tropical Studies Fellowship (1982-83); Atkins Fellowship, Harvard (1982-83); Sigma Xi Award (1981-82); President's Undergraduate Fellowship, UCSC (1978-79); Chancellor's Research Award, UCSC (1977-78); Natural History Honors Program, UCSC (1976-79); Piedra Blanca Scholarship, UCSC (1974-75).



James A. Roberts

Professor and Chairman, EECS, The University of Kansas, 1990–present;

Manager, TRW Denver Operations, 1987–1990;

Program Manager, TRW, 1983-1987;

Adjunct Lecturer in EECS, Santa Clara University, 1978–1983;

MTS, Dept.. Mgr., Lab. Mgr., ESL Inc., 1969–1983;

Member of Technical Staff, RCA, 1966–1969;

Research Assistant, RSL, The University of Kansas, 1965-1966.

Education

Ph.D., Electrical Engineering, Santa Clara University, 1979.

M.S., Electrical Engineering, Massachusetts Institute of Technology, 1968.

B.S., Electrical Engineering, The University of Kansas, 1966.

Teaching

Statistical communication theory,
Stochastic processes,
Fading channel communications,
Information theory and coding,
Electric circuits,
Introduction to the profession.

Research Interests

Wireless communication systems,
Spread-spectrum communications,
Telecommunication networks,
Information theory,
Statistical communication theory.

Recent Publications/Presentations

M. Mangal, V.K. Paulrajan, J.A. Roberts, "CDMA Cellular Capacity Assessment," TR-11880-01, Telecommunications and Information Sciences Laboratory, The University of Kansas Center for Research, Inc., December 1996.

V.J. Paulrajan, J.A. Roberts, D.L. Machamer, "Capacity of a CDMA Cellular System with Variable User Data Rates," Proc. IEEE GLOBECOM'96, London, UK, November 18-22, 1996, pp. 1458-1462.

M.C. Kong, J.A. Roberts, "Teaching Computing Service Courses for Fun and Profit," Proc. FIE'96, Salt Lake City, UT, November 6-9, 1996, pp. 7a4.21-7a4.24.

V.K. Paulrajan, J.A. Roberts, "Rapidly Deployable Radio Network (RDRN) Link Budget," TR-10920-18, Telecommunications and Information Sciences Laboratory, The University of Kansas Center for Research, Inc., May 1996.

J.R. Abeysinghe, J.A. Roberts, "Bit Error Rate Performance of Antenna Diversity Systems with Channel Correlation," Proc. of IEEE GLOBE COM'95 Conf., Singapore, November 13-17, 1995.

Professional Affiliations

IEEE, ACM, American Association for Engineering Education, K*STAR NSF EPSCoR, Registered Professional Engineer in Kansas, FCC General Radiotelephone License (Ship Radar Endorsement).

Honors and Awards

Tau Beta Pi;
Eta Kappa Nu;
Sigma Xi;
Omicron Delta Kappa;
Listed in American Men and Women of Science, Who's Who in the Midwest, and Who's Who in Science and Technology;
President of the Central States Electrical Engineering Department Heads Association;
Selected as Education Society co-Program Chair, FIE'98;
Selected as General Chair, FIE'2000;
Selected to chair the Salary Survey for the National Electrical Engineering Department Heads Association.

Kim Roddis

Licensed Professional Engineer, States of Massachusetts and Kansas;

Associate Professor, Civil Engineering, University of Kansas, 1994-present;

Assistant Professor, Civil Engineering, University of Kansas, 1988-1994.

Education

Ph.D., Civil Engineering, Massachusetts Institute of Technology, 1989.

M.S., Civil Engineering, Massachusetts Institute of Technology, 1987.

B.S., Civil Engineering, Massachusetts Institute of Technology, 1977.

Teaching

Structural design,
Advanced steel design,
Knowledge based expert systems in engineering.

Research Interests

Applications of artificial intelligence to civil and structural engineering;
Design of computer-aided tools for civil engineering;
Qualitative, quantitative, and causal reasoning;
Nondestructive testing and evaluation of structures;
Fatigue and fracture in steel bridges;
Structural failure assessment.

Recent Publications/Presentations

W.M.K. Roddis, J. Bocox, "Case-Based Approach for Bridge Fabrication Errors," Journal of Computing in Civil Engineering, American Society of Civil Engineers, Vol. 11, No. 2, April 1997, pp. 84-91.

H.G. Melhem, W.M.K. Roddis, S. Nagaraja, M.R. Hess, "Knowledge Acquisition and Engineering for a Steel Bridge Fabrication Expert System," Journal of Computing in Civil Engineering, American Society of Civil Engineers, Vol. 10, No. 3, July 1996, pp. 248-256.

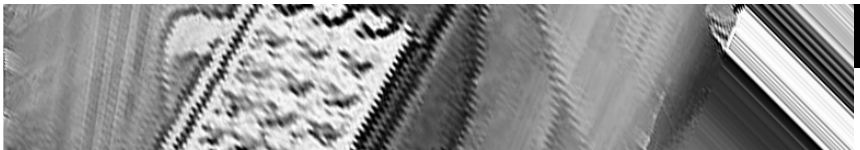
W.M.K. Roddis, M. Hess, H. Melhem, S. Nagaraja, "BFX: An Operational Expert System for Bridge Fabrication," Transportation Research Record, TRB, No. 1491, Transportation Research Board, pp. 62-68, 1995.

Professional Affiliations

American Association for Artificial Intelligence, American Concrete Institute, American Institute of Steel Construction, American Society of Civil Engineers, American Society for Engineering Education, Society of Women Engineers, Transportation Research Board.

Honors and Awards

Miller Engineering Research Award, School of Engineering, University Of Kansas, 1997;
Quest for the Best Faculty Competition, Academic Computing Services, University of Kansas, 1993;
Harold E. Lobdell Distinguished Service Award, Alumni/Alumnae Association of MIT, 1988;
Fannie and John Hertz Fellow, 1986 to 1988;
American Institute of Steel Construction Fellowship, 1987;
American Society of Civil Engineers O.H. Ammann Research Fellow, 1986;
Cameron Scholarship Recipient CRSI, 1984-1985.



K. Sam Shanmugan

Southwestern Bell Distinguished Professor, The University of Kansas, 1986–present;

Professor, The University of Kansas, 1982–1986;

Associate Professor, The University of Kansas, 1980–1982;

Director of Telecommunications Laboratory, The University of Kansas, 1982–1987;

Member of Technical Staff, Bell Telephone Laboratories, 1978–1980;

Associate Professor, Wichita State University, 1977–1978;

Assistant Professor, Wichita State University, 1973–1977.

Education

Ph.D., Oklahoma State University, 1970.

M.E., Indian Institute of Science, 1966.

B.E., Madras University, 1964.

Teaching

Communication systems,
Probabilistic analysis,
Signals and systems.

Research Interests

Communications systems theory,
Communication systems simulation,
General systems theory,
Pattern recognition,
Image processing.

Recent Publications/Presentations

P. Rajagopalan, K. Sam Shanmugan, "Channel Estimation and Adaptive Communication Techniques," Information and Telecommunication Technology Center Technical Report, ITTC-FY97-TR-10920-28, December 1996.

S. Gurrapu, H. Samra, Glenn Prescott, K. S. Shanmugan, "Digital Beamforming Receiver Architecture," Telecommunications and Information Sciences Laboratory Technical Report, TISL-10920-24, October 1996.

K.S. Shanmugan, "Rapidly Deployable Radio Networks: Semi-Annual Progress Report," TISL -10929-19, July 1996.

B. Ewy, C. Sparks, K.S. Shanmugan, J. Evans, G. Prescott, "Rapidly Deployable Radio Network: Proof of Concept System," TISL Technical Report, TISL-10920-16, April 1996.

Professional Affiliations

IEEE (fellow status), USC Communication Sciences Institute.

Honors and Awards

Eta Kappa Nu, Phi Kappa Phi;
Listed in Who's Who in Engineering, Who's Who in Technology, and American Men and Women of Science.
H.O.P.E. Award, Finalist, 1994;
Higuchi Award for Research at the University of Kansas, 1990;
Burlington-Northern Outstanding Teaching Award, 1987;
Henry E. Gould Award for Distinguished Service to Undergraduate Engineering Education, 1982;
Amoco Foundation Outstanding Teacher Award, 1982;
Society of Automotive Engineers Ralph Teetor Outstanding Young Engineering Educator Award, 1979.

Costas Tsatsoulis

Associate Professor, The University of Kansas, 1993–present;

Assistant Professor, The University of Kansas, 1988–1993;

Visiting Scientist, Lockheed-Martin AI Center, 1995.

Education

Ph.D., Electrical Engineering, Purdue University, 1988.

M.S., Electrical Engineering, Purdue University, 1984.

B.A., German, Purdue University, 1987, with distinction.

B.S., Electrical Engineering, Purdue University, 1983, with distinction.

Teaching

Computer system software,
Artificial intelligence,
Knowledge-based systems,
Image processing and computer vision,
Case-based reasoning and distributed AI,
Introduction to database systems,
Structured programming.

Research Interests

Case-based reasoning,
Multiagent systems and distributed artificial intelligence,
Artificial intelligence and design,
Intelligent information retrieval,
Image processing and computer vision.

Recent Publications/Presentations

C. Tsatsoulis, J. Holtzman, "Transferring Artificial Intelligence Technology Through A Research Center of Excellence," ITESM '96 International Symposium on Artificial Intelligence/International Conference on Industrial Fuzzy Control and Intelligent Systems, Cancun, Mexico, November 12-15, 1996, pp. 30-35.

C. Tsatsoulis, G. Yee, "Learning Reliability Models of Other Agents in a Multiagent System," AAAI-96 Workshop on Adaptive Multiagent Systems, AAAI Press, WS-96-04, 1996.

D. Haverkamp, C. Tsatsoulis, "Using Temporal Information in an Automated Classification of Summer Marginal Ice Zone Imagery," IGARSS '96 Conference, Vol. I, 1996, pp. 109-111.

L. Soh, C. Tsatsoulis, "Determining the Number of Classes of Segmentation in SAR Sea Ice Imagery," IGARSS '96 Conference, 1996, Vol. III, pp. 1565-1567.

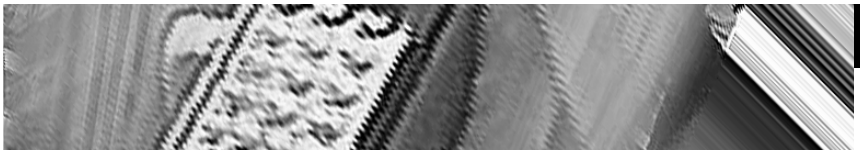
L. Soh, C. Tsatsoulis, "Texture Representation of SAR Sea Ice Imagery Using Multi-Displacement Co-Occurrence Matrices, " IGARSS '96 Conference, Vol. I, 1996, pp. 112-114.

Professional Affiliations

Association for Computing Machinery (ACM), ACM/SIGART, American Association for Artificial Intelligence (AAAI), IEEE, IEEE Computer Society, ESKAMO.

Honors and Awards

Eta Kappa Nu;
Sigma Xi;
AT&T Engineering Education Excellence Award by the State of Kansas, 1995;
National AT&T Engineering Education Excellence Award, National Finalist, 1995;
Miller Award for Research Excellence, 1994.



Industrial Advisory Board

CECASE was guided by the advice and assistance of an industrial advisory board. Past members were active in charting the path which led to the success and growth of CECASE over the past years. Members were

Jeff Alholm, Digital Ocean Inc., Lenexa, KS
Phil Anderson, Kantronics Inc., Lawrence, KS
Marc Epard, Farallon Computing Inc., Lawrence, KS
Charles Holt, Midwest Research Institute, Kansas City, MO
Jake Maczuga, Kansas Innovation Corporation (KIC), Lawrence, KS
Howard Mossberg, University of KS Research and Public Service
Susan Norris, Sprint, Kansas City, MO
Joe Ozorkiewicz, Cadence Design Systems, Lawrence, KS
Brian Ruf, RUF Corporation, Olathe, KS
Carolyn Shelton, Campbell-Becker Associates, Lawrence, KS
Mike Wojcicki, Kansas Technology Enterprise Corporation, Topeka, KS
Robert Zerwekh, Technology Transfer, The University of Kansas

While many of these Board members will continue to serve ITTC, the newly formed Industrial Advisory Board will also include many new leaders from nationally known information and telecommunications companies. This board will guide the ITTC by

- reviewing and selecting internally funded faculty development projects with commercial potential;
- counseling and assisting in the Center's strategic planning;
- providing guidance in marketing and commercialization strategies;
- networking and promoting ITTC;
- reviewing selected policies, procedures, and operations.

Persons who, to date, have agreed to serve on the ITTC Industrial Advisory Board for FY98 are

Phil Anderson, Kantronics, Lawrence, KS
Bob Boaldin, Elkhart Telephone Co., Inc., Elkhart, KS
Steve Chaddick, Ciena, Linthicum Heights, MD
Terry Champion, Rome Laboratories, Hanscom AFB, MA
Dale Clements, Allied Signal, Kansas City, MO
Jim Dahmen, Columbus Telephone Company, Inc., Columbus, KS
Marc Epard, Farallon Computing, Inc., Lawrence, KS
Charles Holt, Midwest Research Institute, Kansas City, MO
Andy Hopper, Olivetti & Oracle Research Laboratory, Cambridge, England
James Isaacs, ITT Aerospace Optical Div., TAC, Ft. Wayne, IN
Marty Kaplan, Sprint, Overland Park, KS
Ali Kazeroonian, Worldwide Broadcasting Network (WBN), Cambridge, MA
Richard Kennedy, Lucent Technologies, Inc., Overland Park, KS
John R. LaLonde, Integrated Imaging Solutions, GE Medical Systems, New Berlin, WI
Leland Langston, Texas Instruments Corporate Research, Dallas, TX
Barry Leiner, MCC West Coast Laboratories, Sunnyvale, CA
Peter Leong, USAF Rome Labs, Griffiss AFB, Rome, NY
Tom Lyon, Ipsilon Networks, Inc., Sunnyvale, CA
Jake Maczuga, Kansas Innovation Corporation, Lawrence, KS
Joe Ozorkiewicz, Cadence Design Systems, Lawrence, KS
Robert Parker, USC-IC, Arlington, VA
Brian Ruf, RUF Corporation, Olathe, KS
B. S. (Sam) Samra, Sprint Spectrum, Lenexa, KS
Robert Sanson, FORE Systems, Pittsburgh, PA
Srini W. Seetharam, Integrated Telecom Technology (IgT), Gaithersburg, MD
David Smith, Network Services Division, Public Networks Group, NEC, Irving, TX
Arun Sobti, Third Generation Cellular Systems Development, Arlington Heights, IL
Ram Sriram, Commerce NET AIMS, Inc., Palo Alto, CA
Jerry White, Black & Veatch, Overland Park, KS
Greg Williams, Wireless Systems, Technology Resources Inc., Austin, TX
Mike Wojcicki, Kansas Technology Enterprise Corporation, Topeka, KS
Robert Zerwekh, Technology Transfer, The University of Kansas

Research Highlights

A Large-Scale Internetwork Supporting High Speed Distributed Storage—MAGIC II

Student Investigator: William M. Dinkel, Anand Subramanian, Yulia Wijata

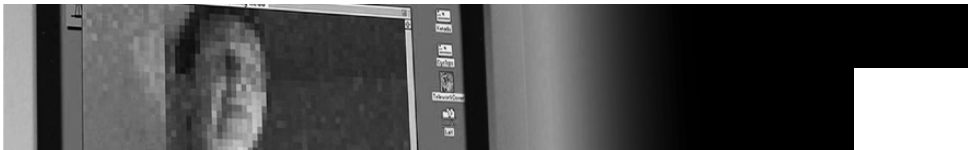
Faculty Investigators: Victor S. Frost, Joseph B. Evans, Gary Minden, Douglas Niehaus

Sponsors: Sprint Corp. and DARPA

The current MAGIC Gigabit Testbed (MAGIC-I) has demonstrated a high-speed, wide-area IP/ATM testbed that supports a real-time terrain visualization application and a high-speed, distributed storage system. The MAGIC-II effort extends that environment by connecting the MAGIC-I testbed to other wide-area IP/ATM testbeds and adding a variety of capabilities that enable large-scale, distributed information systems. There are two major inter-related goals in MAGIC-II: (a) to develop a proof-of-concept visualization application that demonstrates the utility and capabilities of distributed processing and network-based storage coupled with high-speed networks, and (b) to create a very large internetwork with many end-users to provide a realistic test environment for ATM technology and for the above application.

The MAGIC-II application is based on a very general paradigm in which high-performance computing, storage, and communications are used to provide rapid access to large collections of data that have to be quickly processed and delivered to an end-user. Applications that use this paradigm arise in a variety of situations, including military operations, intelligence imagery analysis, and natural disaster response. These applications share a requirement for access to large amounts of data, the exact type, location, and ownership of which may not be known in advance. They also require a large amount of processing to transform data into useful information, which may have to be delivered to mobile end users. KU will incorporate a wireless component into the MAGIC-II testbed, which will demonstrate mobile access to broadband services. MAGIC-II will provide an environment for experimenting with mobile wireless access to broadband services. The MAGIC visualization application will be designed to operate with the user interface on a wireless node.

A challenge for large-scale distributed information systems will be the requirement to compute and communicate independent of a wired connection to the broadband infrastructure: for example, users on the move or in remote locations. These users will require access to the distributed information systems over a wireless link. A major component of the MAGIC-II program is the development, implementation, and demonstration of a wired/wireless internetwork that can scale. This is being accomplished by integrating the wireless ATM networking elements being developed at KU into the MAGIC-II internetwork. Thus the MAGIC-II provides an environment for experimenting with mobile wireless access to broadband services. Further, the MAGIC visualization applications are being designed to operate with the user interface on a wireless node. This process will create a large scale wired/wireless internetwork testbed.



Lightwave Communications Systems Research

Advances in high speed electronics and lightwave devices offer the potential for significant efficiency improvements in long distance communications. However, how to construct systems that provide reliable advanced communications services using these evolving devices is an open issue. The purpose of this research is to identify and investigate those issues that are necessary to integrate high-speed electronics and lightwave devices into efficient and robust systems to support leading edge services. The focus will be on how to migrate from the existing network to a system more heavily dependent upon lightwave elements. This research will address fully utilizing the capability offered by optical communications by using techniques such as wavelength-division-multiplexing (WDM), soliton, and coherent modulation, which are viable approaches to utilizing the 25,000 GHz bandwidth of a single optical fiber.

Student Investigators: Shuxian Song,
Helin Ji,
Yuyi Guo,
Chris Johnson,
Huk-Yong Pua.

Faculty Investigators: Kenneth Demarest,
Christopher Allen,
Victor S. Frost,
Joseph Evans,
and Karen Nordheden.

Research Scientist: Xiaojun Fang.

Sponsors: Sprint Corporation,
National Science Foundation,
Kansas Technology Enterprise Corporation,
Lucent Technologies, Inc.

This EPS image does not contain a screen preview.
It will print correctly to a PostScript printer.
File Name : tdm_disp_c317_1_xf.eps
Title : /tmp/xfig-fig006674
Creator : fig2dev
CreationDate : Thu Mar 13 16:21:55 1997
Pages : 0

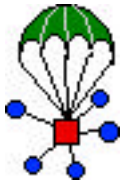
Note: SFM = Single-mode fiber; DCF = Dispersion-compensating fiber.

Rapidly Deployable Radio Network (RDRN) Design and Prototyping

Student Investigators: Stephen F. Bush,
Deb Chatterjee,
Nathan A. Goodman,
Srikanth Gurrapu,
Shane M. Haas,
Nalinimohan Kambhammettu,
Vijayonandi Paulrajan,
Padmanabha Rajogopolan,
Ricardo J. Sanchez,
Ritesh Vishwakarma

Faculty Investigators: K. Sam Shanmugan,
Gary J. Minden,
Joseph B. Evans,
Victor S. Frost,
David W. Petr,
Glenn E. Prescott,
Richard Plumb,
James A. Roberts

Sponsor: DARPA



The primary objective of the RDRN project is to create architectures, protocols, and prototype hardware and software for a high speed network that can be deployed rapidly in areas of military conflicts or civilian disasters where communication infrastructures are lacking and or destroyed (e.g., Desert Storm, Bosnia, Hurricane Andrew, LA earth quake). The rapid deployment requirement, coupled with higher speed requirements and seamless integration with other commercial networks, has lead to an approach that uses wireless technology for the communication links and ATM for networking. The Rapidly Deployable Radio Network (RDRN) being developed by the University of Kansas is a wireless ATM network; it consists of portable (mobile) communication nodes which can be deployed on the ground or on mobile platforms such as trucks, helicopters, or fixed wing aircraft. When deployed, the nodes use GPS derived location information to automatically configure themselves into a high capacity, fault tolerant network infrastructure.

RDRN is made up of two types of nodes: end user nodes providing wireless ATM access for users at a rate of up to 1.5Mbit/sec, and edge nodes which serve as Radio Access Points (RAPs) or base stations and provide switching and connectivity between users. Both types of nodes contain GPS receivers for location determination; software controlled radios with phased-array antennas for beam forming and pointing in the right direction, using GPS derived location information; and Network Control (NC)software. The edge nodes also have built-in ATM (software) switches, and they are interconnected by high capacity (45 to 155Mbit/sec) directional radio links. Edge nodes can also interface to wired ATM networks.

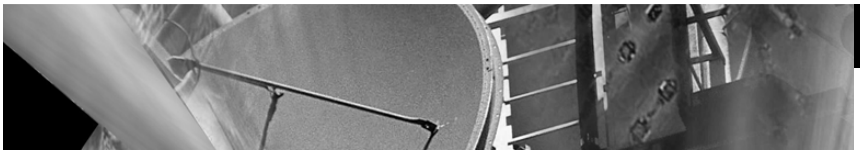
The RDRN architecture consists of three overlaid radio networks: (1) a low bandwidth, low power, omni-directional order wire packet radio network for broadcasting location information, network configuration, and management; (2) a cellular-like ATM radio network for end user access to edge nodes with hand-offs; and (3) a high capacity wireless ATM back bone NW providing connection between switches using high capacity radios with multiple directional beams .

When RDRN is initially deployed in a new area, each of the edge nodes initiates the following activities:

(1) determine its location from GPS and broadcast it over the secure orderwire NW; (2) listen for broadcasts from other nodes; (3) establish the backbone NW by forming high capacity, directional radio links to nearby nodes using the steerable phased array antenna; and (4) begin executing the distributed NW configuration and control algorithm and establish connectivity with end user nodes.

Each edge node is capable of forming multiple radio beams in the direction of other edge nodes or towards end users in the vicinity. A phased array antenna with digital beam forming is used to form these multiple beams, and pointing directions are derived from location information. Assignment of beams to users, node to node connections, and hand-offs of users from one edge node to another are controlled by the distributed network configuration and management algorithm. The network control information is broadcast over the orderwire NW. Changes in NW topology due to mobility or failure of nodes and or links are detected by the NC algorithms, and reconfiguration is carried out automatically in a distributed manner.

RDRN is also adaptable to changes in the quality of the radio communication environment. While ATM is designed to operate on high quality (almost error free) wired links, typical radio links suffer higher error rates and the link quality changes as a function of time due to mobility and changes in the environment. By estimating the channel parameters such as multipath spread and

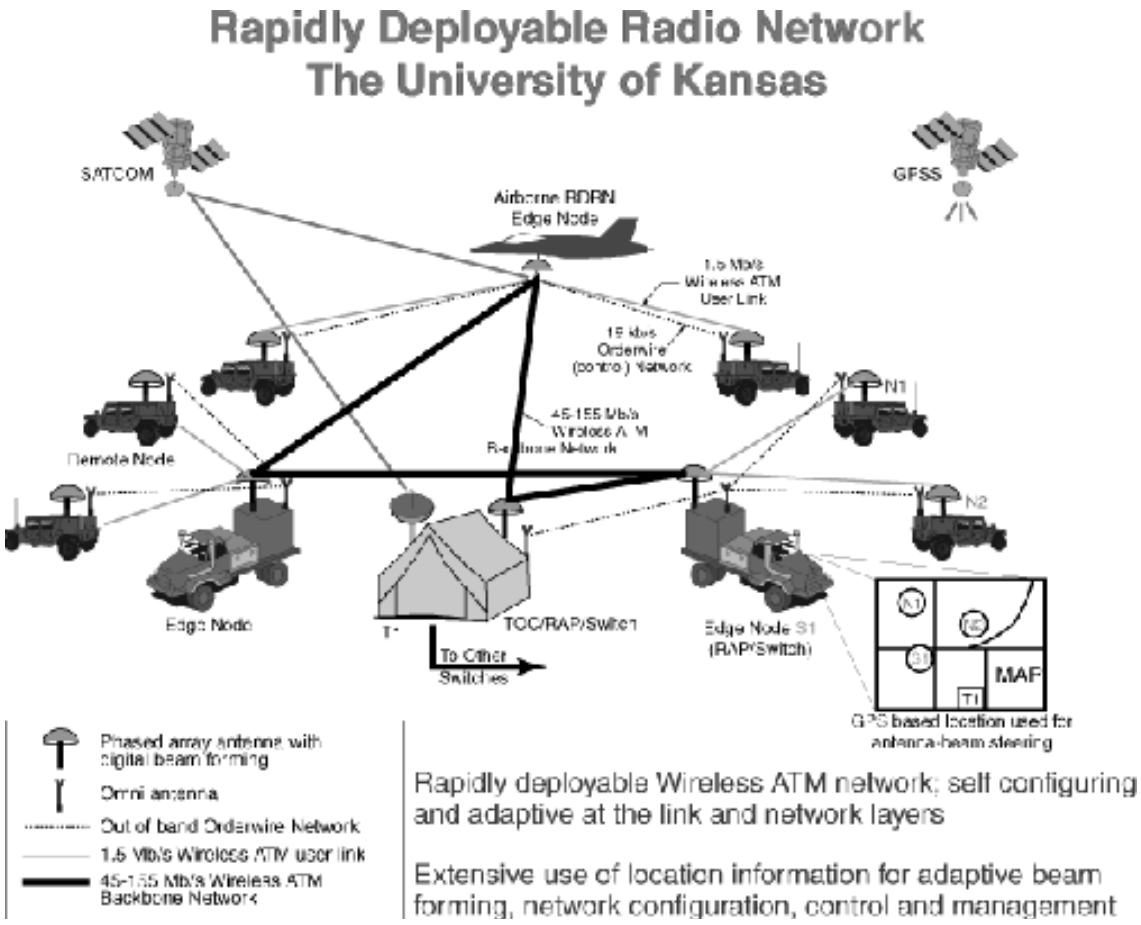


signal to noise ratio, communication parameters at the link and NW levels are adapted to provide appropriate throughput and quality of service.

Prototype algorithms, hardware and software have been developed to demonstrate the following key concepts of RDRN: (1) software controlled radio, (2) phased array antenna with digital beam forming, (3) orderwire NW for network configuration and control, and (4) protocol stack(s) for wireless ATM and IP over ATM. The project is in the final stages of Phase I, and a follow-on contract is expected to be awarded soon.

RDRN is also adaptable to changes in the quality of the radio communication environment. While ATM is designed to operate on high quality (almost error free) wired links, typical radio links suffer higher error rates and the link quality changes as a function of time due to mobility and changes in the environment. By estimating the channel parameters such as multipath spread and signal to noise ratio, communication parameters at the link and NW levels are adapted to provide appropriate throughput and quality of service.

Prototype algorithms, hardware and software have been developed to demonstrate the following key concepts of RDRN: (1) software controlled radio, (2) phased array antenna with digital beam forming, (3) orderwire NW for network configuration and control, and (4) protocol stack(s) for wireless ATM and IP over ATM. The project is in the final stages of Phase I, and a follow-on contract is expected to be awarded soon.



A Functional Programming Environment for Design and Implementation of High Performance Radio and Synthetic Aperture Radar Processing Functions

This project has three research focus areas:

(1) The design and implementation of a Functional Programming Environment (FPE) to express signal and image processing algorithms, mapping (compiling) those algorithms to field programmable gate array (FPGA) architectures, and managing adaptive computing resources.

(2) The implementation and demonstration of radio communication functions with the FPE and mapping these functions onto field programmable gate arrays.

(3) The implementation and demonstration of synthetic aperture radar (SAR) processing algorithms with the FPE and mapping these algorithms onto FPGAs.

The first area creates an important technology for expression and manipulation of signal and image processing algorithms. The second and third areas will be used to evaluate the FPE and implement important radio communications and SAR processing functions and modules.

Principal Investigators: Gary J. Minden, Joseph B. Evans

Co Investigators: Glenn Prescott, J. Michael Ashley, Doug Niehaus

Sponsor: DARPA

Data Discovery on the Information Highway (includes ProFusion)

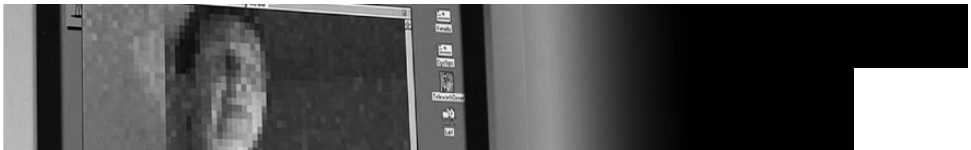
Student Investigator: Yizhong Fan and Tapash Majumder

Faculty Investigator: Dr. Susan Gauch

Sponsors: National Science Foundation, KU Faculty Development Fund

The Information Highway is becoming a reality. The increase in access to the Internet by the public at large, combined with the development of easy-to-use graphical browsing interfaces—for example, Mosaic and Netscape—have lead to an explosion in the information being added. In particular, the World Wide Web (WWW) is being used to present an exponentially growing amount and range of information which people can browse through. Unfortunately, too much information can be the same thing as not enough information: if the information you seek is buried under an avalanche, is it really there? This research has developed a pilot system which can automatically browse the on-line information, filter, and display it, bringing the information to the user rather than requiring the user to seek it out.

In the first phase of this project, we developed a meta search engine, ProFusion, to retrieve, process, and merge search results from multiple search engines. ProFusion sends user queries to multiple underlying search engines in parallel, and retrieves and merges the resulting URLs. It identifies and removes duplicates and creates one relevance-ranked list. If desired, the actual documents can be pre-fetched to remove yet more duplicates and broken links. In addition, users may register queries with ProFusion to have them re-run on a periodic basis. This allows ProFusion to automatically alert users to new information of interest to them.



A Wireless ATM Adaptive Voice/Data Network

Student Investigators: Erik Lindsley,
Zhu Lei,
Vishal Moondhra.

Faculty Investigators: Joseph B. Evans,
Victor S. Frost,
John M. Gauch .

Sponsor: Rome Laboratories.

The objective of this project is the implementation and demonstration of a complete adaptive voice/data (AVD) network, including switches and terminal units, based on wireless asynchronous transfer mode (ATM) technology. This network will serve as a testbed for investigation into the delivery of voice, images, and data to remote users using highly interoperable ATM technology. Dynamic bandwidth allocation algorithms using low bit rate speech coding based on the Sinusoidal Transform Coder are used in the ATM wireless environment. Existing ATM standards are the basis for network control and management where possible, and research into extending the technology into the narrowband arena is being performed. A testbed to evaluate the use of the bit-rate adaptive characteristics of the Sinusoidal Transform Coder (STC) as a means of congestion control for voice/data networks is being designed and built. The testbed consists of two existing network switches and three voice/data terminal units developed in this project. The terminal units are connected to the switches by wireline or wireless modems, and support voice or data traffic. The terminals support bit rate adaptation protocols implemented in the AVD switch. The components of the network support dynamic allocation of bandwidth between voice and data streams, using the bit rate transformation schemes associated with the Sinusoidal Transform Coder. The narrowband network is interfaced to other ATM facilities such as the MAGIC gigabit testbed or the Rapidly Deployable Radio Network (RDRN), as well as to standard ISDN facilities, to demonstrate interoperability.

This project consists of several major tasks:

- AVD switch modifications for ATM networks
- implementation of the terminal units for the AVD network
- development and implementation of the ATM wireless network architecture
- host application software design
- demonstration of interoperability over ISDN facilities
- demonstration of interoperability over future facilities typified by the DREN Testbed

ACTS ATM Internetwork

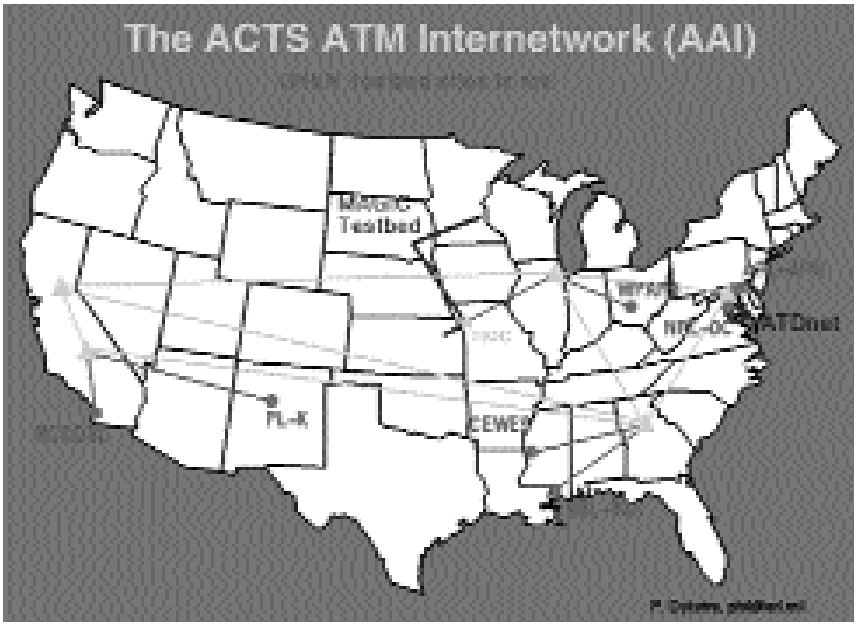
Student Investigators:
Charalambous P. Charlambous,
Roelof J.T. Jonkman,
Georgios Y. Lazarou,
Beng Lee,
Steven G. Pennington.

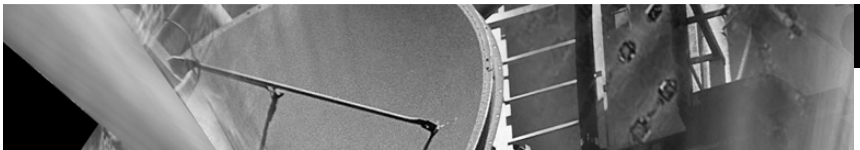
Faculty Investigators: Victor S. Frost,
David W. Petr,
Joseph B. Evans,
Douglas Niehaus.

Prime Contractor: Sprint Corp.;

Sponsor: DARPA.

The ACTS ATM Internetwork (AAI) will be composed of a large number of network elements, connected by both ATM DS-3 (45 Mb/s) and OC-12c (622 Mb/s) satellite (ACTS) facilities. There is a need to perform a quantitative evaluation of the performance of the AAI under a variety of conditions. Such an evaluation will provide valuable information required for the ubiquitous deployment of large ATM networks. The thrust of the tasks for the Information and Telecommunication Technology Center will be on the measurement of AAI network performance and the use of those measurement capabilities to determine the efficacy of call admission and congestion control (that is, the performance of the network under stress) as well as to profile the user applications, i.e., traffic characterization. Thus, the issues associated with control and management of "realistic networks" are being addressed. The results from these tasks will demonstrate if techniques developed and tested on "small" systems scale up to networks with a "large" number of users. The work is a direct outgrowth of our on-going high speed networking projects. As part of the MAGIC testbed, ITTC has conducted some preliminary ATM measurements and will be conducting an extensive measurement program.





Traffic Management and Controls for ATM Networks

Student Investigators: Qingyang Hu,
Kunyan Liu,
Jason Keimig,
Sampat Sreepathi-Komanduri.

Faculty Investigators: David W. Petr,
Victor S. Frost,
Doug Niehaus

Sponsor: Sprint

Component 1: Integration and Evaluation of CBR/VBR/ABR Controls with Voice/Data/Video/ Image Traffic

There have been several traffic controls proposed and studied for CBR, VBR and ABR services. Some of these would function within customer equipment, some at the ATM access point (or User-Network Interface—UNI), and others would be distributed throughout the ATM network. This component will focus on UNI and network-distributed controls, and only those that are applicable once a connection has been established.

Component 2: Development and Evaluation of Dynamic Renegotiation of Traffic Contract

Recent traffic measurements indicate that a connection may have traffic requirements that vary significantly with time, even when the time scale is large (tens of seconds, minutes, or even hours). If the traffic contract is static, the connection user must estimate the most demanding values for the traffic contract parameters that would be expected over the duration of the connection. This would be not only difficult but also wasteful of network resources. ITTC plans to develop a complete dynamic traffic contract renegotiation system and evaluate its performance.

Component 3: Modeling and Evaluation of a Global Network Management Overlay for Call Admission Control (CAC) and Network Resource Management

A major unknown in network resource management is the uncertainty about what information is needed by the "resource allocator" and how often this information should be collected. ITTC's approach will be to structure simulation-based experiments to determine the sensitivity relationships between control parameters: e.g., the CAC policy on a VP, and the QoS.

Component 4: Real-Time Experimental Evaluation of ATM Network Controls With Multimedia Connections

ITTC will evaluate the feasibility of implementing various traffic controls within a real-time control and measurement framework, choose a set of controls to implement, design experiments to evaluate the performance of these controls with multimedia connections, perform the experiments, and analyze the results.

Component 5: Evaluation of Service Aspects, Controls, and Signaling for Network Interfaces (BICI/NNI)

This component will provide a careful evaluation of the service aspects, controls, and signaling for interfaces between network service providers.

RF Channel Simulation for a UHF Wireless Communication System

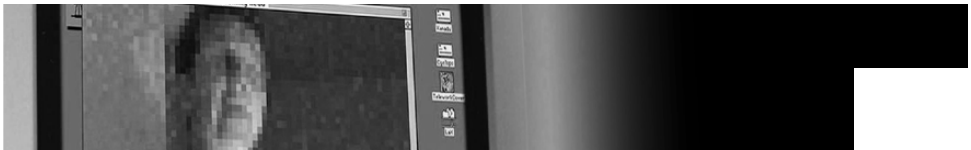
Student Investigators: Artur Leung, Ali Serener.

Faculty Investigators: Glenn E. Prescott, James A. Roberts.

Sponsor: (proprietary)

This research involves the design, implementation, and testing of a hardware-based, wireless communications channel simulator. The purpose of the simulator is to provide a laboratory test instrument for evaluating UHF radios. The simulator allows the radios to be tested in a controlled RF environment that can be configured under operator control to approximate closely the propagation conditions found in the confines of a typical hospital. This environment includes flat fading, coherent interference, background noise, and impulsive noise. In order to provide realistic performance, the behavior of the simulator is based on actual channel measurements. These measurements have been incorporated into a software tool (SircimPlus) which generates the behavior files based on parameters which are input to this program by the operator. Our task is to verify the preliminary design of a channel simulator, assemble the necessary RF components, fabricate any external circuitry that may be required, program the user interface and any necessary software drivers, and integrate the system into an operational unit.

Proposed RF Channel Simulator



DSP Radio Algorithm Development with Field Programmable Gate Arrays

Student Investigators: Srikanth Gurrapu

Faculty Investigators: Glenn Prescott,
Sam Shanmugan,
Joe Evans

Sponsor: U.S. Air Force Rome Laboratories

Previous research efforts with Rome Laboratories have led to the development of a digital signal processing rapid prototyping system consisting of Cadence Systems Signal Processing Worksystems (SPW), and Synopsys software tools, with algorithms implemented on FPGAs and parallel-DSP processors. With this system we developed and tested radio algorithms for the Air Force's "Smart Radio" program. With the use of FPGAs, we are investigating ways to speed up the radio algorithms and reduce the signal processing tasks required of the DSP processor.

An essential requirement in military communications is extraction of interference from the received signal as early in the detection process as possible. Military radio systems employ spread spectrum techniques which produce extremely wide bandwidth signals. In order to excise interference at spread spectrum bandwidths, high speed digital signal processing is required. The processing speeds needed for interference excision at the spread bandwidth normally exceed those available in traditional DSP microprocessors. Therefore we are investigating the implementation of certain interference excision algorithms using FPGA technology to facilitate the rapid (and possibly adaptive) excision of narrow band interferers within a large operating bandwidth.

Tactical Radio Testbed

The VISION Digital Video Library System

Student Investigator: Aravind Saraff, Bhaswati Ray.

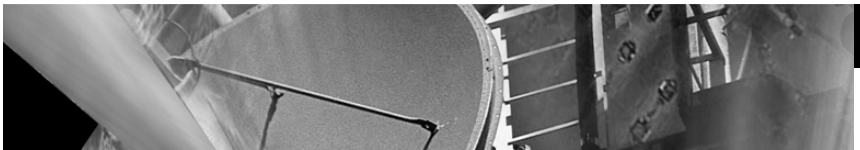
Faculty Investigators: Susan Gauch, John Gauch.

Sponsors: Information and Telecommunication Technology Center (ITTC), DesignLab, University of Kansas Research Development Fund.

This project has developed a prototypical digital video library system called VISION (Video Indexing for SearchIng Over Networks). VISION can digitize, compress, store, index, search, and retrieve video, audio, and closed-caption information. We have developed a client and server which can provide video information over the Internet or the evolving National Information Infrastructure.

To be an effective library, users need to be able to find the video segments they want. This project is conducting ground-breaking research into automatic content-based segmentation and indexing of videos that will significantly improve the users' ability to access specific segments of interest with videos.

Videos, soundtracks and closed-captions are digitized, and the video and audio signals are used together to provide scene-based segmentation rather than pixel-based segmentation. Information from the closed-captions are used to automatically index the segments based on their contents. Together, this allows users to quickly search indices for multiple videos to locate segments of interest, and to view and manipulate these segments on their remote computer. Current work is investigating the use of soundtrack and transcripts for further indexing information.



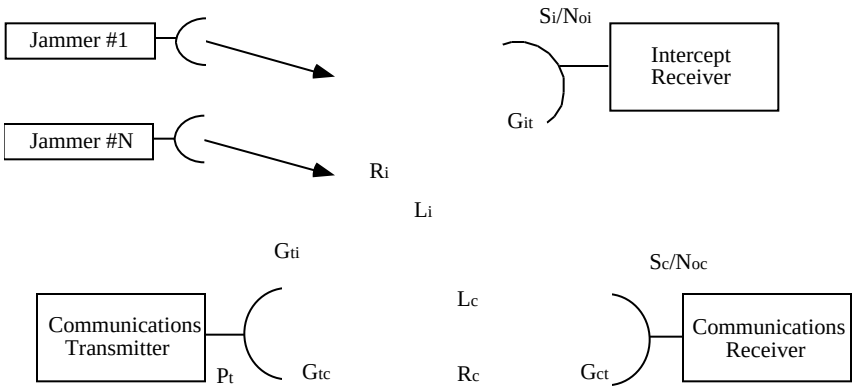
Analytic and Simulation Based Models for the Investigation of Low Probability of Intercept (LPI) Waveform Detectability

The goal of this research consists of investigating two distinct interrelated problems. First, we are performing the research necessary to establish and describe a set of metrics and theorems for Low Probability of Intercept waveforms. This will lead to the development of a design and analysis methodology and capability for Low Probability of Intercept signals and systems. This methodology and capability will result in an algorithmic approach to LPI design and will be composed of two primary elements: an analytical-based, computer-aided system to evaluate the detectability of LPI waveforms; and computer simulation models which will allow the LPI communications link to be simulated and evaluated against the effects of jamming and intercept receivers. Second, we are conducting basic research into the design of the next generation LPI waveforms and possible strategies for detecting them. The two research objectives are complementary efforts.

Student Investigator: Tom Farrell

Faculty Investigator: Glenn E. Prescott

Sponsor: Air Force Office of Scientific Research



LPI Scenario

ATM Adaptation Layer for Composite Users (AAL-CU) Research

Student Investigator: Prema Sampath

Faculty Investigator: David W. Petr

Sponsor: Sprint

AAL-CU (ATM Adaptation Layer for Composite Users) is a new AAL that is currently being discussed and standardized within the ATM Forum and ITU-T.

The intent is for AAL-CU to fill a need (not met by existing AALs) for multiplexing several small data units from different sources/connections into a single ATM VC connection. This will limit packetization delay for compressed voice without wasting transmission bandwidth due to partial filling of ATM cells.

The original motivation for AAL-CU was to support compressed voice as found in many cellular systems, but voice trunking and ATM to the desktop have since been added as potential AAL-CU applications.

Proposed Project Goals:

• Provide a detailed performance evaluation of the new AAL-CU, including comparisons with AAL1 and AAL5 alternatives, and recommendations for appropriate protocol parameter values.

• Provide an evaluation of the various impacts of this new protocol on the ATM control plane (e.g., signaling).

• Provide specific recommendations concerning the application of AAL-CU to wireless/cellular networks and concerning interworking of AAL-CU between wireless/cellular networks and fiber-optic ATM networks.

• Provide a technical assessment of AAL-CU's capabilities for other potential applications besides wireless/cellular.

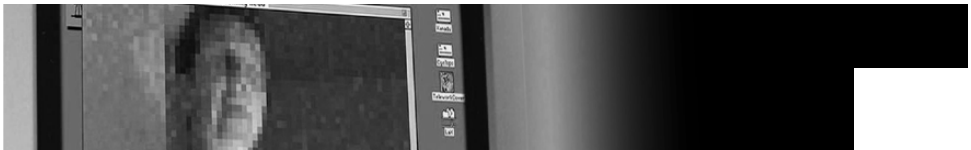
ATM Available Bit Rate Service Simulation Models

Student Investigator: Timothy Gallagher

Faculty Investigators: Joseph B. Evans, Victor S. Frost

Sponsor: Integrated Telecom Technology (IgT)

This project involves the development of simulation models of the ATM Forum Available Bit Rate (ABR) traffic management specification. In particular, models of the end-system and switch processing functions will be developed. These models will be developed in C++ to enable the use of these models in existing simulations developed by the University of Kansas. The models which are developed will be exercised using the previously developed KU ATM and TCP models in order to investigate the performance of actual systems which are using the ABR ATM service.



CDMA Capacity Assessment for Personal Wireless Communications

This project assesses the capacity of a cellular personal communications system using code-division-multiple-access (CDMA). With a multiple user CDMA system where all the users have the same data rate, the same activity factor, and the same fidelity requirement, and where perfect power control is employed for users talking to the cellular base station, the formulas for computing the maximum number of CDMA users that can be accommodated in a given bandwidth have been found. However, the case with different classes of users—differentiated by their individual data rate, activity factor, and fidelity requirement—had not. This project is developing a methodology for predicting the allowable number of users of each class. Such an analysis is important for considering the mixing of voice and data users in a wireless system.

Graduate Student Investigators: Ranjit Cavatur, Manish Mangal, Vijay Paulrajan

Faculty Investigators: James Roberts, Victor Frost, Glenn Prescott, Sam Shanmugan

Sponsor: Sprint

Corpus Linguistics for Information Retrieval

Rapidly increasing storage media capabilities and spreading interconnectivity have heralded the arrival of the information age. Unfortunately, accessing on-line information remains an inexact science. While valuable information can be found, typically many irrelevant documents are also retrieved and many relevant ones are missed. Terminology mismatches between the user's query and document contents are one cause of retrieval failures. Expanding a user's query with related words can improve search performance, but the problem of identifying related words remains.

This research uses corpus linguistics techniques to automatically discover word similarities directly from the contents of an untagged textual database and to incorporate that information in an information retrieval system. These similarities are calculated based on the contexts in which the words appear. Using these similarities, user queries are automatically expanded, resulting in conceptual retrieval rather than requiring exact word matches between queries and documents. The effects of using different algorithms to calculate the similarities and the effects of expanding different sets of query words is evaluated. In addition, the search performance of the retrieval engine serves as a task-based method for comparing the quality of word-word similarities calculated using different corpus linguistics techniques.

We have demonstrated improved search results on the TREC-5 database and dramatic improvements with the Cystic Fibrosis database. Work is currently being done to extend the results to distributed databases.

Student Investigators: Jianying Wang, Satya Mahesh Rachakonda

Faculty Investigator: Susan Gauch

Sponsors: NSF (Infrastructure Grant)

Data Mining of Blood Incident Databases

Student Investigator: Leen-Kiat Soh

Faculty Investigator: Costas Tsatsoulis

Sponsor: National Institutes of Health

The US public and the various health organizations and providers place extreme importance to the quality of the blood supply. While all blood banks, blood handling organizations, and hospitals have very strict quality control procedures, there are still thousands of incidents of incorrect handling of blood and blood products. The goal of the project is to mine very large databases of blood incidents and identify patterns that can lead us to a better understanding of why such incidents occur and how we can minimize them.

We are working together with a group of blood suppliers organized by the University of Texas' Southwestern Medical Center to collect and analyze reports of blood handling incidents. We are using techniques from KDD and data mining, such as clustering and induction, to generate coherent, novel, describable, significant patterns.

Determination of the Impact of Advanced Traffic Controls on the Performance of Edge/Core ATM Network Architectures

Student Investigators: Sandeep Bhat, Isaac Eyeson, Sohel Khan, Shyam Murthy, Haritha Pindi.

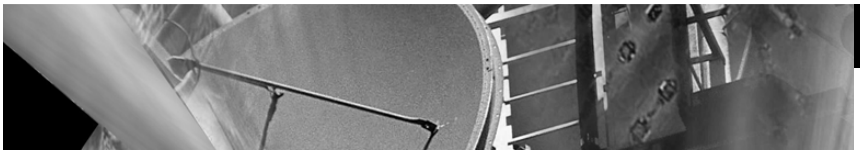
Faculty Investigators: Victor Frost, Douglas Niehaus, David Petr, Joseph Evans.

Sponsors: Sprint Corp., NEC of America.

Understanding the customer perceived performance as high speed networks rapidly evolve is critical to success of service providers. Using analysis, simulation, and measurements on the MAGIC and AAI system, we have come to comprehend the performance implications of the first generation of ATM products and networks. This proposal addresses the next challenges; i.e., to consider the issues related to the variety and interactions of Available Bit Rate (ABR) control algorithms, implications of Virtual Source/Virtual Destination (VS/VD) architectures, and interactions between TCP/IP, ABR and Quality of Service (QoS) guarantees provided by policing traffic flows.

We will approach obtaining an understanding of these issues using the tools we have successfully developed and applied to the first generation of ATM networks: algorithmic analysis, simulation, and measurements on prototype networks, specifically using the KU/TIOC facilities, MAGIC, AAI, and SPARTAN. It is significant to note that these facilities will allow us to evaluate the impact of hosts connected over a range of link capabilities, from low speed wireless to 622 Mb/s (OC-12c).

The results of this effort will enable the deployment of an efficient long distance ATM network that meets customer expectations for functionality and quality of service.



Development and Testing of Advanced Signaling Protocols for ATM Networks

B-ISDN protocols and technology make it possible to offer a wide variety of new services, such as multiparty multimedia communications and interactive video distribution, which require transport capabilities more complex than permanent point-to-point virtual circuits (PVCs). These new services require switched virtual circuits (SVCs) supporting point-to-point, point-to-multipoint, and multipoint-to-multipoint connections. Such complex connection types require the support of a flexible signaling system, exceeding the capabilities of existing systems.

This project will investigate the signaling issues associated with creating and maintaining SVCs in broadband networks. Several approaches have been proposed to the further evolution of signaling in broadband networks, ranging from simple extensions of existing protocols to complex architectures which address the interworking of ATM and existing networks. We will evaluate existing signaling software and will investigate extensions capable of supporting future services, and provide those whose implementation is within the range of the available programming resources.

Student Investigators: Furquan A. Ansari,
Raghavan P. Menon,
Scott W. Shumate,
Michael T. Swink

Faculty Investigators: Douglas Niehaus,
Joseph B. Evans,
Victor S. Frost,
David W. Petr

Sponsor: Sprint Corp.

Evaluation of Distributed Control and Signaling Infrastructure for ATM Networks

Student Investigators: Robert Hill, Anil Gopinath, Sachin Sheth, Arvind Kaushal.

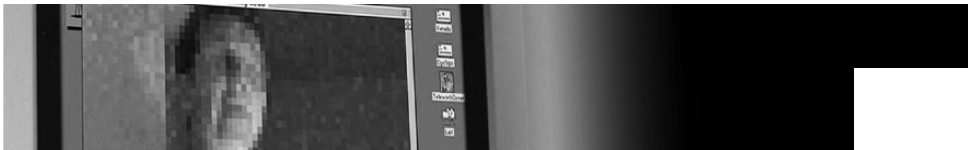
Faculty Investigators: Douglas Niehaus, Dave Petr.

Sponsor: Sprint.

Two of the most important problems which must be solved before large-scale, multi-service ATM networks can become a practical reality are the efficient provision and management of services, especially effective available bit rate (ABR) services, and adequate support for network management computations. The focus of this project is on the creation of a testbed within which the performance of network services and network management can be evaluated. This has required the creation and integration of a number of tools, some developed under other projects, to enable us to consider all factors affecting network performance.

The tools which are part of the testbed include NetSpec, the ATM Reference Traffic System (ARTS), Call Generator(CG), and the Data Stream Kernel Interface (DSKI). NetSpec is a tool for describing and conducting network level performance evaluation experiments. ARTS is a system designed to record and produce packet level ATM traffic reproducibly. The CG is designed to set up and tear down ATM connections according to various load patterns. The DSKI is a device driver which provides a general interface for collecting event traces from the operating system. Integrated into a single suite under the control of NetSpec, we can now describe and conduct performance evaluation experiments addressing the role of every level of the user, operating system, and network signaling software in determining the performance of an ATM connection.

The architecture of next generation network management software (NMS) will be required to support an increasingly complex set of services, and must be able to continuously evolve. The NMS will be object oriented, and subject to significant real-time performance constraints. The TINA standards are addressing these issues, but they are still very general and do not consider implementation details which will have a vital influence on network performance. Our work is addressing this by creating the ability to test the performance of CORBA based applications under NetSpec. This will enable us to consider how each component of the total system affects the performance of NMS structures described by TINA, and thus what type of computational resources will be required to manage next generation networks using TINA based control architectures.



Intelligent Information Dissemination Server (IIDS)

Information needed by the warfighter is available from many different sources and in many different formats: unstructured and semi-structured text (e.g., news wires, intelligence reports, etc.), structured data in database systems (e.g., logistics and inventory databases), and image and video data (e.g., weather maps from satellites, area maps and battlefield snapshots from UAVs or fly-bys, etc.). All this information needs to be integrated into a comprehensive scenario called the "Battlefield Infosphere."

Our work supports the generation of this infosphere by providing intelligent dissemination of information to the warfighters. KU is working as a member of a consortium of Universities and companies, namely Global InfoTek, ISX, Lockheed-Martin, and Stanford University, that is designing and implementing IIDS.

The project involves research in AI, multiagent systems, adaptive and learning agents, CORBA, and heterogeneous databases.

Student investigator: Huseyin Sevay.

Faculty Investigator: Costas Tsatsoulis.

Sponsor: DARPA.

KEURP Net & Link

In Phases I and II, we implemented technologies which created a World Wide Web site for the Kansas Electrical Utilities' Research Program (KEURP). This site created a World Wide Web presence for KEURP, providing information about KEURP to the world at large. In addition to providing information about KEURP, the site provides custom programs to allow the Technical Committee to operate electronically, distributing, commenting on and voting on pending proposals via any World Wide Web browser. Finally, the site contains a suite of management tools, including an online meeting scheduler, electronic calendar of meetings, and electronic mailing list support.

The goals for Phases I and II have been completed, and a useful and reliable World Wide Web site for KEURP is operational. However, there is no mechanism by which KEURP can maintain their site independently. As new information is generated (e.g., yearly research objectives) and as old information needs updating (e.g., the members of various committees), KEURP cannot currently add or update their own Web pages. The goal for Phase III, therefore, is to provide easy-to-use facilities whereby KEURP staff members can remotely add, remove, and update information.

Faculty Investigators: Susan Gauch,
Doug Niehaus,
Joe Evans

Sponsor: Kansas Electric Utilities Research Program (KEURP)

Object Motion Analysis for Biomedical Applications

Student Investigators: Chun Yen Liu, Jay Peterson, Edu Metz

Faculty Investigators: John Gauch, Max Fiskin (Microbiology, KU Med Center), Elliot Goldstein (Medicine, KU Med Center)

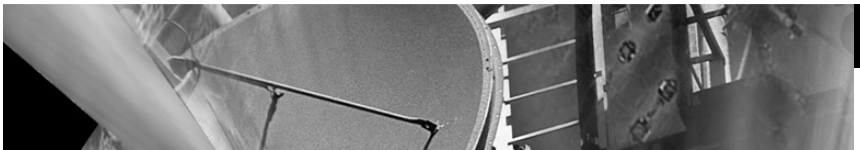
Sponsors: The Whitaker Foundation (Biomedical Engineering Research Program)

This project addresses two fundamental problems in biomedical image analysis: object motion quantification, and shape change characterization. It will result in powerful new tools to assist researchers interested in studying the biomedical mechanisms responsible for object motion and shape change. There are three phases to this project: (1) the development of new motion quantification methods, (2) the development of new shape change characterization methods, and (3) the evaluation of these techniques by collaborators in Biology and Medicine.

The first phase of this project involves the development of new methods for detecting object motion in biomedical image sequences and quantifying this motion. Our objective is to construct an integrated boundary-based and region-based motion detection system based on the calculus of variations. Here, we plan to build on our experience with 2D and 3D deformable object models for image segmentation, multisensor data fusion, and robust optic flow calculation methods. By simultaneously detecting object boundaries and tracking their motion, researchers will be able to quantify the motion of objects or regions of interest in images more reliably.

The second phase of this project involves the development of new methods for characterizing shape change using the motion information obtained above. Shape change analysis (also known as morphometrics) is typically performed based on manually identified biological landmarks. Our objective is to automatically identify visually distinct landmarks which follow the motion field we have calculated. To do so, we plan to make use of multiscale shape analysis applied to object boundaries to identify image landmarks based on their geometric properties. Thus, we will be extending morphometric tools to a wider range of applications.

The third phase of this project involves the evaluation of our motion analysis tools. We have been working with Prof. Max Fiskin and Prof. Elliot Goldstein at the University of Kansas Medical Center (KUMC) on a project to track and quantify the motion of white blood cells (PMNs) in microscopic image sequences. Since PMNs play an important role in fighting infection, the motility of these cells in different patients with different treatments is of great medical interest. In our current system, moving PMN cells are video taped, digitized on a PC, and processed using KUIM software to locate and track moving cells. The movement of individual of cells is then statistically analyzed to determine the motility of the population cells. Our future goals are to investigate two fundamental questions: (1) how PMNs change shape prior and during motion, and (2) how Ca+ and pH vary in PMNs as they change shape and move.



The Pricing of Services in ATM Networks

While a great deal of research has been carried out in the last few years on traffic management and traffic models for ATM networks, the issue of pricing remains largely unexplored. The pricing structure affects not only revenue, but customer behavior, statistical multiplexing capabilities and, ultimately, network performance.

We wish to study desirable pricing structures for commercial ATM networks, taking into account

a. customers' decision-making process;

b. economic efficiency requirements (maximizing network provider and customer benefits).

Customers' decision process consists of finding, at any given time, the service that optimizes their individual cost/benefit relationship. Network providers, on the other hand, must take into account the satisfaction of all users, as well as fairness, network performance, and overall revenue when deciding which pricing structure to implement.

While at times these may be conflicting objectives, pricing can be used as a way to encourage users to exhibit behavior that is beneficial to the network as a whole. The ultimate goal is to identify properties of a pricing structure for a commercial ATM network which best achieves the objectives of the network provider, as well as customers' goals.

Student Investigator: Luiz A. DaSilva.

Faculty Investigator: David W. Petr.

Sponsor: Sprint Corporation.

A Wireless Extension to the ACTS ATM Internetwork

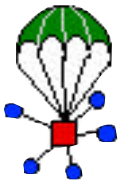
Wireless ATM based services will provide Sprint's customers the ability to seamlessly use advanced communications services independent of a connection to the wired infrastructure. For example, future networks will support the seamless movement of users from fixed high speed wired connection (i.e., a ATM-based service in the office) to mobile platforms. The network must be able to recognize the change in capabilities caused by such movements and respond appropriately. To realize this vision, issues in mobile networks, such as, mobile-IP users, and network management must be addressed.

This effort is investigating such issues. The approach will focus on implementing a prototype wire/wireless network that contains the critical elements of these future systems. The prototype system will be used to demonstrate the delivery of wireless ATM based services, and then to investigate mobile-IP and network management issues.

Student Investigators: Ranjit Cavatur,
Sunil Jagannath,
John D. Paden,
Rajesh Yelisetti

Faculty Investigators: Joseph B. Evans,
Glenn E. Prescott,
Victor S. Frost

Sponsor: Sprint



Formulate Project: End-User Programming Language

Student Investigators: Jennifer Leopold

Faculty Investigators: Allen Ambler

Sponsor: ASE/CECASE

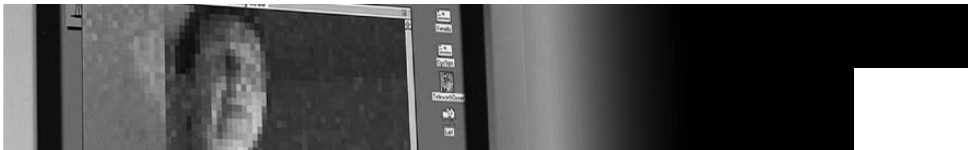
The primary objective of our research on declarative form-based programming is to develop a programming language which, to the greatest extent possible, supports end-user programming of potentially sophisticated problems.

The premise for this project is that we must keep the specification of programs in the domain of the end-user rather than in the domain of the computer. Concepts such as assignment and side-effecting iteration are computer domain concepts and are not encountered in most professions. Programming using these concepts requires additional training. Equations, on the other hand, are widely understood. Most professionals are comfortable with stating problems in terms of equations or expressions of some type. Such equations may be very wordy by comparison with higher mathematics; i.e., they may not be notationally dense. Declarative programming languages focus on solving systems of expressions and/or equations. Visual programming helps with the notation. The combination can be very powerful.

An important point about programming using systems of equations is that while interdependencies may dictate order of evaluation, there is no programmed order of evaluation. Also, there is no notion of assignment. In solving these equations, our expectation is that variables will be bound once. If an equation is used more than once, it is understood that each use involves distinct instances of its variables. Arbitrary systems of equations are computationally hard to solve. Many interesting problems can be expressed by systems of equations which can be solved. To insure solvability requires some restrictions on the form of allowed equations. The nature of these restrictions varies depending upon the declarative paradigm.

Form-based programming is a particular approach to solving systems of equations. Forms are composed of cells, each defined by one or more equations. That these forms have an associated physical representation eases the process of constructing, manipulating, and understanding the associated notation. For form-based systems, the restriction is that the equations must not lead to circularities in evaluation. Form-based systems vary in how they enforce this restriction. Some enforce it by evaluating variable dependencies statically; others detect it dynamically. Some even allow finite circularity as a limited form of iteration. The form-based systems we have developed detect circularity dynamically. In summary, form-based programming eliminates the many language concepts that are really computer domain concepts. There is no notion of control sequencing other than the natural notion imposed by variable dependencies and no notion of assignment or other side-effects; however, there are notions of input, output, and persistent data.

Visual interfaces can improve our ability to express, view, edit, and interact with programs; but visual representations are multi-dimensional, unordered, and limited in resolution. Thus, visual programming languages must balance the usage of visual representations with textual representations.



In brief, programming in Formulate proceeds by using direct manipulation to construct forms, attach objects, and specify equations by which these objects obtain their values. An equation can be a constant or it can contain (graphically represented) references to other objects composed with functions like, +, *, etc., as well as user-defined functions which are themselves forms. Formulate has structured objects, arrays, lists, and database tables, as well as event-handling objects, buttons, text entry objects, and selection objects. Development and execution modes are provided for building, and then executing applications.

For Formulate, visualness provides the means for direct manipulation of variables, making variables tangible and eliminating many conceptual issues associated with naming and scoping. Visualness also creates a concreteness through working with prototypical values. In addition, as users develop programs, errors propagate, making it possible to see where calculations fail. Forms representing screen images, scratch paper calculations, order forms, and documentation can easily be developed, facilitating our understanding and organization of information through Formulate's visual representation.

Projects During Past Five Years

AASERT Program FY92: LPI Signal Detection Using the Wavelet Transform
AFOSR
PRESCOTT, Glenn

ACTS ATM Internetwork
Sprint
FROST, Victor S.
(w/Evans, Petr, Niehaus, Minden, Co-Is)

Adaptive Voice/Data Networks
Calspan-UB Res. Ctr.
EVANS, Joseph
(w/Johnson, Tim, Co-I)

Advanced ATM Research
NEC America
FROST, Victor S.
(w Evans, Niehaus, Petr, Co-Is)

Advanced Telecommunication Network Signaling Model
TRW
ROBERTS, James A.
(w/Evans, Petr, Minden, Frost, Co-Is)

Aerodynamic Modeling for Aircraft in Unsteady Flight Conditions
NASA-Langley
LAN, C. Edward

Air Force Defense Research Sources Program: Rapid Prototyping of Software Radio System Using Field Programmable Gate Arrays
AFOSR
PRESCOTT, Glenn

Analysis and Simulation of Traffic Management Algorithms for Frame Relay/Fast Packet Networks
Sprint/KTEC
PETR, David
(w/Frost, Evans)

Analysis of Canopy Architecture and Solar Radiation Regimes for Australian Eucalyptus Forests
Stanford U.
RICH, Paul

Analysis of Hemispherical Photographs for Quantification of the Light Regime in Giant Forest Canopy Gaps
Sequoia & Kings Canyon Natl. Park
RICH, Paul

Analysis of Hemispherical Photographs of Southern Swamplands
US Army Corps of Engineers
RICH, Paul

Analytic and Simulation Based Models for the Investigation of Low Probability of Intercept (LPI) Waveform Detactability
AFOSR
PRESCOTT, Glenn

Analytic Models for the Detection and Interception of Low Probability of Intercept (LPI) Communication Signals
AFOSR, RDL
PRESCOTT, Glenn

Application of Artificial Intelligence Techniques in Air Combat Simulation
ARL-Taipei Econ. & Cult. Rep. Ofc.
LAN, C. Edward

Application of Computational Aerodynamics to Interference Assessment/Correction in Wind Tunnel Testing
Aeronautical Res. Lab-Taiwan
LAN, C. Edward

ATM Adaptation Layer for Composite Users (AAL-CU) Research
Sprint/United Management Co.
PETR, David

ATM Available Bit Rate Service Simulation Models
Integrated Telecom Technology
EVANS, JOSEPH
(w/Frost, Co-I) (IgT)

ATM Reference Traffic System
Sprint
NIEHAUS, Douglas
(w/Evans, Frost, Co-Is)

Battle Lab's CINCUSAREUR Project
SRI International
FROST, Victor S.

Biometry and Hemispherical Photography Measurements of Auxiliary Sites in Support of BOREAS
Canada C.R.S.
RICH, Paul

Block Oriented Network Simulation (BONeS)
Sprint/United Mgmt. Co.
PETR, David
(w/Frost, Co-I)

Calculation of Aircraft Parameters for Mooney M20J
Azure Technology
LAN, C. Edward

CDMA Capacity Assessment for Personal Wireless Communications
Sprint
ROBERTS, James A.
(w/Frost, Prescott, Shanmugan, Co-Is)

Characterization of Vegetation Properties
Univ. CA Los Alamos
RICH, Paul

COEDS Analysis on Frequency Hopping Communication Systems
San Diego St. U. Fd.
HOLTZMAN, Julian C.

COEDS Analysis on Wideband Communication Systems
San Diego St. U .Fd.
HOLTZMAN, Julian C.

Collection and Application of ATM Network Performance Characteristics
Sprint
FROST, Victor S.
(w/Evans, Co-I)

Color Displays for COEDS
San Diego St. U. Fd.
HOLTZMAN, Julian C.

Consulting Service Support on RDD 100™ - BONeS™ Interface Project
COMDISCO
HOLTZMAN, Julian C.

Design Rules and Associated Tools for ATM Networks
KTEC
PETR, David
(w/Frost, Co-I)

Design Rules and Associated Tools for ATM Networks
Sprint Comm. Co.
PETR, David
(w/Frost, Co-I)

Design, Code, and Test the Electromagnetic Antenna Computer Model
ITT Defense
CHAKRABARTI, S.

DesignLab
NSF
Ambler, A.
(w/Brown, Darwin, Evans, J. Gauch, S. Gauch, Miller, Niehaus, Roddis, Tsatsoulis, Wallace, Co-Is)

Determination of the Impact of Advanced Traffic Controls on the Performance of Edge/Core ATM Network Architectures
Sprint/United Management Co.
FROST, Victor S.
(w/Evans, Niehaus, Petr, Co-Is)

Developing Modules for Simulating Military Communications Systems Using SPW
RADC
SHANMUGAN, Sam
(w/Prescott, Co-I)

Development and Testing of Advanced Signaling Protocols for ATM Networks
Sprint
NIEHAUS, Douglas
(w/Evans, Frost, Petr, Co-Is)

Development of a Geographical Information System Database for Las Cruces Biological Station and Vicinity, Costa Rica
Organ. for Tropical Studies
RICH, Paul

Development of a Large-scale ATM Simulation Environment (LANSE)
Sprint
FROST, Victor S.
(w/Evans, Petr, Co-Is)

Development of a Transonic Small-Disturbance Aerodynamic Code for Airplane Configurations
Aero. Ind. Dev. Ctr., Taiwan
LAN, C. Edward

Development of a Transonic Small-Disturbance Aerodynamic Code for Store Separation Simulations
Aero. Ind. Dev. Ctr., Taiwan
LAN, C. Edward

Development of an Autorotative Toy
Hewitt & Howe
LAN, C. Edward

Development of an Unsteady Transonic Small Disturbance Code for Airplane Flutter Prediction
Aero. Ind. Dev. Ctr.
LAN, C. Edward

Development of Bandwidth Assignment and Performance Simulation Software
Telesat Canada
PETR, David
(w/Frost, CO-I)

Development of New Modeling Structures within the Block Oriented Network Simulation (BONeS)
COMDISCO/KTEC
FROST, Victor S.

Development of Project Activity Duration and Resource Requirement Algorithms Based on Historical Data
KDOT/KTRAN
RODDIS, Kim

Digital Signal Processing (DSP) Rapid Prototyping for Military Communication Systems
Rome Laboratory
SHANMUGAN, Sam
(w/Prescott and Johnson, Co-Is)

Digital Signal Processing (DSP) Rapid Prototyping of Advanced Tactical Communication Systems with Field Programmable Gate Arrays (FPGA)
AFMC/Rome Lab.
PRESCOTT, Glenn
(w/Shanmugan, Evans, Co-Is)

DSP Rapid Prototyping Implementation of Advanced Tactical Communications Waveform and Signal Processing Functions
Rome Laboratory Air Force
SHANMUGAN, Sam
(w/Prescott and Johnson, Tim, Co-Is)

Establishment of a National Geospatial Data Clearinghouse (NGDC) Node for Biological Resource Geospatial Data
U.S.G.S.
RICH, Paul
(w/Luckey, Co-I)

Evaluation of Distributed Control and Signaling Infrastructure for ATM Networks
Sprint
NIEHAUS, Douglas
(w/Petr, Co-I)

Expert System for Fabrication Error Solutions
KDOT/K-TRAN
RODDIS, Kim

Generating a Rule-Base for Sea-Ice Classification
Naval Res. Lab
TSATSOULIS, COSTAS
(w/J. Gauch, Co-I added 6/97)

GIS-Based Pilot Study of Lepidoptera Biodiversity in the Spring Range, Nevada
Stanford U.
RICH, Paul

Global Change Fellowship Program:
Donna S. Haverkamp
NASA-HQ
TSATSOULIS, Costas

Graduate Student Researchers Program: Donna Haverkamp "Multi-Image Data Classification of Sea-Ice Using a Blackboard"
NASA-HQ
TSATSOULIS, Costas

High Frequency-Digital Signal Processing Modem
Kantronics/KTEC
PRESCOTT, Glenn

Implementation of Distributed Electronic Mail System
MAMTC
HOLTZMAN, Julian C.

Improved Information Retrieval and Value-added Automated Search Based on Closed Caption Text and Customer Profile
Worldwide Broadcasting Network
GAUCH, Susan

Improved Video Processing System
Worldwide Broadcasting Network
GAUCH, John

Improving Steel Design and Fabrication Using Integrated KBES-CADD; and Research Experience for Undergraduates (REU)
NSF
RODDIS, Kim

Intelligent Information Dissemination Server (IIDS) Project - Phase 0
Lockheed Martin
TSATSOULIS, Costas

Investigation of Aerodynamics for Maneuvering Aircraft
Aeronautical Res Lab-Taiwan
LAN, C. Edward

Investigation of Communication System Performance in a Hospital Environment
KTEC
ROBERTS, James A.
(w/Minden, Co-I)

Investigation of Communication System Performance in a Hospital Environment
Radiant Systems
ROBERTS, James A.
(w/Minden, Co-I)

Investigation to Determine the Information Needed to Design a Fiber Beacon
Bearfax
DEMAREST, Kenneth
(w/Rummer, Co-I)

K*STAR First Awards - Type II
KTEC/NSF EPSCoR
NORDHEDEN, Karen

Kansas Integrated Commercialization Information Network: A Demonstration Project
KTEC
HOLTZMAN, Julian C.
(w/Johnson, Prescott, Co-Is)

KEURP - Link: Phase III
KEURP, Kansas Electric Utilities Research Program
GAUCH, Susan

KEURP - Net: Phase II
KEURP
NIEHAUS, Douglas
(w/ S. Gauch, Co-I)

KEURP-Net, Phase I
KEURP
NIEHAUS, Douglas
(w/S. Gauch, J. Evans, Co-Is)

Lightwave Communications Systems Research
Sprint, NSF EPSCoR, KTEC
FROST, Victor S., DEMAREST, Kenneth
(w/Evans, Allen, Nordheden, Co-Is. As of 2/97: delete Nordheden, add Minden, Fang)

MAGIC II: A Large-Scale Internetwork Supporting High Speed Distributed Storage, Processing and Applications
ARPA
FROST, Victor S.
(w Evans and Niehaus, Co-Is)

Multidisciplinary Research in Mine Detection and Neutralization Systems
U. of MO-Rolla/ARO
PLUMB, Richard
(w/Plumb and Gogineni, Co-Is)

Multiple-Access Low Probability of Intercept (LPI) Communications Networks
AFOSR
PRESCOTT, Glenn

Novel Digital Speech Compression Techniques
AFOSR, RDL
EVANS, Joseph

Object Motion Analysis for Biomedical Applications
Whitaker Found.
GAUCH, John

Performance Evaluation of IP Firewalls over ATM Networks
Trusted Info. Systems, Inc.
EVANS, Joseph
(w/ Frost, Co-I)

Prediction of Transonic Flutter Characteristics of Business Class Jet Aircraft
Raytheon Aircraft
LAN, C. Edward
(w/Lim, Co-I)

Rapidly Deployable Radio Network (RDRN)
FBI
SHANMUGAN, Sam
(w/ Frost, Roberts, Minden, Prescott, Evans, Plumb, Petr, Co-Is)

Rapidly Deployable Radio Network (RDRN) - Phase II
DARPA
SHANMUGAN, Sam
(w/Evans, Frost, Minden, Petr, Prescott, Plumb, Roberts, Co-Is)

Reporting System to Improve Safety of the Blood Supply
U. of TX-SW Med. Ctr.
TSATSOULIS, Costas

Research in Technologies in Modeling of Telecommunications Networks
COMDISCO Systems
FROST, Victor S.

Research on Gigabit Gateways: Access to Future Public Switched Networks
Digital Eqpt Corp
MINDEN, Gary
(w/Frost, Co-I)

Research on Gigabit Gateways: Access to Future Public Switched Networks
KTEC
FROST, Victor S.
(w/Minden, Evans, Petr)

Research on Gigabit Gateways: Access to Future Public Switched Networks
USAF (ARPA)
FROST, Victor S.
(w/Minden, Evans, Petr, Co-Is)

Research on the Real Time Estimation of Traffic Descriptors for High Speed Telecommunications Networks
BNR, Inc.
FROST, Victor S.
(w/Minden, Petr, Evans, Co-Is)

REU Site: Information Systems Engineering at the University of Kansas
NSF
ROBERTS, James A.

RF Channel Simulator for Wireless Communications
(Proprietary)
PRESCOTT, Glenn
(w/Roberts, Co-I)

RIA: A Testbed for the Application of Corpus Linguistics to Information Retrieval
NSF
GAUCH, Susan

Sea-ice Classification by the Intelligent Integration of Active and Passive Microwave Data
NASA-HQ
TSATSOULIS, COSTAS
(w/Gogineni, Co-I)

Software System Installation and Support
Materials Tech. Institute
HOLTZMAN, Julian C.

Studies of Microwave Scattering and Canopy Architecture for Boreal Forests: Acquisition and Analysis of Hemispherical Photographs
NASA-Goddard
RICH, Paul
(w/Gogineni, Co-I)

Study of the Role of ACTS in Remote Manufacturing Operations
NASA-HQ
TSATSOULIS, COSTAS
(w/Frost)

Targeting Expert Systems for Bridge Engineering
KDOT/KTRAN
RODDIS, Kim

Technology Transfer
ProFusion, LLC
JOHNSON, Timouthy

The Pricing Services in ATM Networks
Sprint/United Management Co.
PETR, David

Torsion of Exterior Girders of a Steel Girder Bridge During Concrete Deck Placement
KTRAN
RODDIS, Kim
(w/Ray Moore, Co-I)

Traffic Management and Controls for ATM Networks
Sprint
PETR, David
(w/Frost, Niehaus, Co-Is)

Unsteady Transonic Aerodynamic Modeling for Prediction of Control Surface Buzz
Aero. Ind. Dev. Ctr.
LAN, C. Edward

Voice Transport via ATM Networks
Sprint Comm. Co.
PETR, David
(w/Evans, Frost, Co-Is)

Wireless ATM Adaptive Voice/Data Networks
U.S. Air Force
EVANS, JOSEPH
(w/Frost, J. Gauch, Co-Is)

Wireless Extension to the ACTS ATM Internetwork
Sprint
EVANS, JOSEPH
(w/Prescott and Frost, Co-Is).

Affiliated Faculty Publications

Books and Book Chapters

1997

Identifying Ice Floes and Computing Ice Floe Distributions in SAR Image, L-K. Soh, C. Tsatsoulis. To appear in The Polar Oceans: Analysis of Synthetic Aperture Radar Data, ed. C. Tsatsoulis and R. Kwok, Springer Verlag, 1997.

Integrating Cases, Sub-cases, and Generic Prototypes for Design, C. Tsatsoulis, P. Alexander. To appear in Case-Based Reasoning and Design, ed. P. Pu and M.L. Maher.

Introduction to 'The Polar Oceans: Analysis of Synthetic Aperture Radar Data,' C. Tsatsoulis and R. Kwok. To appear in The Polar Oceans: Analysis of Synthetic Aperture Radar Data, ed. C. Tsatsoulis and R. Kwok, Springer Verlag, 1997.

The Polar Oceans: Analysis of Synthetic Aperture Radar Data, ed.C. Tsatsoulis and R. Kwok, Springer Verlag, 1997 (to appear).

1996

Modeling and Simulation of Telecommunications Networks V.S. Frost, B. Melamed. The Froehlich/Kent Encyclopedia of Telecommunications, Vol. 11, ed. Fritz E. Froehlich, Allen Kent, Carolyn M. Hall, Marcel Dekker, Inc., New York, 1996.

Stochastic Adaptive Control, T. Duncan, B. Pasik-Duncan. The Controls Handbook, ed. W.S. Levine, CRC Press, 1996, pp. 1127-1136.

Waveguides, K.R. Demarest. The Electronics Handbook, ed. J. Whitaker, CRC Press, 1996, pp. 259-268.

1995

A Data Compression Technique for Synthetic Aperture Radar Images, V.S. Frost, G.J. Minden. IEEE Transactions on Aerospace Electronics Systems, January 1986, Vol. AES-22, No. 1, pp. 47-55. Also to appear in Image Data Compression: Block Truncation Coding, ed. B.V. Dasarathy, IEEE Computer Society Press, 1995.

Implementation of Digital Filters, J.B. Evans. Invited section in Circuit and Filter Handbook, editor-in-chief W.K. Chen, section 16.5, CRC Press, 1995.

Stochastic Control Problems on Real and Complex Symmetric Spaces, T. Duncan, H. Upmeier. Stochastic Processes, Physics and Geometry II, ed. S. Albevero, U. Cattaneo, and D. Merlini, World Scientific, 1995, pp. 209-220.

1994

Chapter 6, Modeling and Simulation in Network Management, V.S. Frost. Network Management into the 21st Century, ed. S. Aidarous and T. Plevyak, IEEE Press, 1994.

Journal Articles

1997

Adaptive Control of a Partially Observed Discrete Time Markov Process, T. Duncan, B. Pasik-Duncan, L. Stettner. To appear in Journal of Applied Mathematical Optimization.

ATM WAN Performance Tools and Results, L. DaSilva, J. Evans, D. Niehaus, V. Frost, R. Jonkman, B. Lee, G. Lazarou. IEEE Communications Magazine, August 1997.

Case-Based Approach for Bridge Fabrication Errors, W.M.K. Roddis, J. Bocox. Journal of Computing in Civil Engineering, American Society of Civil Engineers, Vol. 11, No. 2, April 1997, p. 84-91.

A Control and Management Network for Wireless ATM Systems, S.F. Bush. S. Jagannath, R. Sanchez, J.B. Evans, K.S. Shanmugan, V.S. Frost, G. Minden. Accepted for publication in ACM/Baltzer Wireless Information Networks (WINET) Journal.

Design and Analysis of a Bandwidth Management Framework for ATM-Based Broadband ISDN, K. Liu, H. Zhu, D.W. Petr, V.S. Frost, C. Braun, W. Edwards. IEEE Communications Magazine, Vol. 35, No. 5, May 1997, pp. 138-145.

Discretized Maximum Likelihood Estimates for Adaptive Control of Ergodic Markov Models, T. Duncan, B. Pasik-Duncan, L. Stettner. To appear in SIAM Journal of Control Optimization.

Ergodic Control of Some Stochastic Semilinear Systems in Hilbert Spaces, T. Duncan, B. Maslowski, B. Pasik-Duncan. To appear in SIAM Journal of Control Optimization.

On Ergodic Control of Stochastic Evolution Equations, T. Duncan, B. Pasik-Duncan, L. Stettner. To appear in Stochastic Processes and Applications.

Implementation of Signal Power Estimation Methods,
S. Cheng, J.B. Evans. Accepted for publication in IEEE Transactions Circuits & Systems, scheduled for publication March 1997.

Integrating Case-Based Reasoning and Decision Theory: Theory and Experiments,
C. Tsatsoulis, Q. Cheng, H-Y. Wei. To appear in IEEE Expert.

Intelligent Information Agents: Review and Challenges for Distributed Information Sources,
D. Haverkamp, S. Gauch. To appear in Journal of the American Society for Information Science.

A Kiefer-Wolfowitz Algorithm with Randomized Differences,
T. Duncan, H.F. Chen, B. Pasik-Duncan. To appear in IEEE Transactions on Automatic Control.

Nonlinear Filtering and Estimation,
T. Duncan. To appear in Encyclopedia of Electrical and Electronics Engineering, John Wiley & Sons.

Performance Benchmarking of Signaling in ATM Networks,
D. Niehaus, A. Battou, A. McFarland, B. Cecina, H. Dardy, V. Sirkay, B. Edwards. IEEE Communications Magazine, August 1997.

A Survey of Active Network Research,
D.L. Tennenhouse, J.M. Smith, W.D. Sincoskie, D.J. Wetherall, G.J. Minden. IEEE Communications Magazine, Vol. 35, No. 1, January 1997.

The VISION Digital Video Library,
S.E. Gauch, W. Li, J.M. Gauch. To appear in Information Processing and Management.

1996

Adaptive Boundary Control of Linear Distributed Parameter Systems Described by Analytic Semigroups,
T. Duncan, B. Maslowski, B. Pasik-Duncan. Journal of Applied Mathematical Optimization, 33, 1996, pp. 107-138.

Cell Loss Quality of Service in an Integrated Traffic ATM Network,
D.W. Petr, V.S. Frost, T. Kelley, C. Braun, A. Demirjis. International Journal of Communications Systems, Vol. 9, 1996, pp. 97-104.

Conmix: Integrating Specifications, Data and Models,
W. M. K. Roddis, D. L. Melber, G. P. Pasley. Information Representation and Delivery in Civil and Structural Engineering Design, ed. B. Kumar and A. Retik, Civil-Comp Press, Edinburgh, Scotland, 1996, pp. 99-104.

Constraint-Based Genetic Algorithm Optimization Applied to Reinforced Concrete Design,
W. K. Lucas, W. M. K. Roddis. Information Processing in Civil and Structural Engineering Design, ed. B. Kumar, Civil-CompPress, Edinburgh, Scotland, 1996, pp. 171-175.

Detection Models,
R.F. Mills, G.E. Prescott. IEEE Transactions on Aerospace and Electronic Systems, January 1996.

GIS-Based Solar Radiation Modeling,
R. Dubayah, P.M. Rich. In GIS and Environmental Modeling: Progress and Research Issues, ed. M.F. Goodchild, L.T. Steyaert, B.O. Parks, C. Johnston, D. Maidment, M. Crane, and S. Glendinning, GIS World Books, Fort Collins, CO, 1996.

Image Segmentation and Analysis via Multiscale Gradient Watersheds,
J.M. Gauch. Accepted for publication in IEEE Transactions on Image Processing, 1996.

In-Service Monitoring for Cell Loss Quality of Service Violations in ATM Networks,
H. Zhu, V.S. Frost. IEEE/ACM Transactions on Networking, Vol. 4, No. 2, April 1996.

Knowledge Acquisition and Engineering for a Steel Bridge Fabrication Expert System,
H.G. Melhem, W.M.K. Roddis, S. Nagaraja, M.R. Hess. Journal of Computing in Civil Engineering, American Society of Civil Engineers, Vol. 10, No. 3, July 1996, pp. 248-256.

A 622 Mb/S LAN/WAN Gateway and Experiences with Wide-Area ATM Networking,
J.B. Evans, D. Niehaus, D.W. Petr, V.S. Frost, G.J. Minden, B.J. Ewy. IEEE Network, Vol. 10, No. 3, May/June 1996, pp. 40-48.

Mobile ATM Buffer Capacity Analysis,
S.F. Bush, J.B. Evans, V.S. Frost. ACM/Baltzer Mobile Networks and Nomadic Applications (NOMAD): Topical Journal on Mobility of Systems, Users, Data and Computing, Vol. 1, No. 1, 1996.

Noise Squeezing Due to Kerr Effect Nonlinearity in Optical Fibers with Negative Dispersion,
R. Hui, M. O'Sullivan. IEEE Electronics Letters, Vol. 32, No. 21, October 1996.

Numerical Differentiation and Parameter Estimation in Higher Order Stochastic Systems,
T. Duncan, P. Mandl, B. Pasik-Duncan. IEEE Transactions on Automatic Control, 41, 1996, pp. 522-532.

ProFusion: Intelligent Fusion from Multiple, Distributed Search Engines,
S. Gauch, G. Wang, M. Gomez. Journal of Universal Computer Science, September 1996.

Stochastic Adaptive Control for Continuous Time Linear Systems with Quadratic Cost,
T. Duncan, H.F. Chen, B. Pasik-Duncan. Journal of Applied Mathematical Optimization, 34, 1996, pp. 113-138.

1995

Automatic Implementation of FIR Filters on Field Programmable Gate Arrays,
S. Mohanakrishnan, J.B. Evans. IEEE Signal Processing Letters, March 1995, pp. 51-53.

BFX: An Operational Expert System for Bridge Fabrication,
W.M.K. Roddis, M. Hess, H. Melhem and S. Nagaraja. Transportation Research Record, TRB, No. 1491, Transportation Research Board, 1995, pp. 62-68.

A Comprehensive, Automated Approach to Determining Sea Ice Thickness from SAR Data,
D. Haverkamp, L-K Soh, C. Tsatsoulis. IEEE Transactions on Geoscience and Remote Sensing, Vol. 33, No. 1, 1995, pp. 46-57.

An Efficient Bit-Serial FIR Filter Architecture,
Y.C. Lim, J.B. Evans, B. Liu. Circuits, Systems & Signal Processing, Vol. 15, No. 5, 1995, pp. 639-651.

An Equivalent Markov Model for Burst Errors in Digital Channels,
K.S. Shanmugan, S. Sivaprakasam. IEEE Transaction on Communications, April 1995, pp. 1347-1356.

FDTD Modeling of Scatterers in Stratified Media,
K. Demarest, R. Plumb, Z. Huang. IEEE AP-S Transactions, Vol. AP-43, No. 10, October 1995, pp. 1164-1168.

Input-Queued Switch Based on a Scheduling Algorithm,
S. Motoyama, D.W. Petr, V.S. Frost. Electronics Letters, Vol. 31, No. 14, July 6, 1995, pp. 1127-1128.

Interferometric Synthetic Aperture Radar,
C.T. Allen. IEEE Geoscience and Remote Sensing Society Newsletter, Issue #96, September 1995, pp. 6-13.

Limit Theorems of Probability Theory in Linear Controlled Evolution Systems with Quadratic Cost (Summary),
B. Pasik-Duncan. J. Math. Sys. Estim. Control, 5, 1995, pp. 99-102.

On Stochastic Adaptive Control of an Investment Model with Transaction Fees,
B. Pasik-Duncan, T. Duncan, M. Faul, O. Zane. Ulam Quarterly, 1995, pp. 101-109.

Performance of BPSK and TCM Using the Exponential Multipath Profile Model for Spread-Spectrum Indoor Radio Channels,
J.M. Bargallo, J.A. Roberts. IEEE Transactions on Communications, Vol. COM-43, February 1995, pp. 615-623.

Recovery of Surfaces with Discontinuities by Fusing Shading and Range Data within a Variational Framework,
J. Shah, H.H. Pien, J.M. Gauch. IEEE Transactions on Image Processing, Vol. 5, No. 8, August 1995.

Robust Target Classification Using ANN,
S. Chakrabarti, N. Bindal, K. Theagarajan. IEEE Transactions on the Neural Network, Vol. 6. No. 3, May 1995, pp. 760-766.

Simulation Comparison of Broadband Networking Technologies,
D.W. Petr, V.S. Frost, L. Neir, A. Demirtjis, C. Braun. Simulation, Vol. 64, No. 1, January 1995, pp. 42-50.

Solvable Optimal Control of Brownian Motion in Symmetric Spaces and Spherical Polynomials,
T. Duncan. Geometry in Nonlinear Control and Differential Inclusions, Banach Center Publ., 32, 1995, pp. 183-197.

Some Results for the Adaptive Boundary Control of Stochastic Linear Distributed Parameter Systems,
T. Duncan. Adaptive Control, Filtering and Signal Processing, IMA Volumes in Mathematics and Its Applications, Springer-Verlag, 74, 1995, pp. 43-64.

Static and Dynamical Properties of Dispersive Optical Bistabilitiy in Semiconductor Lasers,
R. Hui. IEEE Journal of Lightwave Technology, Vol. 13, No. 1,1995.

Stochastic Control Problems and Spherical Functions on Symmetric Spaces,
T. Duncan, H. Upmeier. Transactions Amer. Math. Soc., 1995, pp. 1083-1130.

A Variational Approach to Multi-Sensor Fusion of Images,
H.H. Pien, J.M. Gauch. Applied Intelligence (special issue on sensor fusion), Vol. 5, No. 3, July 1995.

1994

Adaptive Boundary and Point Control of Linear Stochastic Distributed Parameter Systems,
T. Duncan, B. Maslowski, B. Pasik-Duncan. SIAM Journal of Control Optimization, 1994, 32, pp. 648-672.

Almost Self-Optimizing Strategies for the Adaptive Control of Diffusion Processes,
T. Duncan, B. Pasik-Duncan, L. Stettner. Journal of Optimization Theory and Applications, 81, 1994, pp. 479-507.

The Combination of Algorithmic and Heuristic Methods for the Classification of Sea Ice Imagery,
D. Haverkamp, C. Tsatsoulis, S.P. Gogineni. Remote Sensing Reviews, Vol. 9, 1994, pp. 135-159.

Computing Optical Flow in Color Image Sequences,
J. Lai, J.M. Gauch, J.D. Crisman. Innovation and Technology in Biology and Medicine (special issue on motion analysis in biomedical images), Vol. 15, No. 3, 1994.

DPSK Performance for Indoor Wireless Rician Fading Channels,
J.A. Roberts, J. M. Bargallo. IEEE Transactions on Communications, Vol. COM-42, February 1994, pp. 592-596.

The Digital Video Library System: Vision and Design,
S. Gauch, R. Aust, et al. Digital Libraries '94, College Station, TX, June 1994, pp. 47-52.

Efficient FIR Filter Architectures Suitable for FPGA Implementation,
J.B. Evans. IEEE Transactions Circuits and Systems, July 1994.

G-TOR: A Hybrid ARQ Protocol for Narrow Bandwidth HF Data Transmission,
G.Prescott, P. Anderson, M. Huslig, K. Metcalf. QEX: The American Radio Relay League Experimenter's Exchange, No. 147, May 1994, pp. 12-19.

G-TOR: The New, Faster HF Digital Mode for the KAM Plus,
P. Anderson, M. Huslig, G. Prescott, K. Metcalf. RTTY Digital Journal, March Vol. 42, No. 3, 1994, pp. 20-21.

HEMT Degradation in Hydrogen Gas,
P.C. Chao, M.Y. Kao, K. Nordheden, A.W. Swanson. IEEE Electron Device Letters, Vol. 15, No. 5, 1994, pp. 151-153.

Hybrid ARQ for HF Data Transmission,
G. Prescott, P. Anderson. Communications Quarterly, Summer 1994, pp. 31 - 40.

Modeling Baluns with the Method of Moments,
K. Demarest, R. Plumb, Z. Huang. IEEE AP-S Transactions, Vol. AP-42, No. 8, August 1994, pp. 1195-1198.

Network-Based Multimedia Information Services,
S. Gauch. NIST Virtual Library Consortium Working Group Report, July 1994.

On the Ergodic and the Adaptive Control of Stochastic Differential Delay Systems,
T. Duncan, B. Pasik-Duncan, L. Stettner. Journal of Optimization Theory and Applications, 81, 1994, pp. 509-531.

On Statistical Sampling for System Testing,
T. Duncan, P. Mandl, B. Pasik-Duncan. IEEE Transactions on Automatic Control, 39, 1994, pp. 118-122.

On the Stochastic Adaptive Control of an Investment Model with Transaction Fees,
T. Duncan, M. Faul, B. Pasik-Duncan, O. Zane. Ulam Quarterly, 4, 1994, pp. 1-15.

Optimization in a Class of Priority Discarding Policies for Finite Queues,
D.W. Petr. IEEE Transactions on Automatic Control, Vol. 39, No. 5, May 1994, pp. 1020-1024.

Packet Error Rates for DPSK and Differentially-Encoded Coherent BPSK,
J.A. Roberts. IEEE Transactions on Communications, Vol. COM-42, April 1994, pp. 1441-1444.

Simulation and Implementation of Communication Systems,
K.S. Shanmugan. IEEE Communications Magazine, Guest Editorial, July 1994.

Simulation and Implementation Tools for Communication and Signal Processing Systems,
K.S. Shanmugan. IEEE Communications Magazine, July 1994, pp. 36-40.

Traffic Modeling for Telecommunications Networks,
V.S. Frost, B. Melamad. IEEE Communications Magazine, March Vol. 32, No. 3, 1994, pp. 70-81.

Triple Crystal X-Ray Diffraction Analysis of Reactive Ion Etched Gallium Arsenide,
V.S. Wang, R.J. Matyi, K.J. Nordheden. Journal of Applied Physics, 75(8), 1994, p. 3835.

Using AI for Concurrent Design in the Steel Building Industry,
G.P. Pasley, W.M.K. Roddis. Concurrent Engineering: Research and Applications, Vol. II, No. 4, 1994, pp. 303-310.

Papers/Presentations

1997

Combination of Machine Learning and Regression Analysis in Knowledge Acquisition,
W.M.K. Roddis, L. Zhang. Computing in Civil Engineering, Proceedings of the Fourth Congress, ed. Teresa Adams, American Society of Civil Engineers, June 1997, pp. 312-318.

A Corpus Analysis Approach for Automatic Query Expansion,
S. Gauch, J. Wang. Accepted for CIKM '97: 7th International Conference on Information and Knowledge Management, Las Vegas, NV, November 1997.

Equilibrium Pricing in Multiservice Priority-Based Networks,
L.A. DaSilva, D.W. Peter, N. Akar. Accepted for presentation at and publication in Proceedings of 1997 IEEE Globecom Conference, November 1997.

Ergodic Distributed Control for Parameter Dependent Stochastic Semilinear Systems in Hilbert Space,
T. Duncan, B. Maslowski, B. Pasik-Duncan. To appear in Proceedings of the Conference on Stochastic Differential and Differentia Equations, Birkhauser, 1997.

Information Fusion from Distributed World Wide Web Sources,
S. Gauch. Accepted for Proceedings of the ACM SIGIR '97 Workshop on Networked Information Retrieval, Philadelphia, PA, July 1997.

A Measurement-Based CAC Strategy for ATM Networks,

K. Kiu, D.W. Petr, C. Braun. Proceedings of the1997 IEEE International Conference on Communications (ICC'97), June 1997, pp. 1714-1718.

Modulation Instability in Amplified Optical Systems with Dispersion Compensation,
R. Hui, M. O'Sullivan, A. Robinson. Optical Fiber Communication Conference, OFC'97, Dallas USA, February 1997.

Performance Experience in a Wide Area Network,
L. DaSilva, J. Evans, D. Niehaus, V. Frost, R. Jonkman, B. Lee, G. Lazarou. IEEE ICC '97, Montreal, Quebec, Canada, June 1997.

1996

AAI ATM WAN Performance: Tools, Experiments, and Results,
J.B. Evans, V.S. Frost, D. Niehaus, R. Jonkman, L. DaSilva, B. Lee, G. Lazarou. Invited presentation, 1996 DARPA ATM WAN Performance Workshop, June 1996.

An Active Network Architecture for ATM WANs,
A.B. Kulkarni, G. Minden, V. Frost, J. Evans, Third International Workshop on Mobile Multimedia Communications, Princeton, NJ, September 25-27, 1996.

An Active Networking Program,
G.J. Minden. DARPA ITO General PI Meeting, Dallas, TX, October 6-9, 1996.

Adaptive Control of Markov Processes Using Large Deviations,
T. Duncan, B. Pasik-Duncan, L. Stettner. Proceedings of the 35th Conference on Decision and Control, Kobe, Japan, 1996, pp. 360-365.

Capacity of a CDMA Cellular System with Variable User Data Rates,
V.J. Paulrajan, J.A. Roberts, D.L. Machamer. Proceedings of the IEEE GLOBECOM'96, London, UK, November 18-22, 1996, pp. 1458-1462.

A Comparison of Various Radiometer Experiences with Wide-Area ATM Networking: From Hardware Development to System Performance, Victor Frost. 18th Biennial Symposium on Communications, Queen's University, Kingston, Ontario, Canada, June 4, 1996 (keynote address).

Computational Methods for Stochastic Partial Differential Equations,
T. Duncan, B. Pasik-Duncan, P. Zimmer. Proceedings of the 35th Conference on Decision and Control, Kobe, Japan, 1996, pp. 1765-1766.

Constraint-Based Reasoning for Optimal Concrete Design and Detailing,
W.K. Lucas, W.M.K. Roddis. Analysis and Computation Proceedings of the Twelfth Conference Held in Conjunction with Structures Congress XIV, ed. Franklin Y. Cheng, American Society of Civil Engineers, April 1996, pp. 154-165.

A Control and Management Network for Wireless ATM Systems,
S.F. Bush, S. Jagannath, J.B. Evans, V.S. Frost. IEEE International Conference on Communications, Dallas, TX, June 1996.

Corpus Analysis for TREC-5 Query Expansion,
S. Gauch, J. Wang. TREC-5: The 5th Annual Text Retrieval Conference, Gaithersburg, MD, November 1996.

DARPA ITO Experimental Networking Testbeds,
G.J. Minden. AIAA Conference, Washington, DC, February 29, 1996.

Design and Analysis of a Bandwidth Management Framework for ATM-Based Broadband ISDN,
K. Liu, H. Zhu, D.W. Petr, V.S. Frost, C. Braun, W. Edwards. IEEE International Conference on Communications, Dallas, TX, June 1996.

Detection of Fast Frequency Hop Signals with Quadrature Mirror Filter Banks,
T. Farrell, G. Prescott. 1996 International Conference on Acoustics, Speech and Signal Processing (ICASSP-96), May 1996.

High Speed Optical Transmission Systems with Bidirectional Fiber Amplifiers,
R. Hui, M. Poettcker, M. O'Sullivan. SPIE Photonics China '96 , Beijing, November 1996.

Information Fusion with ProFusion,
S. Gauch, G. Wang. WebNet '96: The First World Conference of the Web Society, San Francisco, CA, October 1996, pp. 174-179.

The ITO Networking Systems Program,
G.J. Minden. ARPATech Symposium, Atlanta, GA, May 21-24, 1996.

Learning Reliability Models of Other Agents in a Multiagent System,
C. Tsatsoulis, G. Yee. AAAI-96 Workshop on Adaptive Multiagent Systems, Wsp-96-04, AAAI Press, 1996.

The MAGIC Gigabit Testbed Project,
G.J. Minden. Iowa State, Ames, IA, October 23, 1996.

MAGIC Testbed Results,
J.B. Evans, V.S. Frost, D. Niehaus, D.W. Petr, G.J. Minden, B.J. Ewy. IEEE HOT Interconnects Conference, Stanford, CA, August 14-16, 1996.

A 622 Mb/s ATM LAN/WAN Gateway with Cell Level Measurement and Pacing Capabilities,
J.B. Evans, V.S. Frost, D. Niehaus, D.W. Petr, G.J. Minden, B.J. Ewy. IEEE Hot Interconnects IV, Kresge Auditorium, Stanford University, Palo Alto, CA, August 1996.

Measuring Glacier and Ice Sheet Thickness in Greenland with an Airborne Radio Echosounder,
C.T. Allen. University of Kansas Physics and Astronomy Department Colloquium, Nov. 4, 1996.

A Novel Technique of Modeling GPR Antennas,
Z. Huang, K. Demarest, R. Plumb. Proceedings of the Sixth International Conference on Ground-Penetrating Radar, GPR '96, Sendai, Japan, October 1996, pp. 57-60

Over the Shoulder: Real-Time Collaboration Over High Speed Networks,
M.T. Swink, J.B. Evans, V.S. Frost. 1996 IEEE Gigabit Networking Workshop, March 1996.

Performance Benchmarking of ATM Signaling Software,
A. Kaushal, S. Shumate, R. Hill, D. Niehaus, V. Sirkay, B. Edwards. Proceedings of the OpenSig Workshop, Columbia University, October 1996.

Performance Considerations in File Transfers Using FTP Over Wide-Area ATM Networks,
L. DaSilva, R. Lett, V.S. Frost. 22nd International Conference for the Resource Management and Performance Evaluation of Enterprise Computing Systems, San Diego, CA, December 8-13, 1996.

Plasma Processes for GaAs Devices,
K.J. Nordheden. Department of Electrical and Computer Engineering, University of Illinois, Urbana, IL, December 1996.

Predictive Systems in Network Management with Mobility,
S.F. Bush, V.S. Frost, J.B. Evans. 1996 IEEE Symposium on Planning & Design of Broadband Networks, Montebello, Quebec, Canada, October 1996.

Projecting the Future for Engineering,
J.A. Roberts. Myron D. Calkins. Management Seminar, presented at the International Public Works Congress and Exposition, Washington, D.C., August 26, 1996.

A Quadrature Mirror Filter Hopped Spread Spectrum System,
T. Farrell, G. Prescott. 1996 Military Communications Conference, McLean, VA, October 21-24, 1996.

Radar Sounding of Glaciers in Greenland,
C.T. Allen. 1996 International Geoscience and Remote Sensing Symposium (IGARSS '96), Lincoln, Nebraska, May 31, 1996.

Radar Sounding of Greenland Outlet Glaciers,
C.T. Allen. XXVth General Assembly of the International Union of Radio Science (URSI), Lille, France, Sept. 5, 1996.

Real-Time Detection of Quality of Service Violations in High-Speed Networks,
V.S. Frost, H. Zhu. 1996 SIAM Annual Meeting, Kansas City, Missouri, July 22-26, 1996.

Self-Tuning Fuzzy Control for Available Bit Rate (ABR) Traffic,
Q. Hu, D.W. Petr. Mini-symposium talk given at Society for Industrial and Applied Mathematics (SIAM) Annual Meeting, Kansas City, July 1996.

Self-Tuning Fuzzy Traffic Rate Controller for ATM Networks,
Q. Hu, D.W. Petr, C. Braun. Proceedings of the IEEE International Conference on Communications (ICC), June 1996, pp. 424-428.

Single-Criteria Genetic Optimization for Design and Detailing of Concrete Structures,
W.M.K Roddis, W.K. Lucas, V. Chunnanond. Computing in Civil Engineering, Proceedings of the Third Congress, ed. Jorge Vanegas and Paul Chinowsky, American Society of Civil Engineers, June 1996, pp. 91-96.

A Stochastic Approximation Algorithm with Random Differences,
T. Duncan, H.F. Chen, B. Pasik-Duncan. Proceedings IFAC 1996 World Congress, San Francisco.

Teaching Computing Service Courses for Fun and Profit,
M.C. Kong, J.A. Roberts. Proceedings IEEE FIE'96, Salt Lake City, UT, November 6-9, 1996, pp. 7a4.21-7a4.24.

Texture Representation of SAR Sea Ice Imagery Using Multi-Displacement Co-Occurrence Matrices,
L. Soh, C. Tsatsoulis. IGARSS '96 Conference, 1996, Vol. I, pp. 112-114.

Transferring Artificial Intelligence Technology Through a Research Center of Excellence,
C. Tsatsoulis, J. Holtzman. ITESM '96 International Symposium on Artificial Intelligence/International Conference on Industrial Fuzzy Control and Intelligent Systems, Cancun, Mexico, November 12-15, 1996, pp. 30-35.

Using Measurements to Validate Simulation Models of TCP/IP Over High Speed ATM Wide Area Networks,
G.Y. Lazarou, V.S. Frost, J.B. Evans, D. Niehaus. IEEE Int. Conference on Communications, Dallas, TX, June 1996.

Using Temporal Information in an Automated Classification of Summer, Marginal Ice Zone Imagery,
D. Haverkamp, C. Tsatsoulis. IGARSS '96 Conference, 1996, Vol. I, pp. 109-111.

VISION: A Digital Video Library,
W. Li, S. Gauch, J. Gauch, K.M. Pua. ACM Digital Libraries '96, Baltimore, March 1996.

1995

Automatic Word Similarity Detection for TREC-4 Query Expansion,
S. Gauch, M.K. Chong. Proceedings of TREC-4: The 4th Annual Text Retrieval Conference, Gaithersburg, MD, November 1995.

Benchmarking of High Performance Networks,
J.B. Evans. Invited presentation, 1995 Int. Conf. Comp. Comm. & Networks, Las Vegas, Nevada, September 1995.

Bit Error Rate Performance of Antenna Diversity Systems with Channel Correlation,
J.R. Abeysinghe, J.A. Roberts. Proceedings of the IEEE GLOBECOM'95, Singapore, November 13-17, 1995, pp. 2022-2026.

A Connection Admission Control Based on Real Time Traffic Statistics,
S. Motoyama, D.W. Petr, V.S. Frost. Proceedings of the13th Brazilian Telecommunication Symposium, Aguas de Lindoia, SP, Brazil, September 3-6, 1995, Vol. 1, pp. 31-36.

Considerations for Automatic Gain Control in DSP Receivers and Modems,
G.E. Prescott. 1995 TAPR Symposium, St. Louis, MO, May 2-3, 1995.

Constraint-Based Reasoning for Concrete Design and Detailing,
W.K. Lucas, W.M.K. Roddis, F.M. Brown. CONSTRAINT-95, Proceedings of LAIRS-95, The Eighth Florida Artificial Intelligence Research Symposium, April 26, 1995.

Credit-Based Flow Control for ATM Networks Revisited,
J.B. Evans, L. DaSilva, H. Zhu, V.S. Frost. 1995 IEEE Gigabit Networking Workshop, April 1995.

Current Research at the University of Kansas Applying Artificial Intelligence in Structural Engineering,
W.M.K. Roddis. Applications of Artificial Intelligence in Structural Engineering–II: Proceedings of the 2nd Workshop of the European Group for Structural Engineering Applications of Artificial Intelligence (EG-SEA-AI), ed. Marco Lazzari and Paolo Salvaneschi, ISMES, Bergamo, Italy, March 18, 1995, pp. 48-52.

Discretized Maximum Likelihood Estimates and Almost Self-Optimizing Controls for Ergodic Markov Models,
T. Duncan, B. Pasik-Duncan, L. Stettner. Proceedings of the 34th IEEE Conference on Decision and Control, New Orleans, 1995, pp. 1630-1634.

Electrical Engineering vs. Computer Engineering vs. Computer Science: Developing Three Distinct but Interrelated Curricula,
K.R. Demarest, J.R. Miller, J.A. Roberts, C. Tsatsoulis. Proceedings of the IEEE FIE'95, Atlanta, GA, November 1-5, 1995, pp. 4b2.1-4b2.4.

Entropy of English Text: Experiments with Humans and a Machine Learning System Based on Rough Sets,
H. Moradi, J. Grzymala-Busse, J.A. Roberts. Proceedings of the Fourth Annual Conference on Fuzzy Theory and Technology, Wrightsville Beach, NC, September 28-October 1, 1995, pp. 87-88.

Experiences with a 622 Mb/s ATM/SONET Gateway,
J.B. Evans, G.J. Minden, V.S. Frost, D.W. Petr, D. Niehaus, D. Braun, B. Buchanan, B. Ewy, C.N. Gupta, S. Seetharam, V. Sirkay, M. Swink, H. Uriona, E. Yousefi. Invited presentation, 1995 MAGIC Symposium, Minneapolis, Minnesota, July 1995.

A Forward Only Recursion Based HMM for Modeling Burst Errors,
K.S. Shanmugan, S. Sivaprakasam. Proceedings of Globecom'95, Singapore, November 1995, pp. 1054-1059.

A High Speed Implementation of Adaptive Shaping for Dynamic Bandwidth Allocation,
C. Braun, V. Sirkay, H. Uriona, S. Seetharam, E. Yousefi, D. Petr, D. Niehaus, V.S. Frost, J.B. Evans, G.J. Minden. Fourth IEEE Symposium on High Performance Distributed Computing, August 1995, pp. 94-101.

How to Encourage Cheating with Virtual Path Policing in ATM Networks,
A. Demirtjis, D.W. Peter. Proceedings of the International Conference on Computer Communication and Networks (IC3N), September 1995, pp. 225-228.

Integrating KBES and CADD for Steel Design and Fabrication,
W.M.K. Roddis, G.P. Pasley. IABSE Colloquium, Knowledge Support Systems in Civil Engineering, Bergamo, Italy, March 16-17, 1995, pp. 131-134.

Knowledge-Based Systems for Steel Fabrication,
W.M.K. Roddis. 40th Annual Structural Engineering Conference, The University of Kansas Department of Civil Engineering and Division of Continuing Education, Lawrence, Kansas, April 4, 1995.

LPI Requirements for Military C3 Networks,
G.E. Prescott. Workshop on Communications Networks for Command and Control, North Carolina State University, Raleigh, NC, March 9-10, 1995.

Network Integrated Processing,
J.B. Evans, V.S. Frost, D. Niehaus, D.W. Petr. 1995 IEEE Gigabit Networking Workshop, April 1995.

Network Performance Measurement Tools: NetSpec and ARTS,
D. Niehaus. Proceedings of the Magic Technical Symposium, Minneapolis, MN, August 1995.

A New Simulation Approach for Modeling Intelligent Networks Based on Signaling System No. 7,
K. Medhat, J.B. Evans, J.A. Roberts. Proceedings 4th Midwest Electro-Tech. Conference, March 1995, pp. 108-111.

Numerical Methods for the Stochastic Adaptive Control of Some Investment and Consumption Models with Transaction Costs,

T. Duncan, B. Pasik-Duncan, O. Zane. Proceedings 34th Conference on Decision and Control, New Orleans, 1995, pp. 3360-3365.

Parallel Implementation of the CELP Speech-Compression Algorithm on a Network of TMS320C40 DSP Processors,
H. Chakravarthula, S. Srinivas, G. Prescott, T. Johnson, S. Tyler. Proceedings of the Sixth International Conference on Signal Processing Applications and Technology (ICSPAT-95), October 24-26, 1995.

Performance Evaluation of Congestion Control Mechanisms in ATM Networks,
H. Zhu, L.A. DaSilva, J.B. Evans, V.S. Frost. 20th International Conference of the Computer Measurement Group, Nashville, TN, December 3-8, 1995.

Plasma Etching of HEMTs and MMICs, K.J. Nordheden. Department of Electrical and Computer Engineering, Washington University, St. Louis, MO, March 1995.

Rapidly Deployable Radio Network: ATM to the End User,
G.E. Prescott. Defense Information Systems Agency/AFOSR/Rome Labs Technical Exchange, Reston, VA, October 12, 1995.

Reactive Ion Etching of Via Holes for GaAs HEMTs and MMICs Using Cl2/BCl3/Ar Gas Mixtures,
K.J. Nordheden. IEEE International Conference on Plasma Science (ICOPS), Madison, WI, June 1995.

A Real-Time Description Language,
D. Niehaus, J.A. Stankovic, K. Ramamritham. Proceedings of the Real-Time Technology and Applications Symposium, Chicago, IL, May 1995, pp. 104-115.

Real Time Implementation of an Adaptive Shaper for Dynamic Bandwidth Allocation in ATM Networks,
V. Sirkay, D. Niehaus, J.B. Evans, W. Edwards. IEEE ATM '95 Workshop, October 1995, pp. W3A:11-W3A:22.

Single Point On-line Estimation of Cell Loss in ATM Networks,
H. Zhu, V.S. Frost. 14th European Conference of Operations Research, Jerusalem, Israel, June 3-6, 1995.

Some Approaches to Adaptive Control of Stochastic Linear Distributed Parameter Systems,
T. Duncan, B. Pasik-Duncan. Proceedings Third IEEE Mediterranean Symposium on New Directions in Control and Automation II, Limassol, Cyprus, 1995, pp. 197-204.

Some Computational Aspects of Stochastic Adaptive Control,
T. Duncan, B. Pasik-Duncan. Proceedings International Conference on Control and Information, Hong Kong, June 1995, pp. 81-186.

Some Results for the Identification and Adaptive Control of Stochastic Linear and Semilinear System,
T. Duncan, H.F. Chen, B. Pasik-Duncan. Proceedings 1995 American Control Conference, Seattle.

Targeting Expert Systems for Bridge Engineering,
W.M.K Roddis, H.G. Melhem. Applications of Artificial Intelligence in Structural Engineering–II: Proceedings of the 2nd Workshop of the European Group for Structural Engineering Applications of Artificial Intelligence (EG-SEA-AI), ed. Marco Lazzari and Paolo Salvaneschi, ISMES, Bergamo, Italy, March 18, 1995, pp. 147-149.

TCP/ATM Experiences in the MAGIC Testbed,
B.J. Ewy, J.B. Evans, V.S. Frost, G.J. Minden. Proceedings of the Fourth IEEE Symposium on High Performance Distributed Computing, August 1995, pp. 97-93.

A Two-State Rician Model for Predicting Indoor Wireless Communication Performance,
J.A. Roberts, J.R. Abeysinghe. Proceedings of IEEE ICC'95, Seattle, WA, June 18-22, 1995, pp. 40-43.

The UNITE Project: Distributed Delivery and Contribution of Multimedia Objects Over the Internet,
C. Deniau, M. Swink, R. Aust, J. Evans, S. Gauch, J. Miller, D. Niehaus. Proceedings of INET'95: The 5th Annual Conference of the Internet Society, Honolulu, HI, June 1995, pp. 91-99.

Waveform Design and Analysis of Frequency Hopping LPI Networks,
R.F. Mills, G.E. Prescott. Proceedings of the 1995 Military Communications Conference (MELCOM-95), San Diego, CA, November 6 - 7, 1995, pp. 778 -782.

1994

Aspect-Independent Radar Target Classification Using Fuzzy Neural Network,
S. Chakrabarti, E.K. Miller. Proceedings of the International Symposium on IEEE AP-S, June 19-24, 1994, Vol. 1, pp. 566-569.

Bridge Fabrication Error Solution: Developing a Knowledge-Based Expert System for a State Department of Transportation,
W.M.K. Roddis, M.R. Hess. Computing in Civil Engineering Proceedings, First Congress, ASCE, June 20-22, 1994, pp. 1687-1694.

Bridge Fabrication Error Solution: Developing an Expert System for a State DOT,

H.G. Melhem, M.R. Hess, W.M.K. Roddis. Proceedings, 11th International Bridge Conference, Engineer's Society of Western Pennsylvania, June 13-15, 1994, pp. 416-423.

The CECASE/Kantronics Technology Transfer Effort in the Development of G-TOR,
G.E. Prescott. 1994 Annual Kansas Technology Enterprise Corporation (KTEC) Board of Directors and Centers Committee Meeting, Lawrence, KS, December 9, 1994.

Characterization of Reactive Ion Etch Damage in GaAs by Triple Crystal X-Ray Diffraction,
V.S. Wang, R.J. Matyi, K.J. Nordheden. Materials Research Society Symposium Proceedings, 1994, Vol. 324, pp. 445-450.

Checking of CAD Drawings for Fabrication Issues,
J. Ernst, W.M.K. Roddis. Analysis and Computation Proceedings, Eleventh Conference, ASCE, April 24-28, 1994, pp. 248-253.

Code Acquisition Performance in a Fading Environment for Variable and Fixed Dwell Detectors,
J.W. Pope, J.A. Roberts. Proceedings of the IEEE Wichita Conference on Commununications, Networking, and Signal Processing, Wichita, KS, April 25-27, 1994, pp. 97-91.

Comparison of Parametric and Non-Parametric Spectral Estimation of Continuous Doppler Ultrasound Shift Waveforms,
T. Kodado, D. Maulik, S. Chakrabarti. Proceedings of the Sixth IEEE Digital Signal Processing Workshop, Yosemite National Park, CA, October 2-5, 1994, pp. 145-148.

Computation Methods for the Stochastic Adaptive Control for an Investment Model with Transaction Fees,
T. Duncan, M. Faul, B. Pasik-Duncan, O. Zane. Proceedings of the 33rd Conference on Decision and Control, Orlando, 1994, pp. 2813-2816.

Computer Vision and Graphics in Fluorescence Microscopy,
L.M. Lifshitz, J.A. Collins, E.D. Moore, J.M. Gauch. IEEE Workshop on Biomedical Image Analysis, June 1994.

A Concept for a Rapidly Deployable Radio Network,
G.E. Prescott. Advanced Research Projects Agency (ARPA) Wireless and Low Power Principal Investigator's Meeting, Alexandria, VA, July 24-26, 1994.

Covert Communications: Fundamentals and Applications,
G.E. Prescott. Sunflower Seminar Series, Wichita State University, April 14, 1994.

Delay Performance of Segmentation Options for Mixed Packet Networks,
D.W. Petr, R. Rabi, C. Braun. Proceedings of IEEE Southeastern Conference, August 1994.

Decision-Theoretic Evaluation of Design Choices in a Case-Based Environment,
Q. Cheng, C. Tsatsoulis. AAAI CBR Workshop, AAAI'94, 1994, pp. 79-83.

Detection of Multiple Access Low Probability of Intercept Networks,
R. Mills, G. Prescott. Proceedings of the 1994 Tactical Communications Conference, Ft. Wayne, Indiana, May 10-12, 1994, pp. 497-504.

The Digital Video Library System: Vision and Design,
S.E. Gauch, R.J. Aust, J.B. Evans, J.M. Gauch, G.J. Minden, R.D. Niehaus, J.A. Roberts. Proceedings of Digital Libraries '94, College Station, TX, June 19-21, 1994, pp. 47-52.

Digital Video Library System: Vision and Design,
S. Gauch, R. Aust, J.B. Evans, J. Gauch, G. Minden, D. Niehaus, J. Roberts. Proceedings of Digital Libraries '94, June 1994.

DISNES: A Distributed Network Emulation System for Gigabit Networks,
R.J. Sanchez, G.J. Minden, J.B. Evans. 1994 IEEE Computer Aided Design and Modeling Workshop, April 1994.

E-Beam Re-Aligned HBTs and A New Broadband MMIC Power Amplifier Using Bathtub as Heat Sink,
L.W. Yang, J.J. Komiak, M.Y. Kao, D.E. Houston, D.P. Smith, K.J. Nordheden. IEEE International Electron Devices Meeting (IEDM) Technical Digest, San Francisco, CA, December 11-14, 1994, pp. 203-206.

Estimation of Cell Loss Probabilities for Tandem ATM Queues,
Q. Wang, V.S. Frost. IEEE Communications Conference, 1994.

An Experiment to Determine Improvements in Automated Problem Solving in a Complex Problem Domain,
M. Van Dyne, C. Tsatsoulis. Sixteenth Annual Conference of the Cognitive Science Society, 1994, pp. 899-904.

Experiments in Automatic Word Class and Word Sense Identification for Information Retrieval,
S. Gauch, R. Futrelle. Third Annual Symposium on Document Analysis and Information Retrieval, April 1994, pp. 425-434.

Feature Matching from SAR Arctic Data Using Neural Networks,
P.E. Silveira, M. Van Dyne, C. Tsatsoulis. IGARSS'94, 1994, pp. 4960-4968.

A Framework for the Design of High Speed FIR Filters on FPGAs,
S. Mohanakrishnan, J.B. Evans. 1994 International Conference on Signal Processing Applications and Technology, October 1994.

Golay-TOR: The New HF Protocol, G.E. Prescott. 1994 Dayton Amateur Radio Convention, Digital Forum Session, Dayton, OH, May 1, 1994.

G-TOR: The Protocol, M. Huslig, P. Anderson, K. Metcalf, G. Prescott. Proceedings of the 13th Annual ARRL Digital Communications Conference, Minneapolis, MN, August 19 - 21, 1994, pp. 49 - 79.

HEMT Degradation in Hydrogen Gas, P.C. Chao, M.Y. Kao, K. Nordheden, A.W. Swanson. U.S. Conference on GaAs Manufacturing Technology (MANTECH), 1994, pp. 105-108.

How Big Is a Bit?, J.A. Roberts. IEEE University of Kansas Student Branch Meeting, Lawrence, KS, September 16, 1993 and IEEE Kansas City Section Meeting, Overland Park, KS, February 3, 1994.

A Hybrid ARQ Protocol for Limited Bandwidth HF Packet Radio Transmission, G. Prescott and P. Anderson. Proceedings of the IEEE Wichita Conference on Communications, Networking, and Signal Processing, Wichita, Kansas, April 26-27, 1994, pp. 13-17.

Hybrid Boundary-Based and Region-Based Deformable Models for Biomedical Image Segmentation, J.M. Gauch, H.H. Pien, J. Shah. SPIE Mathematical Models in Medical Imaging III, San Diego, July 1994.

Hybrid Deformable Models for Three-Dimensional Biomedical Image Segmentation, J.M. Gauch, H.H. Pien, J. Shah. IEEE Medical Imaging Conference, November 1994.

Implementation of an OC-12c and 4-by-OC-3c ATM/SONET Gateway Based on Xilinx FPGAs, G.J. Minden, J.B. Evans, V.S. Frost, D.W. Petr. 1994 Gigabit Mini-Jamboree, January 1994.

Implementation of Per VC Credit-Based Batch Acknowledgments and ATM Cell Pacing Schemes at 622 Mbps, S. Seetharam, J.B. Evans, G.J. Minden, D.W. Petr, V.S. Frost. 1994 Gigabit Mini-Jamboree, January 1994.

Integrating Disparate Representations of Large Systems, C. Tsatsoulis, J. Holtzman, S. Woodward. AAAI AI in Systems Engineering Workshop, AAAI'94, 1994, pp. 1-8.

Long-Range Dependence in Telecommunication Traffic, Y.-Q. Lu, D.W. Petr. Proceedings of IEEE Wichita Conference on Communications, Networking and Signal Processing, April 1994, pp. 101-105.

The MAGIC Testbed and Access to V.S. Frost. IEEE Symposium on Planning and Design of Broadband Networks, Montebellow, Quebec, October 21-23, 1994 (Keynote Address)

Manufacturing Technology for High Performance HBT Linear Power Amplifiers, L.W. Yang, J.J. Komiak, D.P. Smith, M.Y. Kao, R.S. Brozovich, K.J. Nordheden, D.R. Helms, D.E. Houston, F.R. Bardsley. IEEE GaAs IC Symposium Technical Digest, Philadelphia, PA, October 16-19, 1994, pp. 127-130.

A Narrowband Adaptive Voice/Data Switch, N.I. Ansari, S.S. Kapadia, J.B. Evans. 1994 IEEE Wichita Conference on Communications, Networking, and Signal Processing, April 1994.

The Need for Efficient Flow Control in High Speed Wide Area Networks, S.W. Seetharam, J.B. Evans, G.J. Minden. 1994 IEEE Wichita Conference on Communications, Networking, and Signal Processing, April 1994.

Network Integrated Processing, J. Evans, D. Niehaus, V. Frost. Proceedings of GIGA-Bit Workshop, Crystal City, VA, 1994.

Neural Network Based Classification of Subsurface Targets, P. Chaturvedi, R. Plumb, S. Chakrabarti. Proceedings of the International Symposium on IEEE AP-S, June 19-24, 1994, Vol. 1, pp. 570-573.

A New Method for In-Service Estimation of Cell Loss QoS in ATM Networks, H. Zhu, V.S. Frost. IEEE Symposium on Planning and Design of Broadband Networks, Montebello, Quebec, Canada, October 21-23, 1994.

Numerical Differentiation and Parameter Estimation in Higher Order Stochastic Systems, B. Pasik-Duncan, T. Duncan, P. Mandl. Proceedings of the 33rd Conference on Decision and Control, Orlando, 1994, pp.1666-1671.

On Ljung's Approach to System Parameter Identification, T. Duncan, H.F. Chen, B. Pasik-Duncan. Proceedings 10th IFAC Symposium on Systems Identification, ed. M. Blanke and T. Soderstrom, 1994, Vol. 2, pp. 667-671.

Performance Evaluation of Equivalent Capacity for Admission Control, C. Braun, D.W. Petr, T. Kelley. Proceedings of IEEE Wichita Conference on Communications, Networking and Signal Processing, April 1994, pp. 155-158.

The Performance of FDTD Absorbing Boundary Conditions for Buried Scatterers,

K. Demarest, R. Plumb, Z. Huang. Presented at the 1994 International Radio Science Symposium, Seattle, WA, June 19-24, 1994.

Performance of Non-Orthogonal Trellis Coded Modulation on a Bandlimited HF Channel,
G. Gupta, G. Prescott. Proceedings of the IEEE Wichita Conference on Communications, Networking and Signal Processing, Wichita Kansas, pp. April 26-27, 1994, 123-128.

Performance Scalability of ATM Networks,
C.M. Gupta, J.B. Evans. 1994 IEEE INFOCOM, June 1994.

A Pipelined Architecture to Map ATM Cells to 622 Mbps SONET OC-12 Payloads,
S.W. Seetharam, G.J. Minden, J.B. Evans. 1994 IEEE International Symposium on Circuits and System., May 1994.

A Potential Use for the Artificial Neural Networks in the Detection of Frequency Hopped Low Probability Intercept Signals,
T.C. Farrell, G. Prescott, S. Chakrabarti. Proceedings of the IEEE Wichita Conference on Communications, Networking, and Signal Processing, Wichita, KS, April 26-27, 1994, pp. 25-30.

The Relationship of Performance Metrics to Quality,
J.A. Roberts. Kansas Quality Initiative Seminar, Wichita, KS, September 21, 1994.

SAR Image Classification Using ANN,
T.S. Chuah, S. Chakrabarti, P. Gogineni. Presented as a poster in URSI 1994 International Conference, Lawrence, KS, 1994.

A Single Chip Implementation of Receive Path Termination for SONET OC-12c and Quadruple OC-3c,
S.W. Seetharam, G.J. Minden, J.B. Evans. IEEE International Symposium on Circuits and Systems, May 1994.

Sinusoidal Transform Coder Based Congestion Control in Integrated Voice/Data Networks,
S.S. Kapadia, N.I. Ansari, J.B. Evans. International Conference on Signal Processing Applications and Technology, October 1994.

Speech Coding Using Wavelet Transforms and Vector Quantization,
M. Krishnan, G. Prescott. Proceedings of the IEEE Wichita Conference on Communications, Networking, and Signal Processing, Wichita, Kansas, April 26-27, 1994, pp. 119 - 122.

Speaker-Independent Isolated Word Recognition Using Fuzzy Neural Network,
J. Kim, S. Chakrabarti. Proceedings of the IEEE Wichita Conference on Communications, Networking, and Signal Processing, Wichita, KS, April 26-27, 1994, pp. 175-180.

TCP and ATM in Wide Area Networks,
B.J. Ewy, J.B. Evans, V.S. Frost, G.J. Minden. 1994 IEEE Gigabit Networking Workshop, June 1994.

TCP and ATM Measurements in the MAGIC Testbed,
J.B. Evans, B.J. Ewy, V.S. Frost, G.J. Minden. Invited presentation, 1994 MAGIC Symposium, Lawrence, Kansas, August 1994.

Technology Transfer from the University Laboratory Point of View,
G.E. Prescott. IEEE International Conference on Requirements Engineering, Colorado Springs, CO, April 18-21, 1994.

A Theoretical Evaluation of the G-TOR Hybrid ARQ Protocol,
G. Prescott, P. Anderson. Proceedings of the 13th Annual ARRL Digital Communications Conference, Minneapolis, MN., August 19 - 21, 1994, pp. 86-91.

Using Inductive Machine Learning, Expert Systems and Case Based Reasoning to Predict Preterm Delivery in Pregnant Women,
M. Van Dyne, C. Tsatsoulis, J. Thorp. 5th Int. Conf. on Database and Expert System Applications, in Database and Expert System Application, ed. D. Karagiannis, Berlin: Springer-Verlag, 1994, pp. 690-702.

Using Artificial Intelligence to Bridge Communication Gaps in the Steel Building Industry,
G.P. Pasley, W.M.K Roddis. Proceedings, Mid-America Conference on Intelligent Systems, Advanced Manufacturing Institute, Kansas State University, October 27-28, 1994, pp. 49-55.

Using Machine Learning and Expert Systems to Predict Preterm Delivery in Pregnant Women,
M. Van Dyne, L. Woolery, J. Grzymala-Busse, C. Tsatsoulis. 10th Conference on Artificial Intelligence Applications, 1994, pp. 344-350.

Utilizing the Dynamic Behavior of Sea Ice for Determining Ice Thickness Distributions in SAR Imagery,
D. Haverkamp, C. Tsatsoulis. IGARSS '94, 1994, pp. 1753-1755.

Variational Segmentation of Multi-Channel MRI Images,
H.H. Pien, J.M. Gauch, J. Shah. First International Conference on Image Processing, November 1994.

Virtual Path Policing in ATM Networks,
A. Demirtjis,
T. Kelley, D.W. Petr. Proceedings of IEEE Wichita Conference on Communications, Networking and Signal Processing, pp. 149-154, April 1994.

Wavelet Transform Speech Recognition Using Vector Quantization, Dynamic Time Warping, and Artificial Neural Networks,
M. Krishnan, C. Neophytou, G. Prescott. Proceedings of the 5th International Conference on Signal Processing Applications and Technology (ICSPAT-94), Dallas, Texas, October 18-21, 1994, pp. 1684-1686.

Weighted Fair Queuing vs. Weighted Round Robin: A Comparative Analysis,
K. Mezger, T. Kelley, D.W. Petr. Proceedings of IEEE Wichita Conference on Communications, Networking and Signal Processing, April 1994, pp. 3-8.

Technical Reports

1997

Buckling Length of Unbraced Frame Columns,
H.A. Hamid, W.M.K. Roddis. SL Report 97-1, The University of Kansas Center for Research, Inc., 1997.

1996

Case-Based Approach for Bridge Fabrication Errors,
J.C. Bocox, W.M.K. Roddis. SL Report 96-3, The University of Kansas Center for Research, Inc., June 1996.

CDMA Cellular Capacity Assessment,
M. Mangal, V.K. Paulrajan, J.A. Roberts. Technical Report TISL-11880-01, December 1996.

Channel Estimation and Adaptive Communication Techniques,
P. Rajagopalan, K.S. Shanmugan. Technical Report, ITTC-FY97-TR-10920-28, December 1996.

Digital Beamforming Receiver Architecture,
S. Gurappu, H. Samra, G. Prescott, K.S. Shanmugan. Technical Report TISL-10920-24, October 1996.

Effects of Search Depth and Schedule Placement on WRR Schedules,
J. Keimig, D.W. Petr. Technical Report TISL-11230-02, December 1996.

Genetic Algorithms Applied to Single Optimization of Reinforced Concrete Design and Detailing,
W.M.K. Roddis, V. Chunnanond, W.K. Lucas. SL Report 96-1, The University of Kansas Center for Research, Inc., May 1996.

GPR Simulations of a Buried Concrete Wall for Allied Signal,
Z. Huang, C. Leuschen, C. Allen, R. Plumb. RSL Technical Report 11910-1, November 1996.

An Improved Coherent Radar Depth Sounder,
T. Chuah, S. Gogineni, C. Allen, B. Wohletz. RSL Technical Report 10470-4, April 1996.

Maximizing the Minimum Signal-to-Interference Ratio in a Wireless Communication Network,
S. Haas, D.W. Petr. Technical Report TISL-10920-21, May 1996.

A Measurement-Based CAC Strategy for ATM Networks,
K. Liu, D.W. Petr. Technical Report TISL-11230-01, October 1996.

An Overview of the Rapidly Deployable Radio Network Proof of Concept System ,
B. Ewy, C. Sparks, S. Shanmugan, J. Evans, G. Prescott. Technical Report TISL-10920-16, April 1996.

Radar Thickness Measurements Over the Northern Part of the Greenland Ice Sheet,
T. Chuah, S. Gogineni, C. Allen, B. Wohletz. RSL Technical Report 10470-3, April 1996.

Radar Thickness Measurements Over the Southern Part of the Greenland Ice Sheet,
T. Chuah, S. Gogineni, C. Allen, B. Wohletz. RSL Technical Report 10470-2, April 1996.

Rapidly Deployable Radio Networks,
K.S. Shanmugan. Semi-Annual Progress Report, Technical Report TISL-10920-19, July 1996.

Rapidly Deployable Radio Network (RDRN) Link Budget,
V.K. Paulrajan, J.A. Roberts. TISL Technical Report 10920-18, May 1996.

Rapidly Deployable Radio Network: Proof of Concept System,
B. Ewy, C. Sparks, K.S. Shanmugan, J. Evans, G. Prescott. TISL Technical Report TISL-10920-16, April 1996.

Rapidly Deployable Radio Networks - Network Architecture,
S. Bush, S. Jagannath, R. Sanchez, J. Evans, V. Frost, S. Shanmugan. Technical Report TISL-10920-09, April 1996.

Steel Bridge Exterior Girder Response to Concrete Deck Placement Loads,
R. Zhao, W.M.K. Roddis. SL Report 96-4, The University of Kansas Center for Research, Inc., November 1996.

Subjective Test of Voice Transmission Over ATM Networks,
G. Huang, D.W. Petr. Technical Report TISL-10610-05, October 1996.

Targeting Expert Systems for Bridge Engineering,
H.G. Melhem, A. Moran, W.M.K. Roddis, J. Bocox. Report No. K-TRAN: KU/KSU-95-8, Final Report, Kansas Department of Transportation, Topeka, KS, February 1996.

1995

Beamform MATLAB Code,
S.M. Haas, D.W. Petr. Technical Report TISL-10920-03, January 1995.

BONeS TCP Primitive Module Validation,

V.S. Frost, G.Y. Lazarou. Technical Report TISL-10980-6, June 1995.

Bounded Delay for Weighted Round Robin with Burst Crediting,
K. Mezger, D.W. Petr. Technical Report TISL-10230-08, May 1995.

Bounded Delay for Weighted Round Robin ,
K. Mezger, D.W. Petr. Technical Report TISL-10230-07, May 1995.
The Burst Crediting Concept,
K. Mezger, D.W. Petr. Technical Report TISL-10230-06, May 1995.

Calculation of Leaf Area Index and Other Canopy Indices from Gap Fraction: A Manual for the LAICALC Software,
P.M. Rich, J. Chen, S.J. Sulatycki, R. Vashisht, W.S. Wachspress. Kansas Applied Remote Sensing Program Open File Report, University of Kansas, Lawrence, KS, 1995.

A Consistent Labeling Algorithm for the Frequency/Code Assignments in a Rapidly Deployable Radio Network (RDRN),
S.M. Haas, D.W. Petr. Technical Report TISL-10920-04, January 1995.

Electromagnetic Induction Research Issues: Magnetic Dipoles and SQUID Technologies,
C.T. Allen, N.A. Rehoie. RSL Technical Report 11740-1, Sept. 1995.

Measurement of a Multimedia Distance Learning Application Using ATM Network Service,
R. Smischny, D.W. Petr, V.S. Frost. Technical Report TISL-10230-11, November 1995.

Modeling Topographic Influences on Solar Radiation: A Manual for the SOLARFLUX Model,
P.M. Rich, W.A. Hetrick, S.C. Saving. Los Alamos National Laboratory Report LA-12989-M, 1995.

Performance and Traffic Measurement Scenarios for the AAI Network,
L.A. DaSilva, H. Zhu, V.S. Frost, J.B. Evans, D. Niehaus, D.W. Petr. TISL Technical Report TISL-10980-3, 1995.

Performance and Traffic Measurement Techniques for the AAI Network,
H. Zhu, V.S. Frost, J.B. Evans, D. Niehaus, D. Petr. Technical Report TISL-10980-2, February 1995.

Rapidly Deployable Radio Network: Semi-Annual Technical Report,
K.S. Shanmugan, V.S. Frost, J.B. Evans, G. Prescott, R. Plumb, D.W. Petr. TISL Technical Report TISL-10920-09, June 1995.

Research Experiences for Undergraduates: Information Systems Engineering at the University of Kansas,
J.A. Roberts. 1995 Program Report, TR-10190-3, Department of Electrical Engineering and Computer Science, The University of Kansas Center for Research, Inc., August 1995.

Research Experiences for Undergraduates: Information Systems Engineering at the University of Kansas,
J.A. Roberts. 1994 Program Report, TR-10190-2, Department of Electrical Engineering and Computer Science, The University of Kansas Center for Research, Inc., January 17, 1995.

Research on Gigabit Gateways: Final Report,
V.S. Frost, J.B. Evans, D.W. Petr, D. Niehaus, G.J. Minden. Technical Report TISL-9770-34, August 1995.

Research on Gigabit Gateways: Quarterly Report,
V.S. Frost, J.B. Evans, D.W. Petr, D. Niehaus. Technical Report TISL-9770-33, July 1995.

Research on Gigabit Gateways: Quarterly Report,
V.S. Frost, J.B. Evans, D.W. Petr, D. Niehaus. Technical Report TISL-9770-32, April 1995.

Research on Gigabit Gateways: Quarterly Report,
V.S. Frost, J.B. Evans, D.W. Petr, D. Niehaus. Technical Report TISL-9770-31, January 1995.

Sprint Directory Hierarchy,
K. Mezger, D.W. Petr. Technical Report TISL-10230-09, May 1995.

Sprint Voice Transport Over ATM Network,
K. Nguyen, D.W. Petr, J.B. Evans, V.S. Frost. Technical Report TISL-10610-4, July 1995.

Trace Traffic Integration into Model-Driven Simulations,
K. Mezger, D.W. Petr. Technical Report TISL-10230-10, May 1995.

Voice Transport via ATM Networks: Subjective Testing Results,
V.S. Frost, M. Mischler, D.W. Petr. Technical Report TISL-10610-3, March 1995.

1994

Advanced Telecommunications Network Signaling Model (ATNSM),
K. Medhat, J.B. Evans, J.A. Roberts. Technical Report TISL-9890-1, January 1994.

Bridge Fabrication Error Solution Expert System Training Manual,
M.R. Hess, W.M.K. Roddis, H. Melhem, A. Moran. SL Report 94-1, The University of Kansas Center for Research, Inc., January 1994.

Bridge Fabrication Error Solution Expert System Users Manual,
M.R. Hess, W.M.K. Roddis. SL Report 94-2, The University of Kansas Center for Research, Inc., January 1994.

Characterization and Modeling of Long-Range Dependent Telecommunication Traffic, V.S. Frost, Y. Lu, D.W. Petr. Technical Report TISL-10230-04, September 1994.

Delay Performance of Weighted Round Robin Scheduling, B. Lang, K. Mezger, D.W. Petr. Technical Report TISL-10230-3, September 1994.

An Expert System for Fabrication Error Solutions, M.R. Hess, W.M.K. Roddis, S. Nagaraja, H.G. Melhem, A. Moran. Report No. K-TRAN: KU/KSU-93-2, Final Report, Kansas Department of Transportation, Topeka, KS, August 1994.

Feasibility of Ground-Penetrating Radar for Use at MGP Sites: Final Report, R.G. Plumb, P. Chaturvedi, K.R. Demarest, Z. Huang, S. Chakrabarti, S. Ng. Radar Systems and Remote Sensing Laboratory Technical Report 9990-5, June 1994.

Netalyse: A Network Analysis Tool, V.S. Frost, R.J.W. Laan, R.J.T. Jonkman, D. Niehaus. Technical Report TISL-1660-11, November 1994.

An 'Over-the-Shoulder' Implementation, V.S. Frost , M. Ramos. Technical Report TISL-9770-14, May 1994.

Parallel Volume Rendering, P. Daalwijk, J.M. Gauch. TISL Technical Report TISL-1660-12, November 1994.

Per Virtual Circuit Credit Based Flow Control on a Wide-Area ATM Network, S.W. Seetharam, J.B. Evans. Technical Report TISL-9770-24, July 1994.

Performance Evaluation of Dynamic and Static Bandwidth Management Methods for ATM Networks, C. Braun, D.W. Petr. Technical Report TISL-10230-5, December 1994.

Rapid Prototyping of Military Communications Systems Using SPW, Final Report, Rome Labs Contract, K.S. Shanmugan, G. Prescott, et al. July 1994.

Research Experiences for Undergraduates: Information Systems Engineering at the University of Kansas, J.A. Roberts. 1993 Program Report, TR-10190-1, Department of Electrical Engineering and Computer Science, University of Kansas Center for Research, Inc., January 18, 1994.

Research on Gigabit Gateways: Quarterly Technical Report - 2Q94, V.S. Frost, G.J. Minden, D.W. Petr, J.B. Evans, D. Niehaus. Technical Report TISL-9770-013, October 1994.

Research on Gigabit Gateways: Quarterly Technical Report-1Q94, V.S. Frost, G.J. Minden, D.W. Petr, J.B. Evans, D. Niehaus. Technical Report TISL-9770-012, April 1994.

Research on Gigabit Gateways: Quarterly Technical Report-4Q93, V.S. Frost, G.J. Minden, D.W. Petr, J.B. Evans. Technical Report TISL-9770-009, January 1994.

Video Segmentation for a Digital Video Library, E. Metz, J.M. Gauch. TISL Technical Report TISL-1660-13, November 1994.

Voice Transport via ATM Networks Using DSO Packetization, M. Shanableh, J.B. Evans, D.W. Petr. Technical Report TISL-10610-02, July 1994.

Voice Transport via ATM Networks: Proposed System Solutions, V.S. Frost, D.W. Petr, M. Mischler, M. Shanableh. Technical Report 10610-1, July 1994.

The Wichita Conference Papers: A Project Snapshot, D.W. Petr, V.S. Frost, S. Motoyama, C. Braun, Y.-Q. Lu, K. Mezger. Technical Report TISL-10230-2, May 1994.