Information and Telecommunication Technology Center

Annual Report Fiscal Year 2001

The ITTC Vision:

To be a global leader in, and catalyst for,
the unification of computing, communication,
and sensor technologies
while being a strategic partner for their commercialization.

The ITTC Mission:

- To create the fundamental knowledge and technologies required to realize the convergence of computing, communications, and sensors for the expansion of our economy and the improvement of the quality of life.

- To educate the next generation of technology leaders who will drive this convergence.

- To transfer to industry the knowledge and technology that will enable this convergence.

"Our focus is your future!"

Contents

Director's Report

ITTC Director Victor Frost

At ITTC, we feel fortunate to have had many good things happen this past year. We have had many special visitors, including the KTEC Peer Review and our Industry Advisory Board, for productive meetings. We have seen the Lawrence Technology Association form, grow, and succeed in the past year. Also, many of ITTC's affiliated faculty received honors and awards; and some of our former students found success in industry. Perhaps most important, ITTC is continuing to grow. Along with new faculty and staff members, the Center has added an entirely new laboratory—the e-Learning Design Lab. Some of these recent accomplishments are detailed below.

In April, a team of outside experts visited ITTC for the annual site visit. These visitors were updated on new projects and given time to talk with members of ITTC's Industry Advisory Board. ITTC was evaluated on its research portfolio; use of resources; management, administration, and operations; and strategic plan. ITTC's overall performance was rated as excellent.

The Industry Advisory Board gives ITTC an industry perspective and explores methods of increasing the Center's involvement within industry. During the May meeting, Advisory Board members developed a set of action items, provided feedback on the strategic plan, and redefined the group's role. Also during the meeting, Advisory Board members met ITTC's students and learned about their research through a poster session. Most notably, before the day's close, Board members drafted, signed, and sent a letter to the Kansas Governor and members of the Legislature voicing the Board's support of high-technology R&D in the state.

A year ago, ITTC helped form the Lawrence Technology Association (LTA) to help fill the gap in communication between technology companies in Lawrence. This year, the LTA reported a successful first year of operation. Throughout the year, speakers at the meetings included Rich Bendis, KTEC's president and CEO, and KU's Chancellor Robert Hemenway. All of the LTA meetings were well attended. ITTC continues to provide logistical support to the organization.

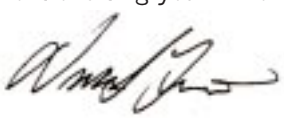
In the past year, many of ITTC's researchers were honored with awards for teaching, service, or research. The following are just some of the recipients: **Arvin Agah**, assistant professor of EECS, won the Henry E. Gould Teaching Award for Outstanding Instruction in the School of Engineering. **Christopher Allen**, associate professor of EECS, was the recipient of the Ned N. Fleming Trust Award for distinguished teaching, scholarship, and service. **Bozenna Pasik-Duncan**, professor of mathematics, was selected as a Fellow of the IEEE, the highest grade of membership. (She is the seventh at ITTC.) **John Gauch**, associate professor of EECS, received the Archie and Nancy Dykes Award for undergraduate teaching and mentoring. **Sivaprasad Gogineni**, distinguished professor of EECS, received the Miller Award for Service. **Dave Petr**, associate professor of EECS, won the John E. Sharp and Winifred E. Sharp Professorship Award. **Glenn Prescott**, professor of EECS, received the National Aeronautics and Space Administration Special Service Award. And **Jim Stiles**, assistant professor of EECS, received the Harry Talley Excellence in Teaching Award.

Also in the past year, ITTC has made a point of recognizing some of our former student researchers for their success in industry. In 1994, three ITTC students decided to form a Web development company called Athenix. Five years later, the three owners—**Scott Woodward**, MS'94; **Galen Blakeman**, BS'94; and **Juan Cuadra-Sola**, MS'94—began doing real business when they won their first contract. Within a year, the Lawrence-based company tripled in size by providing Web-based Internet applications to regional clients.

In 1998, a group of computer-gaming enthusiasts—most from ITTC—capitalized on their knowledge of network, computer, and software design to create NetGames USA. The gaming enhancement company developed a new system of statistics, tournaments, ranking, and scoring for retail and online computer games, including real-time scoring. **Craig Sparks**, MS'96, developed the initial idea and became the company's president, CEO, and chairman of the board. After less than a year of full-time operation, Microsoft bought the Lawrence-based company for an undisclosed amount.

Back on campus, ITTC teamed up with the KU's Center for Research on Learning (CRL) to create the e-Learning Design Lab. This laboratory formalizes years of collaboration. The new lab will explore ways to improve teaching and learning using technology like the Internet, intranets, the World Wide Web, and interactive media. The new lab becomes ITTC's sixth specialized research laboratory. **Scott Hinton**, EECS Department Chair, and **Ed Meyen**, director of CRL's Online Academy, will co-direct the e-Learning Design Lab. Research in this laboratory will be conducted by electrical engineers and computer scientists, as well as by professionals in special education, teaching, and leadership.

This year ITTC researchers continued working on several long-term projects. The next year holds promise for several new, high-profile projects. These accomplishments and a head start on many new projects keep us looking forward to the next exciting year. We look forward to updating you as we progress.



Victor S. Frost
Dan F. Servey Distinguished Professor of EECS
Director

Strategic Focus

Over the past decade the world has witnessed the convergence of computing and communications. We use our cell telephones to check email and browse the Web. We use our computers to make long distance telephone calls. In the near future we will see another change—the convergence of computing, communications, and sensors. This new convergence will be the basis for future economic development and the enhancement of the quality of American society.

In the next 10-25 years, many independent, interacting computing, communication, and sensor systems will dominate the world around us. Our infrastructure—roads, airports, and buildings—will be "intelligent," and computing will be ubiquitous. Sensors will be used to track and monitor the physical world around us. They will be omnipresent.

The convergence of computing, communications, and sensors will enable us to monitor an environment, communicate the observations, and process the information to take an action. The information gathered by these intelligent sensors will be transparently used in a wide variety of ways, including smart highways, weatherproof airports, environmental monitoring, and battlefield decision making.

People will be able to maintain intelligent access to information everywhere. That is, your request for information will be directly satisfied without the need to perform additional filtering. Our interactions with the technology will become increasingly transparent. The technology will be easy to use: plug it in and go. The availability of information will fuel a rapid introduction of new technologies and devices.

Significant advances in new technologies, as well as new methodologies for system design, will need to be created to realize the full potential of a converged computing, communication, and sensor infrastructure. The new convergence will require advances in transmission and networked systems. Transforming the new, sensed environment into information will require extensive digital signal processing (DSP). New sensors with integrated DSP will be needed, as well as advances in DSP technology. The future infrastructure will also be dependent upon highly available, secure, distributed software (operating) systems where personal information is protected. Information search/retrieval/discovery technologies will play a critical role, as will multi-agent software systems. Technologies will be needed to marshal information and other resources to accomplish the new tasks. A converged computing, communication, and sensor infrastructure will require new methodologies for the design and validation of large, complex, ubiquitous, interacting systems.

New technologies for the convergence require research on sensor concepts, networked systems, and information processing. The Information and Telecommunication Technology Center is well positioned to contribute to the advancement of these new technologies. It is a leader in information, telecommunication, and sensor technology research, development, and commercialization in the Midwest. Each of ITTC's six research laboratories focuses on a specific technical thrust area. (For detailed information of each lab, see pages 9-11.) And the Center has already had successful experiences with many large, multi-investigator systems-integration projects. A few of ITTC's projects are explained below.

ITTC's creation of Ambient Computational Environments (ACE) could change the way people use computer resources. ACE researchers want to create a new environment where computers, sensors, and other equipment are embedded into a room and controlled with simple voice commands. The equipment and the room are linked through a network, running throughout the building. Using this network, people can access their information from any station on the network. Some ITTC conference rooms are already being equipped to recognize certain individuals and adjust settings accordingly.

Another ITTC project called Autonomous Negotiating Teams (ANTs) uses case-based reasoning and negotiation among intelligent software agents to share resources and tasks needed to solve complex problems. Each ANT is an independent agent, but works with other ANTs to form a cooperative team. ANTs collectively reason about the mission's probability of success, their utilities, and priorities. They negotiate in light of their shared goal to complete their mission successfully in the given time. ITTC researchers are using ANTs to track vehicles in a distributed sensor network. This work integrates sensor technology with advanced intelligent systems that "live" in a network of distributed computational resources.

Other ITTC researchers have proposed a concept to develop and deploy a mobile sensor web that would measure changes of the polar ice sheet. Computers and radar would work together as a cooperative, intelligent, and mobile system. The information gathered would characterize conditions of the ice sheet at high spatial resolution and over long distances to increase our understanding of global climate change. Once developed, the new technology could also be applicable to precision farming in Kansas.

With these projects and many others, ITTC will continue to pursue interdisciplinary research that involves the prototyping of applications/systems that have the attributes associated with a converged computing, communication, and sensor infrastructure.

Fiscal Year 2001 Overview

The University of Kansas' Information and Telecommunication Technology Center (ITTC) is the State's leading institution in information technology (IT) research and development. IT is an essential component for every aspect of education, business, health care, and everyday life. This places ITTC at the forefront of economic growth considerations for Kansas, the Mid-Western region, and the nation. IT will continue to be a significant focus for the foreseeable future.

The vision of ITTC is to be a global leader in, and catalyst for, the unification of computing, communication, and sensor technologies while being a strategic partner for their commercialization.

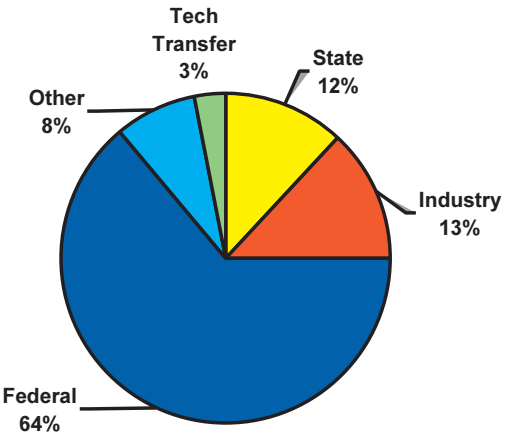
ITTC's Industry Advisory Board (IAB) has indicated that

- ITTC's vision of the convergence of communications, computers, and sensors is likely the core of the next wave of technological development.
- ITTC is uniquely positioned to make significant contributions in the area.
- This convergence is recognized as a force multiplier in ITTC's current efforts.
- This recognition should provide ITTC with significant opportunities.

Kansas companies and their leaders continue to play a significant role in ITTC's Industry Advisory Board. Specific action items resulting from our IAB meeting included recommendations to conduct an open house for State legislators and other decision makers, track ITTC former students, produce a capabilities brochure, continue to pursue regional leadership in IT research and development, and explore ITTC's role in life sciences initiatives.

FY2001 Accomplishments

ITTC R/D&C Funding Sources



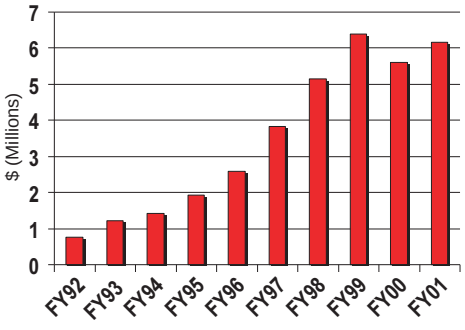
During FY2001, ITTC continued to be successful in partnering with local industry and other nationally recognized universities and agencies to obtain funds for key, cutting-edge research projects in our core technology areas. ITTC had another exceptional year, having attracted funding of over $5.1 million dollars, yielding a leveraging ratio of almost seven dollars for every KTEC state dollar.

ITTC exceeded its objective of obtaining $3 million in FY2001 federal leveraged funds for R/D&C. However, ITTC has seen a shortfall in our industry support due, in part, to the downturn in the high-tech telecommunications industry sector and the shakeout of the IT industry in general. By most accounts, this will be a temporary correction cycle and the long-term outlook continues to be strong. It is anticipated that continued success will lead to yet another strong year in terms of research funds attracted in FY2002.

Other activities included the transfer and patenting of several technologies resulting from Kansas-industry-funded research projects within ITTC. Most projects have involved cooperative development and investment by both ITTC and Kansas businesses. In addition, for FY2001, ITTC and the Mid-America Manufacturing Technology Center (MAMTC) together have had over 100 projects and helped almost 50 companies.

Illustrative Research Highlights

ITTC R&D Core Expenditures



RSL Researcher Publishes Findings from Important Ice Sheet Investigation: Dr. Sivaprasad Gogineni, distinguished professor of EECS and an ITTC faculty member in ITTC's Radar Systems and Remote Sensing Laboratory (RSL), was one of seven researchers whose collaborative work appeared in an article he co-authored in the prestigious journal *Science*. The article concludes that, although the Greenland ice sheet is thinning rapidly around its edges, it is still too early to blame the melting on global warming. This study was made possible in part by instruments developed and years of research conducted by people of ITTC's RSL.

New e-Learning Design Lab is Formed as ITTC's Sixth Area of Technical Specialization: The Information and Telecommunication Technology Center (ITTC) has teamed up with the education-oriented Center for Research on Learning to form ITTC's new e-Learning Design Lab. The e-Learning Design Lab will merge the

expertise of the two research centers to help identify better ways of learning.

Ed Meyen, co-director of the e-Learning Design Lab and professor of special education, thinks the two centers are a perfect fit. "When you bring the knowledge and expertise on learning and teaching together with the knowledge base and history on technology, it makes for a pretty good marriage," Meyen said.

The lab already has submitted proposals for several million dollars in grants. "It's a hot area, and this is an appropriate time for us to jump into it," Hinton [co-director of the e-Learning Lab] *said. About 15 faculty members have asked to be involved with the lab. It also will use KU students studying everything from graphic arts to programming.*

As the program progresses, Hinton hopes the new lab will pay for itself through grants and consulting and will spin off new local e-learning businesses.

—From "KU Hopes to Revolutionize Online Learning," *Kansas City Star*, January 22, 2001, by David Hayes.

ITTC R&D Works to Develop "Smart Rooms": Within the last year, ITTC has been notified it will receive research awards totaling over $3.1 million dollars for the development of an Ambient Computational Environment (ACE)—in other words, "smart rooms." The funding has come from both Federal (National Science Foundation [NSF], $1.29 million; Defense Advanced Research Projects [DARPA], $1.46 million) and industry sources.

These efforts complement ITTC's significant and ongoing work in the field of ambient computational environments, also known as ACEs. In a computational environment, access to equipment such as computers, cameras, video players, projectors, or cell phones is embedded into a room through a network that links them to one another and to other rooms or buildings on the network. These tools can then be controlled or accessed from anywhere along the network. So instead of carrying a laptop, cell phone, and pager to a meeting, a person could access his or her files and telephone messages from equipment found along a network. This effort is already acting as a catalyst for potential economic development opportunities.

NSF Information Technology Research Program Selected ITTC's Multi-Million-Dollar Pre-Proposal: In response to a request from the National Science Foundation (NSF), KU/ITTC has submitted a full proposal to the NSF Information Technology Research (ITR) program. Our pre-proposal was one of the few (only 21 nationally) selected to submit a full proposal for consideration. The full proposal is based on the pre-proposal entitled "Mobile Sensor Web for Polar Ice Sheet Measurements" and will lead to a ~$8.7 million project over five years if funded. The lead principal investigator for the project is Dr. Sivaprasad Gogineni, a KU Distinguished Professor of EECS working in our Radar Systems and Remote Sensing Laboratory. This is a multi-institutional proposal that includes Jet Propulsion Laboratory, University of Chicago, University of Alaska-Fairbanks, The Ohio State University, plus five international organizations.

The Future

ITTC's strategic plan has been updated to reflect the FY2001 changes, progress, and our future direction. A near-term goal for the Center is to continue 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 has also gained approval and support from the University to hire additional research faculty to strengthen critical technical areas within ITTC.

Our long-term (five-year) goals include to

- Grow to a $12 million world-class IT center by FY2006.
- Achieve outcomes in selected key metrics comparable to those of research institutions in the top quartile, as reported by AUTM (Association of University Technology Managers).
- Place in the top 2 of 5 of the KTEC Centers of Excellence per KTEC dollar invested (multi-year average).
- Advance the state of the art in telecommunications and information technologies via basic and applied
- research.
- Provide telecommunications and information technology professionals in Kansas by training students in IT.
- Provide a point of focus for expertise in all IT-related research in the State.
- Develop commercial-grade IT technologies, and transfer technologies developed to Kansas industry.
- Help Kansas companies use appropriate IT technologies to their benefit.
- Serve as a State resource for applications of IT to improve the quality of life for Kansans.
- Diversify ITTC's funding base for IT research and development.

The challenge ahead is to manage the growth and success ITTC has experienced while maintaining the infrastructure needed to grow and continue to serve the State of Kansas. Past success is largely due to the seeds sown and cultivated over many years. Based on available statistics, ITTC is performing at a very high level, compared to State and national averages for R&D organizations. Thus, long-term growth will only occur with the addition of center personnel.

Technology Transfer

Information and telecommunication technology has been identified as a state and national critical technology area with high opportunity and capacity within Kansas. ITTC is one of the largest research centers within the State of Kansas, with annual funding consistently over $5 million per year. In addition, ITTC continues to provide strong support for education, technology transfer, industry enhancement, and commercialization.

ITTC plays a significant role in the region as research centers have been identified as the most important factor in incubating high-tech industries. According to U.S. Department of Commerce indicators, the Association of American Universities estimates that each $1 million invested in research and development in Kansas produces about 41 jobs in the state. Using that estimate, ITTC research alone led to more than 200 jobs in Kansas this year.

Currently an average of 130 students are actively working within ITTC, enhancing their education while providing a valuable resource to ITTC and the State. In addition, today's students will be the industry leaders of tomorrow.

ITTC continues to increase external, industry-funded projects with several new industry projects started in FY2001. Existing projects are progressing well and will continue to completion in FY2002, with other new projects set to begin. ITTC approves new internal commercialization projects only after a positive review by staff and IAB members. These projects must have commercial potential and must be in ITTC's technical areas of expertise. In the past, such projects have led to spin-off companies and licensed technologies and have enhanced the Center's knowledge base, which then can be used to help other Kansas companies.

Below is a partial list of the FY2001 commercialization proposals selected for support in FY2002.

- Commercialization of a high-resolution optical domain spectrum analyzer (OSA).
- Commercialization of Rosetta SLDL technologies via a new Kansas startup company.
- Develop prototype of a WWW conceptual search engine based on queries terms, concepts, and classification.
- Develop a video processing program to detect new, unknown commercials in real time.

ITTC continues to support the KTEC mission. ITTC has received over $5 million in industry, institutional, and federal research funding. During FY2001, ITTC continued to work with Kansas companies on technologies and activities that have potential for significant and sustainable economic benefit to Kansas. FY2001 has been another successful year in terms of licensing return from the transfer of ITTC-developed technologies. KU will receive an expected $139K in FY2001 return on investment (ROI) realized from large international companies such as Turner Broadcasting System International, Inc. (TBS) and small Kansas companies such as ProFusion, LLC. It should be noted that a significant amount of expected ROI was delayed until later years due to existing licenses that were amended to help struggling IT companies.

Illustrative Applied Technology Highlights

Commercial Opportunities from Lightwave Communication Systems Laboratory (LCSL): A good example of the commercialization of technical innovation enabled by the LCSL is a current opportunity involving a high-resolution Optical domain Spectrum Analyzer (OSA). This effort calls for the development of a demonstration prototype. It is believed that the proposed system will provide a factor-of-ten-better price/performance than other known solutions in the market, while in a smaller package. This technology coincides with ITTC's core areas of expertise, as it involves network hardware and optical communications. We are developing this ultra-high resolution OSA tailored to monitor optical link performance with a detailed signal resolution. A more detailed signal resolution will enable the signal to be more finely tuned, allowing for more signals to be carried on a single fiber optic line, thereby increasing the bandwidth of the existing lines.

Companies Vie to Commercialize Results from ITTC Research and Development Efforts: Turner Broadcasting has extended their agreement for evaluation of ITTC's VidWatch technology. We have also had preliminary discussions with other companies with interest in the VidWatch technology. In addition, we have just received the patent for the underlying technology. VidWatch provides easy-to-access, around-the-clock, Web-based monitoring of broadcast video worldwide. ComDetect will then monitor the video source 24x7 to generate immediate commercial detection notices or daily reports for each channel and location being monitored. The ComDetect component of VidWatch has been operational and field tested for two years.

Summary of Additional Technologies Targeted for Commercialization

Rosetta Systems-Level Description Language Tools: Rosetta is an emerging systems-level description language useful for describing various aspects of computing systems. This technology is likely to result in an ITTC Kansas spin-off company in FY2002.

Use of Ultra-Wideband Radar to Improve Railroad Crossing Safety: The technology implements the use of ultra-wideband radar sensors to improve the safety of automobiles as they cross multi-track railroad intersections. The radar technology is being developed and tested in ITTC's Radar Systems and Remote Sensing Laboratory (RSL) and has been funded by a company in Kansas.

Hybrid RF/Laser Radar: ITTC researchers are developing a hybrid RF/laser radar that draws on radar expertise from RSL and fiber-optic knowledge from the Lightwave Laboratory. This NASA-funded, three-year project employs optical, radio frequency (RF), and digital signal processing to greatly enhance the laser radar's receiver sensitivity. Consequently, modest optical transmit powers may be used to perform ranging measurements. Industry interest has already been expressed.

Sub-Carrier Modulation (SCM): We have developed a new transmission technology that uses the optical bandwidth to increase the capacity of fiber optic networks without adding additional optical fiber. Our technique makes the technology particularly useful for long-haul fiber optic networks. SCM has already been transferred to a local Kansas company and other opportunities are being sought.

Adaptive Polarization-Mode Dispersion (PMD) Compensation: We have developed a method for first-order Adaptive Polarization-Mode Dispersion (PMD) compensation for traditional On-Off Keyed (OOK), Non-Return to Zero (NRZ) signals. Our current effort focuses upon extending this technique to more complex signaling schemes. If successful, the technology will be well positioned for commercial applications. ITTC is currently seeking commercialization opportunities.

Temporal Search Engine: We have developed a system that can query a collection of Web pages relative to a specific time or time frame. Whether aimed at a single site, a collection of sites, or the entire World Wide Web, we have created the ability to collect, index, and search online Web pages, based not only on their contents but also on their dates of creation and modifications. Industry interest has already been expressed.

Outreach Highlights

ITTC is a key player in Lawrence's new Lawrence Technology Association (LTA). In January of 2001, the LTA's kickoff luncheon was held. Bob LaGarde, association president, and Marc Epard (see below) are keenly aware of KU's role in the area's tech community. The LTA was originally formed to fill a gap in communication among technology companies in the Lawrence and surrounding areas; the organization has several goals in mind to achieve this mission.

> *ITTC, through its director Victor Frost and its executive director for applied technology, Tim Johnson, was a founding member of the Lawrence Technology Association, which held its first official meeting on Jan. 22. Former ITTC staff member Scott Woodward, now an owner of Athenix Solutions, and Marc Epard, with Netopia and a member of ITTC's Industry Advisory Board, also helped to found the organization. Frost, Johnson, Woodward and Epard all serve on LTA'S Executive Board.*
>
> —From "Techs Seek Venture Capital," *Lawrence Journal World*, January 23, 2001, by Mark Fagan.

Industry Advisory Board

ITTC's Industry Advisory Board met on May 3, 2001, in Nichols Hall. Pictured here are (left to right from top) R. Morris, J. Isaacs, B. Ruf; J. Alholm, R. Hailey; S. Pierson, M. Epard; G. Mastin, G. Minden, B. Griffin; J. Dahmen; P. Distler, T. Johnson, A. Ernstein, V. Frost, J. Baxendale, W. Morgan, B. LaGarde. Photo by Wally Emerson.

ITTC's Industry Advisory Board members provide guidance for the sustainable future of ITTC. They come from a variety of companies, organizations, and U.S. Government agencies. Following is the list of Board members for Fiscal Year 2001.

Jeff Alholm, Kansas Innovation Corporation,Lawrence, Kan.
Phil Anderson, Kantronics, Lawrence, Kan.
James Baxendale, KUMC Research Institute, Inc., Kansas City, Kan.
Jeff Bloomer/Stan Pierson, IFR Systems, Inc., Wichita, Kan.
Darren S. Braun, PMC-Sierra, Santa Clara, Calif.
Beth Brough, Kansas Technology Enterprise Corp., Topeka, Kan.
Chris Brown, TRW, Inc, Redondo Beach, Calif.
Gerard J. Canavan, MSHOW.com, Corporate Headquarters, Littleton, Colo.
Steve Chaddick, Ciena Corporation, Linthicum Heights, Md.
Simon Crosby, CPlane, Inc., Sunnyvale, Calif.
Jim Dahmen, Columbus Telephone Co., Inc., Columbus, Kan.
Peter Distler, Sprint Corp., Overland Park, Kan.
Marc Epard, Netopia, Inc., Lawrence, Kan.
Andrew J. Ernstein, Vpacket Communications, Inc., Overland Park, Kan.
Bennett M. Griffin, Jr., Griffin Technologies, Lawrence, Kan.
Russel L. Hailey, Secure Network Group, Inc., Lawrence, Kan.
Andy Hopper, AT&T Laboratories, Cambridge, England, U.K.
James Isaacs, ITT Aerospace Optical Div., Ft. Wayne, Ind.
Gordon Johnston, NASA Headquarters, Washington, D.C.
Ali S. Kazeroonian, Active Research, Inc., San Francisco, Calif.
Patrick Knorr, Sunflower Cablevision, Lawrence, Kan.
Bob LaGarde, Lagarde, Lawrence, Kan.
John R. LaLonde, GE Medical Systems, Milwaukee, Wis.
Tom Lyon, Lyon-About, LLC, Palo Alto, Calif.
Gary A. Mastin, Lockheed Martin Mgmt. & Data Systems, Reconnaissance Systems, Litchfield Park, Ariz.
Wayne E. Morgan, Midwest Research Institute, Kansas City, Mo.
Rodler F. Morris, Ft. Leavenworth, Kan.
David Nicol, Illuminet, Overland Park, Kan.
Susan Norris, Sprint PCS, Lenexa, Kan.
Maurice O'Sullivan, Nortel Broadband Networks, Ottawa, Ontario, Canada
Robert Parker, USC-IC, Arlington, Va.
Brian Ruf, RUF Strategic Solutions, Olathe, Kan.
David Smith, Public Networks Group, NEC, Irving, Texas
Michael F. Sobek, Information Control Systems, Inc., Overland Park, Kan.
Arun Sobti, Motorola, Schaumburg, Ill.
Gerald J. White, BV Solutions Group, Inc., Overland Park, Kan.

Labs Overview

ITTC houses six major research laboratories that investigate all aspects of the convergence of computing, communication, and sensor technologies. The Center strives to enhance business opportunities for Kansans, as well as improve the quality of life for all people. With state-of-the-art lab facilities, researchers are creating the next generation of computing, communication, and sensor technologies. ITTC's laboratories include

- **e-Learning Design Laboratory**
- **Intelligent Systems and Information Management Laboratory**
- **Lightwave Communication Systems Laboratory**
- **Networking and Distributed Systems Laboratory**
- **Radar Systems and Remote Sensing Laboratory**
- **Wireless Communications and Digital Signal Processing Laboratory**

A train acts as a target in this scaled-down version of Costas Tsatsoulis' project in the ISIM Lab, Autonomous Negotiating Teams. Numerous radars work together as a unit to track the train's movements. This problem-solving research will allow computers to reason their own probabilities for success, their utilities, and priorities, along with other ANTs with whom they are negotiating.

Each lab contributes new knowledge that can be applied to the convergence of computing, communications, and sensors. Together they allow ITTC to research all aspects of IT and sensors, from fiber optics and wireless systems to high-level applications. Such a multi-discipline approach gives ITTC a competitive advantage. This unique advantage is made possible by faculty, students, and staff from various disciplines—electrical engineering, computer engineering, computer science, chemical engineering, mechanical engineering, physics, and math—working in ITTC labs. The Center includes more than 30 faculty researchers and 20 staff members. More than 100 students, from around the world, conduct research at ITTC. The Center's breadth of activity and diversity of disciplines are its greatest strengths.

This past year, ITTC and KU's Center for Research on Learning (CRL) teamed up to establish the e-Learning Design Lab, a new research and development laboratory. The Lab will explore ways to improve teaching and learning using new technology.

"It is my hope that the e-Learning Design Lab will become one of the international leaders in the research of technology-enhanced learning environments," says Scott Hinton, one of the lab's co-directors, chair of KU's electrical engineering and computer science department, and an ITTC faculty researcher. "I also hope that our contributions will help KU, local industry, and the government successfully move into the knowledge-based society that is rapidly approaching."

e-Learning is the ability to engage in educational activities at any time or any place using technology such as the Internet, intranets, the World Wide Web, and interactive CDs. Responding to a need for leadership in this wide-open arena, the lab will explore ways to improve the quality of online education for all learners.

"CRL's research on learning makes us a very strong partner in this joint venture," says Ed Meyen, the lab's other co-director and director of CRL's Online Academy. The Academy develops Web-based educational modules that prepare teachers to work effectively with students who have disabilities.

"ITTC has a strong history in the area of telecommunication, information science, and development. When you bring the knowledge and expertise on learning and teaching together with the knowledge base and history on technology, it makes for a pretty good marriage," Meyen says.

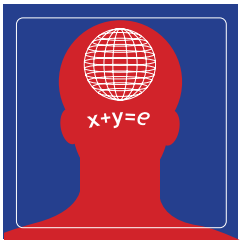
In recent years, e-learning has become one of the most explosive areas for growth, so the lab's accomplishments are expected to interest the private sector. The lab hopes to create new tools and designs to benefit all learners engaged in e-learning from K-12 on to post-secondary education and learners in the business world.

The co-directors see the new Lab as a natural extension of the collaborative projects undertaken by CRL and ITTC in the last several years. The Lab initially will comprise faculty from the electrical engineering and computer science, special education, and teaching and leadership departments. It also will provide research and development experience for KU students, as well as opportunities for professionals whose research interests coincide with the Lab's mission. It will encourage collaboration among University researchers, students, and representatives of industry, governmental agencies, the military, and private foundations.

The major thrust areas of ITTC, which are organized around its research laboratories, are well positioned to contribute to realizing the full potential of a converged computing, communication, and sensor infrastructure. The Center's success in large multi-investigator systems integration projects, which typically span several thrust areas, provides the foundation for ITTC to address the interdisciplinary research problems associated with the convergence of computing, communication, and sensors. ITTC will contribute to advancing the knowledge and technologies required for achieving this convergence by continuing to conduct fundamental research and developing the associated component technologies.

A full description of each lab follows on pages 10 and 11.

Lab Details

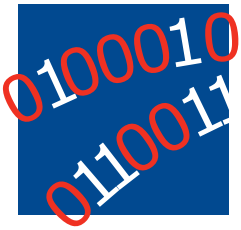


e-Learning Design Laboratory (eLDL)

Lab Directors: H. Scott Hinton, Ed Meyen

The new e-Learning Design Laboratory explores innovative solutions to emerging challenges and opportunities in the education field. It emphasizes the application of enhanced learning environments that will meet the educational and training needs of society. Experts with the e-Learning Lab investigate learning environments that capture the attention of students. They look at forms of passive learning such as videos, lectures, and readings, along with active learning as in tutored homework and interactive stimulation. They hope to create an e-learning environment that uses the best from these two different methods.

- Module creation tools
- e-Learning instructional design
- Authoring tools
- Online assessment tools
- e-Learning evaluation services

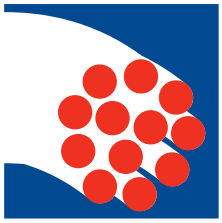


Intelligent Systems and Information Management Lab (ISIML)

Lab Director: Costas Tsatsoulis

ISIML studies theoretical and applied technology in the areas of artificial intelligence, intelligent agents, and agent-based applications. The Lab also investigates information retrieval from distributed and heterogeneous sources and data mining. ISIML's researchers develop advanced methodologies for automated characterization of data sources, dynamic routing, soft- or auto-bots, information fusion and enhanced visualization, image and video processing, knowledge-based systems, and development tools.

- AI development tools
- CATV link
- CORBA
- Data mining tools
- KU Image Analysis Program (KUIM)
- KU Information Retrieval (KUIR)
- KU Real Time (KURT)
- NT PCs and Linux workstations
- Proportional time/real-time network testbed
- Robotics assembly shop
- Video recording/transmission systems
- 2.4 Gbps fiber terminal



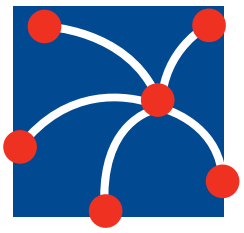
Lightwave Communication Systems Lab (LCSL)

Lab Directors: Christopher Allen, Kenneth Demarest

LCSL explores lightwave technologies, specifically in the areas of photonic devices—including components and fiber—and network flexibility and protocols of existing optical networks. Such research and development is performed in conjunction with government agencies and industry partners to optimize performance, cost, and reliability of such networks and related technologies. Experts within LCSL investigate lightwave systems and networks, wavelength division multiplexing (WDM) and dense wavelength division multiplexing (DWDM), network performance improvements, reduction or elimination of deleterious transmission effects such as polarization mode dispersion (PMD), new fiber technologies, and advanced photonic devices.

- Ciena Multiwave 1600 16-λ WDM system
- Direct fiber link to Sprint facility in Kansas City
- Erbium-doped fiber amplifiers
- Fiber-optic polarization analyzer
- Fiber-optic recirculating loop
- Hundreds of kilometers of assorted optical fiber
- Lucent FT-2000 8-λ WDM system
- Optical clock recovery system
- Optical spectrum analyzer
- Soliton generator
- Tunable lasers
- 12-Gb/s BERT
- 50-GHz sampling oscilloscope
- 100-fs pulsed laser source

Networking and Distributed Systems Lab (NDSL)

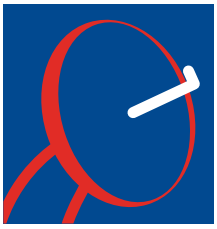


Lab Director: Joseph Evans

NDSL engages in analytical research, advanced simulations, and testbed measurements of large-scale networks and network technologies. It emphasizes networking issues, performance, testing, modeling and enhancements, network control and signaling, and integration of advanced lightwave and wireless communication technologies. Such efforts have had a critical impact on the telecommunication industry, networking community, and information service providers (ISPs). NDSL has produced world-recognized achievements in distributed performance measurement and modeling, network control and management systems, self-configuring networks, optimal data transfer protocols, architectures, reliability, robustness, ubiquitous systems, improved distributed networking routing, management tools, and cost models.

- ATM switches and concentrator
- Direct access to SprintLink, Internet2, CAIRN
- Direct fiber link to Sprint facility in Kansas City
- Extensive high-speed networking infrastructure
- Linux PC array and Sun workstation testbeds
- Miscellaneous routers, switches, and network interfaces
- High-speed WANs
- Network system software and configuration servers
- Several carrier-class Cisco IP routers
- Sprint testbed connections at 40 & 2.4 Gbps
- 2.4 Gbps SONET fiber terminal

Radar Systems and Remote Sensing Lab (RSL)



Lab Director: Christopher Allen

RSL develops, evaluates, and applies new radar systems and other related sensing technologies for remote sensing of land, sea, ice, and atmosphere. A broad range of laboratory activities is involved, including sensor development, data collection, data analysis and modeling, and data dissemination. Remote sensing areas where RSL has made significant contributions throughout the years include remote sensing of the ocean, atmosphere, sea ice, polar ice sheets, vegetation, soil moisture, subsurface, and snow.

- Antenna measurement range
- Field-programmable logic
- High-speed oscilloscope
- Variety of high-end workstations and personal computers
- 20-GHz frequency synthesizer
- 22-GHz spectrum analyzer
- 40-GHz network analyzer

Wireless Communications and Digital Signal Processing Lab (WDSPL)

Lab Director: Glenn Prescott

WDSPL serves as ITTC's focal point for leading-edge research in wireless communications and digital signal processing applications in communications and radar. Well integrated with the other laboratories within ITTC, WDSPL performs design, implementation, testing, measurement, and commercialization of wireless systems and components. Innovative digital communication system design bridges the gap between the simulation world and real-life applications. WDSPL performs both basic and applied research in these areas in collaboration with the government and international industrial leaders. The lab has been successful in demonstrating intelligent wireless communication systems for the government and commercial applications. It is currently engaged in employing digital signal processing technology to the problem of radio and synthetic aperture radar signal processing through the use of rapid prototyping techniques.

- FPGA prototype facility
- Circuit board fabrication facility
- DSP rapid prototyping facility
- Eagleware RF design
- EESof RF design
- High-speed digital T/R rooftop antenna
- MATLAB / Simulink
- Power meters
- Protel PCB Layout
- Signal processing workstation
- Synopsys FPGA design tools
- 2 GHz digital sampling scope
- 20 GHz synthesizer
- 22 GHz spectrum analyzer
- 25 Mbps wireless communications system
- 40 GHz, 6 GHz network analyzers

Student Fellowships at ITTC

ITTC's student researchers receive financial support from a variety of sources. Aside from project grants, students may apply for a few highly regarded honors: the Self, NASA, and Sprint fellowships. While Self Fellows must attend the KU, NASA and Sprint fellows may attend the university of their choice. And yet, ITTC attracts many of these prized scholars because of its cutting-edge research and its own highly regarded reputation.

Self Fellowship

KU Alumni Madison "Al" and Lila Self created a Graduate Fellowship Program in 1991. The fellowship aims to provide opportunities for exceptional doctoral students who demonstrate the ability to make significant contributions in their fields and to society. The program provides tuition, books, and a stipend for up to 32 Ph.D. students. For more information on Self Fellowships, see Web site www.ukans.edu/~selfpro/.

Cory Beard

Cory Beard left his job in industry to pursue his doctoral degree in engineering. The Self Fellowship allowed him to pursue his studies full time and achieve his ultimate goal—a professorship.

Upon receiving his Ph.D. from KU, Beard took a faculty position in the School of Interdisciplinary Computing and Engineering at the University of Missouri-Kansas City, where he is one of 10 faculty members who teach computer networking and electrical engineering.

As a Self Fellow, Beard received funding to work within his own research interest, disaster management communications. Beard developed mechanisms to deal with responses to both natural and man-made disasters.

"ITTC provided me the opportunity to obtain a Ph.D. so I could become a professor, plus it provided me with valuable teaching experience," Beard said. Beard continues his research in disaster management while teaching at UMKC.

Nathan Goodman

Nathan Goodman returned to his hometown of Lawrence for a doctoral degree in electrical engineering. With his return to KU, the ITTC veteran resumed his work at the Center. He spent five years at the RSL while completing his bachelor's and master's degrees in electrical engineering. In May of 1998, Goodman began pursuing his Ph.D. and continued his research of airborne and ground-penetrating radar systems.

He focused his efforts on a space-borne radar system, TechSat 21, which would allow a cluster of satellites to work as one, creating a radar system with higher resolution.

Through his Ph.D. tenure, Goodman has relied on the Self Fellowship. The award includes an annual educational fund that Goodman has used to attend conferences. He said the conferences allowed him to present his research and make invaluable contacts.

"I have had security in knowing that the funding would always be there through the duration of my degree," Goodman said. He will graduate this year and plans to work in a research laboratory.

NASA Fellowship

In 1980, NASA started a Graduate Student Researchers Program to help increase the number of trained scientists and engineers. It provides up to 300 fellowships a year to students who are earning research-based master's degrees or doctoral degrees in math, science, or engineering. The program awards one-year grants of up to $22,000 that can be renewed up to three years.

Carl Leuschen

Carl Leuschen turned his attention toward the planets for his thesis on ground-penetrating radar. He built a radar system to detect the geological structure of Mars and to find if water exists there underground.

As a NASA Fellow, Leuschen received three years of funding for his project. He said the fellowship helped with school expenses and gave him flexibility to travel.

While NASA provided the funding, ITTC gave Leuschen the needed resources to complete the project. During his six years at the Center, he said he learned about general research and hardware design. These tools, along with state-of-the-art technology in the RSL, helped

Leuschen succeed in developing his radar system.

"Working at RSL has given me a chance to perform research on the frontier of both science and technology," Leuschen said.

Leuschen will graduate with his Ph.D. in electrical engineering this academic year; he plans to continue his work in remote sensing in a research laboratory.

Pannirselvam Kanagaratnam

Pannirselvam Kanagaratnam probes the Greenland Ice Sheet for knowledge of its structure. The electrical engineering doctoral student explores the internal strata of the glacier to learn about past weather conditions.

Through his research, scientists will have a better understanding of how climate is affecting the ice sheet, making scientific models more accurate, Kanagaratnam said.

The Malaysian native has spent the last eight years working with radar systems at the RSL. He has developed and refined his technical skills while learning the importance of teamwork.

"The NASA fellowship has given me an excellent opportunity to work in the much-debated field of climate change. The outcome of this research looks very promising and should help scientists with much-needed data for their climate change models," he said. Kanagaratnam will graduate in December and plans to work within the private sector.

Other NASA Fellows include Jonathan Bredow, Paul Racette, Duc Kieu, Douglas Lockwood, Curt Davis, Mike Gedera, Jim Ronnau, Donna Haverkamp, Shaun Nicholson, Joe Heikes, Gary Lance Lockhart, and Justin Legarsky.

Sprint Fellowship

The Sprint Technology Services Advanced Technical Degree Sabbatical Program allows employees to return to the university of their choice for continued technical education. This internal program gives students the opportunity to earn a degree without continual financial worries. The program covers the essentials of tuition and books and also provides a stipend for the Fellow.

Steve Oliva

Former Sprint Fellow, Steve Oliva, now heads a division of Sprint PCS in California. He was promoted after receiving his Ph.D. from the KU and working at ITTC.

The Center's wide range of expertise and its proximity to Sprint led Oliva to ITTC and KU for his doctorate. While here, he focused his research on telecommunications and improving network efficiency. He was specifically concerned with improvements to connection admission control (CAC) algorithms for asynchronous transfer mode (ATM) switching equipment, Oliva said.

The Sprint Fellowship allowed Oliva to finish his formal education. Having a family, Oliva said he couldn't have left his job without the benefits the program provided him.

"The program gave me the time and focus necessary to complete a Ph.D.," Oliva said. "KU's telecommunications specialty in electrical engineering and availability of ITTC were the deciding factors in my choosing KU."

Matt Schlesener

Matt Schlesener will join ITTC this fall as he begins work on his master's degree. The Sprint Fellowship gives Schlesener the opportunity to focus on his studies, which will provide him with the advanced technical knowledge required by leaders in the telecommunications field, he said. To help ensure his place among industry leaders, he chose the University of Kansas and ITTC to continue his education.

"The KU EECS Department has a very strong reputation within Sprint. The department is known to be a leader in academic research in telecommunications and networking," Schlesener said.

While he has not been assigned a project yet, his areas of interest are networking and network architecture design. ITTC will allow him hands-on experience while working with the latest networking equipment, he said. He wants to be a part of the ongoing work that will provide companies and consumers with faster, more reliable, and more secure networks.

After his Fellowship, Schlesener plans on returning to Sprint where he hopes to join the technical management division and help lead Sprint in the competitive telecom industry.

Peter Whiting was ITTC's third Sprint Fellow. For information on his research project, "Genetically Motivated Heuristic for Route Discovery and Selection on Packet Switched Networks," please see page 35.

Executive Staff

Victor S. Frost, Director; Dan F. Servey Distinguished Professor, EECS

Victor Frost has performed advanced research for many 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, DoE, Rome Labs, and NASA. He has published more than 50 journal articles and has served as a guest editor for the *IEEE Communications Magazine* and *IEEE Journal on Selected Areas in Communications*. He was 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, traffic management, communication systems analysis, and simulation and have included projects such as MAGIC and AAI high-speed, wide-area testbeds.

He received his B.S., M.S., and Ph.D. degrees from KU in 1977, 1978, and 1982, respectively. In 1982, he joined KU's Electrical Engineering and Computer Science Department. From 1987 to 1996, he directed the Telecommunications and Information Sciences Laboratory (TISL) at KU. He became ITTC's acting director in January 1998 and its official director in January 2000.

He is a Fellow of the IEEE and a member of Eta Kappa Nu and Tau Beta Pi. He has served on State of Kansas NSF EPSCoR, and DoD EPSCoR committees, as well as on the Kansas Inc. Telecommunications Task Force. He is a member of the Board of Trustees for KU's Center for Research, Inc. In 1984 he received a Presidential Young Investigator award from the National Science Foundation.

Tim Johnson, Executive Director for Applied Technology

Tim Johnson has more than 14 years of experience in the management and design of engineering and software projects and has conducted, presented, and supervised research in communications and digital signal processing. His engineering career includes work with Kansas Power and Light Co. in Topeka, Kan., and work as a senior associate division engineer with Computer Sciences Corp. in Falls Church, Va., where he researched the performance of defense satellite communication systems.

He received a B.S.E.E. from Memphis State University in 1982 and a M.S.E.E. in 1985; he pursued doctoral studies in electrical engineering at Kansas State University. While at K-State, he was an electrical engineering instructor and performed research funded by Motorola, Inc., Government Electronics Group. From 1989 to 1990, he was an assistant professor of electrical engineering at the University of Wyoming in Laramie, Wyo., where he conducted signal-processing research.

In August 1991, he joined KU's Center for Excellence in Computer-Aided Systems Engineering (CECASE), becoming its associate director in December 1993 and its executive director in August 1996. He is a former vice president of Lawrence Applied Research Corp. (LARC) in Lawrence and has served on various corporate boards of directors. He serves on the Kansas Innovation Center's (KIC) Operations committee, Silicon Prairie's Information Technology committee, and KTEC's Telecommunications committee. He is an IEEE member.

Gary J. Minden, Exec. Director for Research/Chief Technologist; Professor, EECS

Gary Minden received his B.S.E.E. degree in 1973 and his Ph.D. in 1982, both from KU. He joined the Electrical Engineering and Computer Science Department in 1981.

From 1971 through 1978, he was a research engineer at KU's Center for Research, Inc., where he focused on image processing systems, multi-processor computer systems, and general systems theory. From 1978 to 1980, he was vice president of CHILD, Inc., where he was a co-designer of the LIGHT-50 computer graphic terminal. From 1983 to 1989, he led the implementation of a new computer engineering degree program within the (then) Electrical and Computer Engineering Department at KU.

In 1991, he completed a sabbatical at Digital's renowned System Research Center, researching gigabit local area networks. He was a principal investigator on the MAGIC gigabit testbed and the Rapidly Deployable Radio Network (RDRN) projects 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.

His research interests are in the area of large-scale distributed systems, which encompasses high performance networks, computing systems, and distributed software systems. He is a member of IEEE and the Association of Computing Machinery.

Keith B. Braman, Associate Director for Applied Technology

Keith Braman manages ITTC's technology transfer, intellectual property, and state-affiliated economic development activities. He has more than 15 years of engineering experience, in addition to more than five years of experience in the practice of law. He received his juris doctorate from Washburn University and B.S. and M.E. degrees in aerospace engineering from KU.

Before joining ITTC, he was a principal in a number of entrepreneurial ventures, which included his law practice, an engineering product development company, and engineering consulting in the areas of flight test research, software development, computer-aided design, and program management. He has also worked on aircraft simulation and advanced flight control systems for McDonnell-Douglas Helicopter Co.

He is a member of the Kansas and Nevada state bars, and Sigma Gamma Tau, the engineering honor society.

Technical and Support Staff

Brett Becker, Network Specialist

Brett Becker joined ITTC as an undergraduate assistant in quality service and high-speed networks. After completing his B.S. degree at KU in electrical engineering in 1999, he accepted a full-time position as a network specialist. His duties include involvement in a variety of projects, including network design and upgrades and supervision of installation. He is interested in becoming more involved with the Center's research.

Tim Buller, Network Specialist

Tim Buller joined ITTC on July 20, 2000, as a network specialist. Buller first started working with computers during college while working with an Internet service provider. Over the next few years, he learned more about networks and taught himself the UNIX operating system. Before coming to ITTC, he worked as a system administrator for KU's Department of Mathematics. At ITTC, helps make the network as seamless as possible. He received his B.A. in religion and German from Bethel College in Newton in 1996. In January 2002 Buller will return to Bethel College as an instructor of system administration in the Mathematical Sciences Department.

Paula Conlin, Facilities Coordinator

Paula Conlin became an official ITTC employee in October 1999 after 18.5 years as the building receptionist and secretary to the manager of research facilities for Nichols Hall. Paula continues to handle the all-building-related issues, such as faxes, mail, key checkout, and maintenance reporting. She is also responsible for all Nichols Hall conference room scheduling and updates on the building's Web site. She has more than 25 years of office experience with positions at a local real estate office and other departments at KU.

Marilyn Cozad, Software Engineer

Marilyn Cozad joined ITTC as a software engineer on January 22, 2001. Since her arrival, she has worked on the Vidwatch project and new software development. She has focused on the documentation and development of the IP tracking program user interface for the Internet. Before coming to ITTC, Cozad worked as a CPA. She earned bachelor's degrees in both accounting and computer information systems from Washburn University, Topeka.

Dan DePardo, RF Electronics Engineer

Dan DePardo studied at the U.S. Army Intelligence Center and graduated from the Aerial Surveillance Sensors School, while co-attending the University of Arizona. During his tours of duty, he supported various airborne electronic warfare systems and provided technical support for the Army's Electronic Proving Ground. After his discharge, he worked for a variety of defense electronics organizations. At ITTC he supports the Center's Wireless Communications and Digital Signal Processing Lab. His areas of expertise include radio frequency and microwave circuit design and testing, SAW (surface acoustic wave) technologies, photolithography, prototype fabrication, hybrid and surface mount device technologies, environmental testing, mil-spec soldering and assembly, as well as RFI (radio frequency interference) and EMI (electro-magnetic interference) suppression techniques.

Donnis Graham, Office Manager, RSL

Donnis Graham has been with the Radar Systems and Remote Sensing Lab (RSL) since 1987. She manages general office tasks, coordinates lab purchasing and payroll, plans travel, organizes conferences, and edits all published articles and technical reports. She has also assisted faculty with the editing of an international professional newsletter and a conference-related special issue of a geophysics journal. She has been a technical editor for more than 35 years. Her career has included coordinating marketing for the subsidiary of a large corporation, managing the office and teaching religious school for a small synagogue, and editing positions including ones at a research division of Yale University and at The Johns Hopkins University Press. She received a bachelor's degree in social work from KU after completing more than 90 hours toward a bachelor's degree in English.

Ying Gu, Software Engineer

Software engineer Ying Gu came to ITTC from the Telecommunication Center of Nanjing Agricultural University in China, where she worked as an assistant engineer. Gu, who started at ITTC on January 22, 2001, works on technology transfer projects. She earned a bachelor's degree in computer and information science from Kansas State University. She also holds a diploma of electrical application from Nanjing Aeronautic Astronautic University and a Comprehensive Telecommunication diploma from Sichuan Post-Telecommunication School, both in China.

Nancy Hanson, Applied Technology Secretary

Nancy Hanson joined CECASE (Center for Excellence in Computer Aided Engineering—a predecessor of ITTC) in January 1993 after several years as secretary for KU Center for Research's Flight Research Laboratory. At ITTC she provides secretarial support for the Associate and Executive Directors for Applied Technology, and maintains records on proposals and funded projects. She also assists the Marketing and Public Relations Manager to produce ITTC publications, including by doing layout, graphics work, and copy editing for the annual report. She has a B.A. in Spanish from Washburn University, in Topeka, and has studied art and design at KU.

Michael Hulet, Systems Administrator

Mike Hulet joined ITTC as a computer systems administrator in July 1998. He manages the Center's network and computer infrastructure. He holds a B.S. degree in electrical and electronic engineering from North Dakota State University and a M.S. degree in systems management from the University of Southern California. Before joining ITTC, he was employed as an electronics engineer for the Naval Warfare Assessment Division in Riverside, Calif.

Ed Komp, Research Engineer

Ed Komp received his B.A. in mathematics and his M.S. in computer science from KU in 1976 and 1979, respectively. He was the primary software architect for the Block Oriented System Simulator (BOSS) and helped found a local company to commercialize this tool. He also was the primary software architect and manager for the Block Oriented Network Simulator (BONeS), a second commercial product success. He joined ITTC in September 1998. He has more than 15 years experience in designing, implementing, and managing commercial software products. His primary interests include specialized computer language design for application specific domains, functional programming, software development environments, and networking.

Ilana Reichman, Student Office Assistant

Ilana Reichman began work at ITTC in November of 2000. She juggles a variety of responsibilities at the Center, which include filing, running errands, working on the annual report, and writing abstracts for the Website. An English major, she plans to graduate from the KU in May of 2002. While she is uncertain about her future plans, they will most likely include law school.

Betsy Schnorenberg, Marketing and Public Relations Manager

Betsy Schnorenberg joined ITTC in October 1999 as a public relations assistant, while still attending classes at KU. After graduating in May 2001 with a bachelor's degree in journalism, she became ITTC's full-time marketing and public relations manager. Schnorenberg manages ITTC's publicity with local news media and State and industry contacts. She publishes the newsletters and the annual report, writes press releases and newsletter articles, and exhibits at trade shows. Before graduation, Schnorenberg spent two years working for KU's daily student newspaper.

Leon Searl, Information Resource Manager

Leon Searl returned to a familiar place when he accepted the position of information specialist at ITTC. Searl worked at TISL (Telecommunications and Information Sciences Lab, a predecessor of ITTC) while he was an electrical engineering student. Before returning to KU, Searl worked with TRW Space and Defense Group, Redondo Beach, Calif., and Cadence Design Systems, Lawrence, Kan. He even owned his own ultralight aircraft company. He is working on two ITTC projects: the Rapidly Deployable Radio Network (RDRN) project and the Ambient Computational Environment (ACE) project. He received his M.S. and B.S. degrees from KU in 1987 and 1985, respectively.

Paula Szuwalski, Program Assistant

Paula Szuwalski joined ITTC as a Program Assistant in the fall of 2000. She assists the Director in the daily operations and strategic development of the Center. Her responsibilities include recruitment and coordination processes for ITTC's staff employees. She also tracks and monitors fiscal information and is involved in special events planning. Before coming to ITTC, she worked as a bonding executive for Kansas Bankers Surety Company in Topeka. She has a B.S. in Computer Information Systems from Friends University and an A.A. in Office Administration from Washburn University, Topeka.

Michelle Ward, Public Relations Assistant

As ITTC's public relations intern, Michelle Ward has written articles for both The Link and ITTC's annual report. She joined ITTC this summer (2001) and plans to continue working at the Center until her graduation next summer. Ward is a graduate student in journalism. She received her bachelor's degree in May of 2000 from Baylor University.

Peggy Williams, Research Secretary

Peggy Williams joined ITTC in March 1997 and is the Center's key resource person for personnel and research-related documentation, office supplies, travel arrangements, and hospitality. She has held positions with the NSF EPSCoR program; Merck & Co., Inc.; KU Center for Research administrative offices; and KU.

New Support Staff, FY2002

Renxiang Huang, Lightwave Research Engineer

Renxiang Hung is no stranger to ITTC. He has worked in the Lightwave Communication Systems Lab since 1998 where he developed a model that can simulate multiple wavelengths. He will continue his work in the Lightwave Lab as a research engineer. Hung graduated with his master's in electrical engineering at KU in May of 2001. He carried a 4.0 GPA through the program. In his new position, he will conduct research and support such projects as polarization-mode dispersion compensation and sub-carrier multiplexing.

ITTC Faculty Investigators

Arvin Agah, Assistant Professor, EECS

Education: Ph.D., Computer Science, University of Southern California, 1994
M.S., Biomedical Engineering, University of Southern California, 1993
M.S., Computer Science, Purdue University, 1988
B.A., Computer Science, University of Texas, 1986

Teaches computer systems design, software engineering, introduction to artificial intelligence, theory and practice of robotics, applied artificial intelligence for mobile robots, intelligent agents.

Research Interests:
- Human interactions with intelligent systems
- Distributed autonomous systems (robots and agents)

Honors and Awards include the KU Henry E. Gould Award for Outstanding Teaching, 2000.

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W. Perry Alexander, Associate Professor, EECS

Education: Ph.D., Electrical Engineering, University of Kansas, 1992
M.S., Electrical Engineering, University of Kansas, 1988
B.S., Electrical Engineering, University of Kansas, 1986
B.S., Computer Science, University of Kansas, 1986

Teaches software engineering, digital systems design, programming language paradigms, formal methods and modeling in software and hardware systems development.

Research Interests:
- Formal specification, synthesis, and verification
- Systems-level design
- Systems-level description languages
- System architectures
- Component retrieval

Honors and Awards include KU Engineering Expo EECS Department Teaching Award; senior member of IEEE; University of Cincinnati (UC) College of Engineering Neil A. Wandmacher Teaching Award; UC ECECS HKN Professor of the Year, 1992-93 and 1996-97; UC Engineering Tribunal Professor of the Quarter, winter 1994 and fall 1998; UC ECECS Department Research Award; UC ECECS Department Teaching Award.

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http://www.ittc.ku.edu/~alex

Christopher Allen, Associate Professor, EECS

Education: Ph.D., Electrical Engineering, University of Kansas, 1984
M.S., Electrical Engineering, University of Kansas, 1982
B.S., Electrical Engineering, University of Kansas, 1980

Teaches circuits, electronic circuits, senior design laboratory, fiber optic communication systems, high-speed digital circuit design, microwave remote sensing.

Honors and Awards include Eta Kappa Nu, Phi Kappa Phi, Tau Beta Pi; recognized by the Center for Teaching Excellence for excellence in the classroom; KU EECS Harry Talley Excellence in Teaching Award; KU Miller Award for Research, 1999; Ned N. Fleming Trust Award for Excellence in Teaching, 2001; Miller Scholar for FY2002 for teaching, research, and service; W. T. Kemper Fellowship Award for Excellence in Teaching, 2001.

Research Interests:
- Microwave remote sensing
- Radar design and analysis
- Synthetic aperture radar
- High-speed digital circuits and applications
- Fiber-optic communication systems
- Photonic systems and devices

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http://www.rsl.ku.edu/~eecs501/callen/

David L. Andrews, Associate Professor, EECS

Education: Ph.D., Computer Science, Syracuse University, 1992
Computer Engineer Degree, Syracuse University, 1990
M.S.E.E., University of Missouri-Columbia, 1984
B.S.E.E., University of Missouri-Columbia, 1983

Teaches digital design, computer architecture, compilers, operating systems.

Honors and Awards include General Managers Award, General Electric Co., 1990; Outstanding Researcher Award, Electrical Engineering, University of Arkansas, 1995; Outstanding Service Award, Electrical Engineering, University of Arkansas, 1996, 1997.

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Research Interests:
- Computer architecture
- Distributed and parallel systems
- Embedded and real-time systems

Ronald J. Aust, Associate Professor, Education

Education: Ph.D., Curriculum and Instruction, University of Washington, 1984
M.S., Education, Western Washington University, 1979
B.S., Education, Western Washington University, 1975

Teaches designing multimedia learning environments and instructional design.

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Research Interests: Designing and developing—
- Multi-state educational networks (including UNITE system and Explorer database)
- Network technologies to support collaborative learning and community publishing of educational resources

David A. Braaten, Associate Professor, Physics and Astronomy

Education: Ph.D., Atmospheric Science, University of California-Davis, 1988
M.S., Meteorology, San Jose State University, 1981
B.S., Meteorology, State University of New York, 1977

Teaches introduction to meteorology, dynamic meteorology, advanced dynamic meteorology.

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Research Interests:
- Snow accumulation
- Ice sheet processes
- Remote sensing

Swapan Chakrabarti, Associate Professor, EECS

Education: Ph.D., Electrical Engineering, University of Nebraska-Lincoln, 1986
M.S., Computational Physics, University of Nebraska-Lincoln, 1982
M.Sc., Physics and Electronics, Calcutta University, India, 1976
B.Sc., Physics, Calcutta University, India, 1976

Teaches digital logic design, algorithmic problem solving, microcomputer applications, computer architecture, graphics in engineering research, computer vision, digital signal processing (including adaptive systems, neural networks, fuzzy systems).

Research Interests:

- Designing hardware and software for true 3-D display systems
- High-speed computation of mathematical functions using analog neural networks
- Digital signal processing

Honors and Awards include honorary member, Golden Key National Honor Society, 1996; KU Ned N. Fleming Teaching Award for Outstanding Classroom Teaching, 1992.

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Kenneth Demarest, Professor, EECS

Education: Ph.D., Electrical Engineering, Ohio State University, 1980
M.S., Electrical Engineering, Ohio State University, 1976
B.S., Electrical Engineering, John Brown University, 1974

Teaches circuits, fiber optic engineering, electromagnetics, microwave systems, noise reduction in electrical systems, antennas, radar engineering, laser engineering.

Research Interests:

- Lightwave communication systems
- Electromagnetic theory
- Antennas

Honors and Awards include Eta Kappa Nu.

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Tyrone Duncan, Professor, Mathematics

Education: Ph.D., Electrical Engineering, Stanford University, 1967
M.S., Electrical Engineering, Stanford University, 1964
B.E.E., Electrical Engineering, Rensselaer Polytechnic Institute, 1963

Teaches stochastic analysis and its applications, stochastics of mathematical finance, stochastic control, stochastic adaptive control, fractional Brownian motion and its applications, probability theory.

Research Interests:

- Stochastic adaptive control
- Stochastic optimal control
- Mathematics of finance
- Stochastic analysis
- Telecommunications
- Mathematics education

Honors and Awards include IEEE Fellow, 1999; KU Olin K. Petefish Award in the Basic Sciences, 1999.

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Joseph B. Evans, Charles E. Spahr Professor, EECS

Education: Ph.D., Electrical Engineering, Princeton University, 1989
M.S., Electrical Engineering, Princeton University, 1986
M.S., Engineering, Princeton University, 1984
B.S., Electrical Engineering, Lafayette College, 1983

Teaches networking implementation, DSP implementation, computer systems design, integrated circuit design, electronics, programming.

Honors and Awards include ETA Kappa Nu; Tau Beta Pi; KU Spahr professorship, 2000-2002; KU Miller Award for Research, 1996; AT&T Bell Laboratories Ph.D. Scholarship, 1984-1988; Garden State Graduate Fellowship, 1983-1987.

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Research Interests:
- Pervasive computing systems
- High-performance networks
- Mobile networking and wireless systems
- System implementations

Victor S. Frost, Dan F. Servey Distinguished Professor, EECS

Education: Ph.D., Electrical Engineering, University of Kansas, 1982
M.S., Electrical Engineering, University of Kansas, 1978
B.S., Electrical Engineering, University of Kansas, 1977

Teaches communication networks and systems.

Honors and Awards include Dan F. Servey Distinguished Professor of Electrical Engineering and Computer Science, 1996; IEEE Fellow; National Science Foundation Presidential Young Investigator Award, 1984; keynote address, 18th Biennial Symposium on Communications, Kingston, Ontario; KU Miller Award for Distinguished Service to Engineering, 1991; KU Miller Award for Distinguished Service to Engineering Research, 1986.

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Research Interests:
- Internet traffic management and quality of service
- High-performance networks
- Network measurement, modeling, control, and simulation

John M. Gauch, Associate Professor, EECS

Education: Ph.D., Computer Science, University of North Carolina at Chapel Hill, 1989
M.Sc., Computer Science, Queen's University at Kingston, Canada, 1982
B.S., Computer Science, Queen's University at Kingston, Canada, 1981

Teaches algorithmic problem solving, structured programming, computer vision, image processing, computer graphics, digital image processing.

Honors and Awards include Archie and Nancy Dykes Award for Undergraduate Teaching and Mentoring, 2001; KU Millers Scholar, 2000; KU Bellows Scholar, 1999.

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Research Interests:
- Digital image processing (segmentation, enhancement)
- Computer vision (stereo, motion tracking)

Susan Gauch, Associate Professor, EECS

Education: Ph.D., Computer Science, University of North Carolina at Chapel Hill, 1990
M.Sc., Computer Science, Queen's University at Kingston, Canada, 1982
B.Sc., Mathematics and Computer Science, Queen's University at Kingston, Canada, 1981

Teaches programming, information retrieval, database systems, software engineering.

Research Interests:
- Multimedia databases
- Intelligent search agents
- Information discovery on the World Wide Web
- Corpus linguistics

Honors and Awards include KU School of Engineering Miller Research Award, 1998; ONR Fellowship, 1988; NF Dupris Prize in Mathematics, 1978.

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Sivaprasad Gogineni, Deane E. Ackers Distinguished Professor, EECS

Education: Ph.D., Electrical Engineering, University of Kansas, 1984
M.Sc., Engineering, Kerala University, Trivanfrum, India, 1976
B.E., Mysore University, India, 1973

Teaches senior design lab, electronics design lab.

Honors and Awards include NASA Group Award to Antarctic Mapping Mission, 2000; KU Miller Award for Outstanding Service, 2000; IEEE Fellow, 1999; NASA Terra Award, 1998; Best-of-Session Award from the Third International Airborne Remote Sensing Conference, 1997; KU Miller Award for Engineering Research, 1991; Taylor and Francis Best Letter Award, 1991.

Research Interests:
- Radar systems
- RF and microwave engineering
- Radar remote sensing
- Microwave radiometers

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Jerzy W. Grzymala-Busse, Professor, EECS

Education: Doctor Habilitatus, Engineering, Technical University of Warsaw, Poland, 1972
Ph.D., Engineering, Technical University of Poznan, Poland, 1969
M.S., Mathematics, University of Wroclaw, Poland, 1967
M.S., Electrical Engineering, Technical University of Poznan, Poland, 1964

Teaches expert systems, knowledge acquisition, artificial intelligence, con-currency models, Petri nets, data structures, computer architecture and networking, computer organization, theory of computing, switching theory, automata theory, computability, discrete structures, and probabilistic analysis.

Research Interests:
- Knowledge discovery
- Data mining
- Machine learning
- Expert systems
- Reasoning under uncertainty
- Rough set theory

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H. Scott Hinton, Distinguished Professor and Chair, EECS

Education: M.S., Electrical Engineering, Purdue University, 1982
B.S., Electrical Engineering, Brigham Young University, 1981

Teaches circuits, active devices, semiconductor devices, optical fiber communications, photonic switching systems.

Honors and Awards include Deane E. Ackers Distinguished Professor, University of Kansas, 1999; Hudson Moore, Jr., Professor of Electrical Engineering, University of Colorado in Boulder, 1994-1999; BNR-NT/NSERC Professor of Photonic Systems, McGill University, 1992-1994; IEEE LEOS Distinguished Lecturer, 1993-1994; Fellow of IEEE; Fellow of Optical Society of America (OSA).

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Research Interests:
- Photonic switching systems
- Free-space optical interconnects
- Optical backplanes
- Technology-enhanced learning environments

Rongqing Hui, Assistant Professor, EECS

Education: Ph.D., Electronics Engineering, Politecnico di Torino, Torino, Italy, 1993
M.Sc., Lightwave Technology, Beijing University of Posts and Telecommunications, Beijing, China, 1988
B.Sc., Microwave Communications, Beijing University of Posts and Telecommunications, Beijing, China, 1982

Teaches fiber-optic communication systems and networks, optical measurements, microelectronic circuits, semiconductor materials & devices, general electric circuits.

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Research Interests:
- Fiber-optic communications
- Photonic devices

Jeremiah James, Assistant Professor, EECS

Education: Ph.D., Computer Science, University of California at Santa Barbara, 2000
M.S., Computer Science, Brigham Young University, 1993
B.S., Computer Science, Brigham Young University, 1992

Teaches advanced operating systems, programming.

Honors and Awards include UCSB Computer Science Department Travel Scholarship, 1995, 1996, and 1998; UC Trustee's Fellowship, 1993-1997; NSF Fellowship, Honorable Mention, 1993; Phi Kappa Phi National Honor Society, 1991; Golden Key National Honor Society, 1990.

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Research Interests:
- Distributed systems
- Concurrent objects
- Data consistency
- Fault tolerance
- Middleware

Stephen P. Lohmeier, Assistant Professor, EECS

Education: Ph.D., Electrical Engineering, University of Massachusetts, 1996
M.S., Electrical Engineering, University of Massachusetts, 1992
B.S., Electrical Engineering, Kansas State University, 1989

Teaches control systems, electromagnetics, adaptive arrays.

Honors and Awards include Tau Beta Pi.

Research Interests:
- Radar
- Remote sensing
- Wireless communication
- Antennas and propagation

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Gary J. Minden, Professor, EECS

Education: Ph.D., Electrical Engineering, University of Kansas, 1982
B.S., Electrical Engineering, University of Kansas, 1973

Teaches introduction to digital logic design, information security, active networking.

Honors and Awards include KU Millers Scholar, 1999 and 2000.

Research Interests: Large-scale systems, including
- Wide-area distributed systems
- Mobile communication systems
- Adaptive computational systems
- Active networking

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Ed Meyen, Professor, Special Education

Education: Ph.D., University of Iowa, Education, 1968
M.A, University of Northern Colorado, Special Education, 1959
B.A., University of Northern Colorado, Education, 1958

Teaches curriculum design courses, instructional design, instructional technology, graduate seminars.

Research Interests:
- Online instructional design
- Web-based instructional tools
- Intellectual property issues
- Online instructional applications for students with disabilities
- Emerging instructional technologies

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Richard K. Moore, Distinguished Professor Emeritus, EECS

Education: Ph.D., Electrical Engineering, Cornell University, 1951
B.S., Electrical Engineering, Washington University, 1943

Teaching duties: Advises graduate students.

Honors and Awards include Australia Prize for Remote Sensing, 1995; Italian Center for Remote Sensing Award, 1995; Fellow AAAS, 1993; National Academy of Engineering, 1989; KU Irvin Youngberg Award in the Applied Sciences, 1989; KU Louise E. Byrd Graduate Educator Award, 1984; IEEE Centennial Award, 1984; IEEE Geoscience and Remote Sensing Society Distinguished Achievement Award, 1982; IEEE Council on Oceanic Engineering Outstanding Technical Achievement Award, 1978; Alumni Achievement Award, School of Engineering and Applied Science, Washington University, 1978; Life Fellow IEEE (Fellow in 1962).

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Research Interests:
- Radar systems
- Radar remote sensing
- Radio wave propagation
- Radar oceanography
- Microwave radiometers

Douglas Niehaus, Associate Professor, EECS

Education: Ph.D., Computer Science, University of Massachusetts at Amherst, 1994
M.S., Computer, Information and Control Engineering, University of Michigan, 1981
B.S., Computer Science, Northwestern University, 1980

Teaches software engineering, concurrent and distributed software development, introduction to operating systems, compiler construction, distributed operating systems, advanced operating systems topics.

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Research Interests:
- High-performance networks
- Network simulation and performance evaluation tools
- Real-time systems
- Distributed and operation systems

Karen J. Nordheden, Associate Professor, Chemical and Petroleum Engineering

Education: Ph.D., Electrical Engineering, University of Illinois, 1988
M.S., Electrical Engineering, University of Illinois, 1984
B.S., Physics, Michigan, 1980

Teaches introduction to semiconductor processing, introduction to computers in engineering, heat transfer, engineering mathematics, process control, semiconductor physics.

Honors and Awards include KU Gould Award for Distinguished Teaching in the School of Engineering, 1999; KU H. Bernerd Fink Award for Excellence in Teaching, 1998; KU EECS Harry Talley Excellence in Teaching Award from the local chapter of Eta Kappa Nu, 1997.

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Research Interests:
- Plasma processing of semiconductors
- Fabrication of III-nitride and III-V based semiconductor devices

Bozenna Pasik-Duncan, Professor, Mathematics

Education: Habilitation Doctorate degree, Mathematics, Warsaw School of Economics, 1986
Ph.D., Mathematics, Warsaw School of Economics, 1978
M.S., Mathematics, Warsaw University, 1970

Teaches probability theory, stochastic processes, mathematical statistics, stochastic adaptive control, calculus, stochastic calculus, differential equations, randomness in the modern world.

Honors and Awards include Tau Beta Pi, Fellow of IEEE; NSF Career Advancement Award for Excellence in Teaching; Ministry of Higher Education and Sciences, Poland; Several Chancellor's Awards for research and teaching, Warsaw School of Economics; IREX Scholar to the United States, 1982; Kemper Fellowship for Teaching Excellence and Advising in Public Outreach; G. Baley Price Award for Excellence in Teaching; IEEE Third Millennium Medal for Outstanding Contributions to IEEE Control Systems Society.

Research Interests:

- Identification and adaptive control of stochastic systems
- Science and mathematics education for K-12
- Stochastic analysis and its applications to mathematics of finance, manufacturing, biomedicine, and telecommunications

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David Petr, Professor of EECS and Sharp Professor of Engineering

Education: Ph.D., Electrical Engineering, University of Kansas, 1990
M.S., Electrical Engineering, Stanford University, 1978
B.S., Electrical Engineering, Southern Methodist University, 1976

Teaches integrated telecommunication networks, analysis of communication networks, random signal theory, optimization with communication applications, introduction to communication systems, signal analysis, circuits.

Research Interests:

- High-speed, wide-area networks
- Network traffic and congestion management
- Traffic integration for networks
- Performance analysis and simulation
- Evaluation of students' confidence in answers
- Digital signal processing for medical applications

Honors and Awards include KU School of Engineering Sharp Teaching Professorship, 2000-2002; Visiting Erskine Fellowship, University of Canterbury, New Zealand, 2000; Excellence in Teaching Award, KU Center for Teaching Excellence, 1999; Member of Sigma Xi, 1992; Senior member of IEEE, 1991; KU nominee for NSF Presidential Faculty Fellow, 1991; Ben Dasher Best Paper Award for the ASEE/IEEE Frontiers in Education conference, October 2000.

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Glenn E. Prescott, John and Winfred Sharp Professor, EECS

Education: Ph.D., Electrical Engineering, Georgia Institute of Technology, 1984
M.S., Electrical Engineering, University of Missouri, 1976
B.S., Electrical Engineering, Georgia Institute of Technology, 1974

Teaches linear systems, electronics design laboratory, senior design laboratory, digital signal processing, digital communications, DSP for communications and radar, advanced modulation and coding.

Research Interests:

- Software radio systems
- Spread spectrum and military communication systems
- Radio and radar signal processing
- DSP applications of field programmable gate arrays
- Design and implementation of wireless communication systems

Honors and Awards include NASA Special Service Award, 2000; KU School of Engineering Sharp Teaching Professorship, 1998-2001; NASA Terra Award, 2000.

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James A. Roberts, Associate Vice Chancellor; Professor, EECS

Education: Ph.D., Electrical Engineering, Santa Clara University, 1979
M.S., Electrical Engineering, Massachusetts Institute of Technology, 1968
B.S., Electrical Engineering, University of Kansas, 1966

Teaches wireless communication systems, information theory, and communication system planning and design.

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Research Interests:

- Wireless communication systems
- CDMA and spread spectrum systems
- Coding and information theory

W. M. Kim Roddis, Professor, Civil Engineering

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

Teaches structural steel design, structural analysis, knowledge-based expert systems.

Honors and Awards include KU Docking Scholar, 1999; KU School of Engineering Bellows Fellow, 1999; American Society of Civil Engineers Fellow, 1997; KU School of Engineering Miller Award for Research, 1997; Fannie and John Hertz Fellow, 1986-1988; American Institute of Steel Construction Fellowship, 1987; American Society of Civil Engineers O.H. Ammann Research Fellow, 1986.

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http://civil-env.ce.ku.edu/fac roddis.html

Research Interests:

- Design, fabrication, and construction engineering processes
- Applications of artificial intelligence to civil and structural engineering
- Design of computer-aided tools for civil engineering
- +++

Hossein Saiedian, Associate Chair and Professor,

Education: Ph.D., Computing and Information Sciences, Kansas State University, 1989
M.S., Mathematics, Emporia State University, 1984
B.S., Information Systems, Emporia State University, 1981

Teaches software engineering; develops and expands software engineering program, EECS; expands EECS programs at Regents Center for KC metropolitan audience.

Honors and Awards include Senior Member, IEEE; Excellence in Teaching Awards, University of Nebraska at Omaha, 2000; Distinguished Research Award, University of Nebraska at Omaha, 2000; top 10 software engineer scholars list, *Journal of Systems and Software*, 1998.

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Research Interests:

Software engineering, including

- Process improvement
- Formalism
- Object-oriented software development

K. Sam Shanmugan, S.W. Bell Distinguished Professor, EECS

Education: Ph.D., Electrical Engineering, Oklahoma State University, 1970
M.S., Electrical Engineering, Indian Institute of Science, Bangalore, India, 1966
B.S., Electrical Engineering, Madras University, India, 1964

Teaches communication systems, simulation, probabilistic analysis, signals, and systems.

Honors and Awards include H.O.P.E. Award Finalist, 1994; KU Higuchi Award for Research, 1990; Burlington-Northern Outstanding Teaching Award, 1987; KU Henry E. Gould Award for Distinguished Service to Undergraduate Engineering Education, 1982; Amoco Foundation Outstanding Teacher Award, 1982; Society of Automotive Engineers Ralph R. Teetor Outstanding Young Engineer Award, 1979.

Research Interests:

- Smart antenna systems
- Signal (image) processing
- Random signals and communications theory
- Wireless and adaptive communication systems and networks
- Communication systems simulation and analysis

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James M. Stiles, Assistant Professor, EECS

Education: Ph.D., Electrical Engineering, University of Michigan, 1996
M.S., Electrical Engineering, Southern Methodist University, 1987
B.S., Electrical Engineering, University of Missouri, 1983

Teaches electronics, electromagnetics, radar, microwave engineering.

Honors and Awards include KU EECS Harry Talley Teaching Award, 2000; KU School of Engineering Miller Award for distinguished research, 2001.

Research Interests:

- Radar signal processing
- Applications of information and estimation theory in remote sensing
- Radar remote sensing of vegetation
- Propagation and scattering in random media
- Ground-penetrating radar

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Costas Tsatsoulis, Charles E. Spahr Professor, EECS

Education: Ph.D., Electrical Engineering, Purdue University, 1987
M.S., Electrical Engineering, Purdue University, 1984
B.S., Electrical Engineering, Purdue University, 1983
B.A., German, Purdue University, 1987

Teaches 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.

Honors and Awards include KU Spahr Professor, 2000-2002; Big-12 Faculty Fellowship; State of Kansas AT&T Engineering Education Excellence Award; KU Miller Award for Research Excellence; Bellows Fellowship, 1999; Elected Senior Member of the IEEE, 1998.

Research Interests:

- Multiagent systems
- Machine learning

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Victor L. Wallace, Professor Emeritus, EECS

Education: Ph.D., Electrical Engineering, University of Michigan, 1969
B.S., Electrical Engineering, Polytechnic Institute of Brooklyn, 1955

Taught computer operating systems, interactive graphics, programming languages, and other computer science subjects.

Honors and Awards include Computer Graphics Pioneer Award, ACM SIGGRAPH, 1984; Irving Faye Memorial Award, Polytechnic Institute of Brooklyn, 1955; Senior Life Member, IEEE; Eta Kappa Nu; Upsilon Pi Epsilon, Tau Beta Pi, Sigma Xi.

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Research Interests:

- Interactive graphics, virtual reality, and human interface design
- Distributed and real-time systems (scheduling and load balancing)
- Network performance modeling (analytical models of correlated traffic and queues)
- Queuing theory for wide-band and multimedia computer networks
- Operating systems theory

New Faculty Investigators, FY2002

Daniel Deavours
Research Assistant Professor

Daniel Deavours joins ITTC as a research assistant professor, who will specialize in the modeling of computer and communications systems. Deavours comes to the Center from the University of Illinois at Urbana-Champaign. He will defend his Ph.D. thesis in August and expects to formally receive his degree in electrical engineering in September (2001). He also earned his master's at UIUC in electrical engineering in 1997.

While a student at the UIUC, Deavours created both software tools and short courses. He helped develop UltraSAN and assumed primary control of maintenance and development of it in 1995. Two years later, he created Mobiuis as he led the design and development of the software. He continues work on both tools in a small capacity.

Deavours founded two short courses on validation methods as well. He co-instructed the one on UltraSAN: Modeling, Analyzing, and Simulating High-Availability Systems, at Motorola University. His areas of interest include Markov modeling, modeling language, simulation, and numerical methods.

Dragos Manolescu
Assistant Professor, EECS

Dragos Manolescu will teach courses at the Edwards Campus in programming language paradigms and software process management. He joins ITTC with research interests revolving around workflow management, software architecture, and object-oriented systems (especially frameworks, business objects, and patterns).

Manolescu earned his Ph.D. in computer science at the University of Illinois at Urbana-Champaign in October of 2000. In 1997, he received his master's degree in computer science at UIUC. Before his arrival at Illinois, Manolescu acquired degrees in mathematics and electrical engineering in his native Romania. He comes to ITTC after working as a senior member of the technical staff at Applied Reasoning, Overland Park, Kan.

Investigation of Adaptive Polarization-Mode Dispersion Compensation for Optical Signals

Imagine downloading the complete Encyclopedia Britannica in one second. With just a few clicks of a mouse, you could have volumes of information at your disposal. The speed and ease of retrieving vast amounts of data could transform the global village from a dream into the commonplace.

Whether it is for entertainment or information, people would only need to log on to access 10 billion bits per second of data. This would be a four-fold increase from the present 2.5 billion bits per second in most of today's Internet backbone. But with increased speed, delivery problems arise as well.

One such impairment is polarization-mode dispersion (PMD), which corrupts data traveling over fiber-optic networks. Presently, the effects of PMD are so small that it goes unnoticed. However, at higher data rates, it becomes a significant problem, said Chris Allen, director of the Lightwave Communication Systems Lab. Thus, Allen and his team at ITTC set out to quiet the disturbances of PMD.

"Maximizing the usable capacity of the existing fiber network is important to meet the growing needs for sending and sharing digital data," Allen said, "the Internet's appetite for communications bandwidth demands higher bit rates. However in systems with higher bit rates, very subtle perturbations (like those from PMD) become significant. That's why PMD and how to compensate for it have become so important to the fiber transport industry."

Scientists thought they had discovered the solution to the increasing dilemma of transmission bandwidth, believing that fiber optics would provide the needed space for growing communication needs. While fiber optics has transformed the telecommunications industry, it is not perfect. These glass, light guides are very sensitive and easily disturbed. They fall prey to changes in temperature, pressure, and other stressors, which make them unpredictable. Furthermore, their core and outer shell must be perfectly circular to work at very high speeds; any errors in their design complicate transmission. Optical fibers' sensitivity only heightens the problems of PMD.

"To use incredible throughput capacity of optical fiber, many technical challenges have been solved; however to take the next step in terms of data rates, new and more complex impediments must be overcome," Allen said. "PMD is particularly challenging, since its characteristics depend somewhat on environmental factors."

To correct these problems and allow for continued growth in bandwidth, Allen and his colleagues have developed an Adaptive PMD Compensator. This system, put at the receiving end of the communication, cleans up the disruptive effects on the information during its journey. The Compensator neutralizes the distortion due to PMD.

Juan Madrid, a computer science Ph.D. student, worked on the programming and electronics design for the Compensator. He said it was a real interdisciplinary effort, as he teamed up with electrical engineering graduate students Arun Chimata and Pradeep Kumar, who developed the optical system and tests for the project. The Compensator's successful demonstration this summer gave all three students a great sense of pride and accomplishment.

"This experience is important, not only for the results we have been able to show in the system demonstration, but also for all that we have learned in the process," Madrid said. "Now, we have a better understanding of the PMD effects in high-speed optical fiber communications, and we hope our device will help us collect more useful data about this phenomenon."

In the future, the team will be fine-tuning the Compensator, Allen said. Researchers will learn about the system's limitations and how they might overcome them. They will be aided in their venture by dark fiber, which is spare fiber connected to the Sprint network. Allen said it was extremely rare for a research lab to have the advantage of working fiber. Its high expense limits its availability within research laboratories. However, KU researchers will have the benefit of testing their theories on working fiber, which provides them with tremendous advantages, Allen said.

"Access to real fiber, professionally installed, and subject to real environmental forces is an incredibly valuable asset," Allen said. "We plan to monitor its characteristics and its effect on various signals. Such data will greatly enhance our understanding of the challenges awaiting network designers and engineers."

Ph.D. student Juan Madrid works with the Adaptive PMD Compensator, which he helped create. Madrid programmed the system that will clear corrupted data that travel over fiber-optic networks.

Quality Access to Online Health Information Based on User Profiles ("VitalSeek")

One of ITTC's researchers specializing in information retrieval on the World Wide Web has partnered with an area start-up company to develop a Web site that rates and provides online medical information to the public and to health professionals.

Today Communications, Inc., of Kansas City, Mo., has contracted with Susan Gauch, an associate professor in KU's Department of Electrical Engineering and Computer Science. Gauch and her graduate-level students created the software that will enable the company to guide consumers through an ever-growing maze of online health resources.

"In 2000, more than 30 million people in the U.S. went to the Web looking for medical information," said Ace Allen, a physician and the young company's CEO. The Web offers tens of thousands of health-related sites, said Allen, who also founded and published Telemedicine Today magazine, which was recently acquired. "So, the good news is that there's lots of information, but it is difficult for people to sort through it all."

The information is not all of equal quality. "Some of the Web's health information is good," Gauch said, "but a lot of it is mediocre or outdated." Because online information comes from a variety of sources, people surfing the Net for medical advice also can't be sure if their sources are reliable or up to date.

Today Communications will offer what Gauch describes as a "one-stop-shopping" site, called VitalSeek, for accessing high-quality healthcare resources from all over the Internet. The company will analyze and rate health sites on such things as accuracy, currency, depth of information, and privacy, and also on how well the facts are presented for general health consumers. Visitors to the Web site will create a user profile that in turn will help guide their Web search. "In effect," Gauch said, "the users can select the qualities that matter to them."

Gauch will provide Today Communications with both the software to process the company's internal rating system and the user profiles that will then determine what information the company's Web browser retrieves.

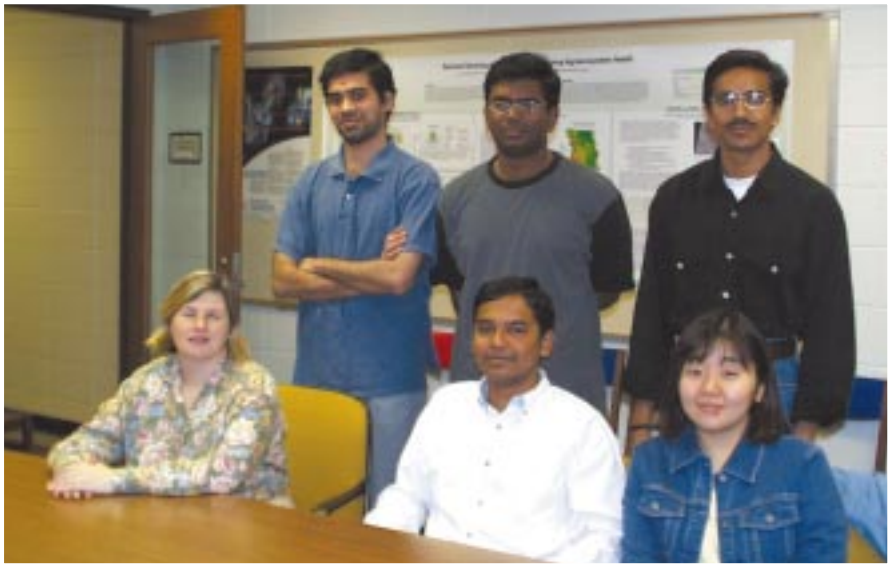
"As a collaboration between the University and industry, this project is one example of KU's commitment to helping to develop the Kansas City area as a hub of life and health science research," Gauch said.

KU connections brought Gauch and the company's executives together. Allen, an oncologist and former teaching physician at the KU Medical Center and the founder of KUMC's Telemedicine Project, teamed up with KU alumni Scott McWilliams, Today Communications' chief technology officer, and Jim Patterson, the company's VP of Internet Development.

McWilliams, who earned a Ph.D. in Communications Studies, learned about Gauch's work and ITTC from Howard Sypher, a Communication Studies faculty member who also serves as an advisor to the fledgling company.

"They wanted KU people for this year-long project," Gauch said. She noted that first two phases of the project were complete and the third will be finished in early fall 2002.

The project's funding includes money from ITTC, the KU Center for Research and KU's School of Engineering.



The research group for ITTC's project with Today Communications includes, in the front row, from left, faculty researcher and PI Susan Gauch, and students Sirivolu Praveen and Keiko Imamura; in the back row, from left, students Vijayaraghavan Rajan, Solomon Nagelli, and Subhash Induri. With the help of Gauch, these students are developing a Web site that rates and provides online medical information to the public and to health professionals.

Learning from Examples Using Rough Sets (LERS) Data-Mining System

ITTC works closely with different departments on the KU campus. One such partnership has teamed Jerzy Grzymala-Busse, an ITTC faculty member, with the Institute for Life Span Studies. Grzymala-Busse, a professor of computer science, aided the Institute in behavioral studies of both humans and rats. The Institute had already collected raw data for its research, but it needed a way to process the information. Grzymala-Busse had the solution with his data-mining system, LERS (Learning from Examples using Rough Sets).

"The program searched the raw data for any patterns within it. LERS gives researchers rules that can serve as advisory tools in their work," Grzymala-Busse said. "These rules predict that a certain type of behavior will occur when certain variables have specific values."

The data-mining system LERS was used to explore the relation between arousal level, environmental events, and the occurrence of problem behavior. Data from this study were collected using a heart rate monitor to gather heart rate every 15 seconds as the subject was videotaped in his home environment. Data represented recorded behaviors and environmental events in real time. Thus the input data were temporal. The data were converted into a new data set, describing the subject's behavior in terms of current external stimuli and heart rate as well as values of both external stimuli and heart rate from the previous 15-second and 30-second intervals. Induced rules show interesting relations between subjects' behavior, external stimuli, and heart rate.

Grzymala-Busse, affiliated with the Intelligent Systems and Information Management Lab at ITTC, stood on more familiar ground with the Institute's other studies. Life Span Studies tested the effects of different levels of the dopamine re-uptake blocker, GBR12909, on rats. KU researchers were testing the theory that abnormal amounts of dopamine in people with developmental disabilities causes aggression, self-injury, and other harmful behavior. Researchers injected three different groups of rats with GBR12909. The rats were videotaped just after the injection and again six hours later. The data-mining system processed the data and induced different rules for each group.

The rules categorized each group of rats by their actions and the amount of time they spent on each action. For example, rats that were licking the cage up to 23 percent of time, paw treading up to 7 percent of the time, poking noses up to 1 percent of the time, and self-nibbling or biting up to 92 percent of the time belonged in the first group.

The first implementation of LERS was created in 1988, and it is continually being improved. Each new assessment challenges the system. Grzymala-Busse sees LERS' future possibilities as limitless. He said the data-mining system could work anywhere from the financial world to the medical world. LERS could take the vast information from a bank's database and process it, determining who would make good candidates for loans.

The LERS data-mining system has been used for years by NASA's Johnson Space Center (Automation and Robotics Division), to develop expert medical decision-making systems on board the International Space Station. LERS was used to enhance facility compliance for the Emergency Planning and Community Right to Know project, a groundbreaking project funded by the Environmental Protection Agency. LERS was used in other areas as well; e.g., in the medical field to assess pre-term labor risk for pregnant women, to compare the effects of warming devices for postoperative patients, and to improve diagnosis of melanoma. Traditional methods currently used to assess pre-term labor risk have accuracy rates between 17 percent and 38 percent, while the expert system with the rule base induced by LERS has an accuracy rate between 68 percent and 90 percent. Other successful applications of LERS were nursing, global warming, environmental protection, natural language, and data transmission.

Jerzy Grzymala-Busse runs the LERS data mining system, which assesses raw data, looking for patterns. Grzymala-Busse developed the system to act as an advisory tool for predicting future occurrences in various situations based on the past.

The LERS data-mining system is universal. It may induce rules from any kind of data. LERS can produce rules for an expert system that gives advice on decision making or that interprets regularities hidden in original data. LERS can process large datasets and frequently outperforms not only other rule induction systems but also human experts.

A Genetically Motivated Heuristic for Route Discovery and Selection on Packet Switched Networks

Route discovery and selection are fundamental to the operation of packet-switched networks, like the Internet. As a packet transits a network, routers must coordinate a path (route) of communications links through which the packet will travel. Each router along the path needs a consistent view of how the packet is to proceed; otherwise the packet may be caught in a never-ending cycle as it passes back and forth between routers with conflicting routes. In addition to being consistent, the selected route should be efficient. While the definition of efficiency is context-specific, generally it is beneficial if the packet experiences minimal delay as it transits the network. The primary objective of a routing system is to support the discovery and selection of feasible and efficient routes.

In a network with capacity constraints, finding the optimal route assignment without exceeding capacity constraints and while minimizing delay is a difficult problem. Although the problem is inherently complex and intrinsically distributed with strong real-time constraints, the fundamental difficulty in solving it lies in the practical reality that the input data are often not available. Because of this limitation, heuristic approaches offer a potential balance between accuracy and computational feasibility. The purpose and contribution of this research is to evaluate both the analytical and empirical performance of an adaptive routing heuristic that bases its operation on a genetic metaphor. The heuristic system simulates evolution, borrowing from nature's familiar operators of reproduction, mutation, and selection. As the landscape changes, the system evolves and changes with it. By modeling nature's "survival of the fittest" optimization operator, near-optimal routing tables can be grown and nurtured. All of this happens without an explicit knowledge of the network's topology or traffic characteristics. The solution is therefore well positioned in an environment where this information is unavailable.

Predictably, the approach has limitations and shortcomings. However, like the genetic mutations it tries to model, this approach represents an evolutionary step in routing protocol design. Therefore, understanding its strengths and weaknesses is essential for determining if, when, and how characteristics of the heuristic routing system are to be incorporated into current routing protocols.

The new routing system will allow packets of information to circumvent extremely busy areas of the regional network. This evolution will provide data with the ability to change their course, taking advantage of freer networks and allowing information to arrive more quickly.

Sponsors and Collaborators

ITTC receives funding for its numerous projects through a variety of sources. The wide array of funding for the Center denotes the important role it plays in creating and developing high-tech industries, which yield high-wage jobs. Thus, continued partnerships between the public-private sectors are essential for long-term economic growth, made possible by establishing and maintaining cutting-edge research.

ITTC's commitment to research and economic growth attracts many sponsors, who provide funding for the Center's more than 50 projects. The Federal Government provides 51 percent of ITTC's funding, with the State contributing an additional 14 percent. Industry supplies the Center with 29 percent of its funds, while other groups and individuals give the last 6 percent. ITTC has been fortunate enough to collaborate with a number of technological leaders. It has worked with such partners as the U.S. Army, The Mayo Clinic, and Columbia University. While ITTC boasts alliances with a number of elite institutions nationally, it does not stop there.

ITTC has joined forces internationally to work on projects with such colleagues as the Alfred Wegener Institute in Bremerhaven, Germany, and the University of Bristol in the United Kingdom. It has ties throughout the world, helping to make it a leading research center.

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University of Bristol, United Kingdom
University of Copenhagen
University of Missouri, Rolla
University of Texas' Southwestern Medical Center
Veteran's Administration
Worldwide Broadcasting Network
Xerox Palo Alto Research Center

Projects Active during FY2001

AAL2 Call/Connection Control Signaling
Sprint
J. Evans, with V. Frost, D. Petr

Acquisition of Testing and Measurement Equipment at Kansas in Conjunction with the RICE Neutrino Astrophysics Experiment
National Science Foundation (NSF)—Office of Polar Programs (OPP)
D. Besson, with C. Allen, A.Bean

Advanced Semiconductor Research Group in the State of Kansas
Kansas State University
K. Nordheden, with R. Hui

Ambient Computational Environments (ACE)
NSF—Computer and Info Science and Engineering (CISE)
G. Minden, with A. Agah, A. Ambler, F. Brown, J. Evans, S. Gauch, C. Tsatsoulis

Ambient Computational Environments (ACE)
Sprint
J. Evans, with A. Agah, V. Frost, J. James, G. Minden

Architecture and Prototype of an Ambient Computation Environment
Defense Advanced Research Projects Agency (DARPA)
G. Minden, J. Evans, with A. Agah, J. James

Architecture for Space Based Internets [SBI]
National Aeronautics and Space Administration (NASA)—Glenn Research Center
G. Minden; with J. Evans

ATM Call Model for Traffic Engineering
Sprint
D. Petr, with S. Chakrabarti, V. Frost

Autonomous Mobile Radar for Temperate Ice Thickness Measurements
Kansas NASA EPSCoR
A. Agah

Broadband Wireless Local Loop
Sprint
J. Evans, with V. Frost, G. Prescott, J. Roberts, K.S. Shanmugan

CAREER/EPSCoR: Cooperative Agents for Conceptual Search and Browsing of World Wide Web Resources
NSF
S. Gauch

Case-Based Reflective Negotiation Model
U.S. Air Force Research Laboratory
C. Tsatsoulis, with R.D. Niehaus

Case Reflective Negotiation Model
U.S. Air Force Research Laboratory
P. Alexander

Center for Excellence
Kansas Technology Enterprise Corporation
T. Johnson

CISE Research Instrumentation: Ambiguity Resolution for Intelligent Systems Using a Cognitive Robot
NSF
F. Brown, with A. Agah, T. Schreiber, J. Gauch

Complexity, Implementation, and Management Trade-Offs for Traffic Aggregation in Future Networks
Sprint
V. Frost, with J. Evans, J. James, R.D. Niehaus

Determining Fiber Plant Characteristics Using Measurement and Modeling
Sprint
K. Demarest, with C. Allen, R. Hui

Development and Evaluation of a Range-Gated Step-Frequency Radar
NASA—Jet Propulsion Laboratory (JPL)
S. Gogineni

Development of a Hybrid RF/Laser Radar
NASA
C. Allen, with S. Gogineni

Development of a Micropower Impulse Radar Based System for Detecting Vehicles at Railroad Crossings
LaBarge, Inc.
S. Lohmeier

Development of Radar System for Accumulation Measurements (ESSF Student: Pannirselvam Kanagaratnam)
NASA
S. Gogineni

Enhancement of the KU PNNI Performance Evaluation tools--TP&I
Sprint
R.D. Niehaus, with V. Frost, J. Evans

Fabrication error Indexed eXamples and Solutions (FIXS)
Kansas Department of Transportation
K. Roddis

High Resolution Optical Spectrum Analyzer for Optical System Link Quality Monitoring
Nortel Networks
R. Hui

High Speed WDM Sub-Carrier Multiplexed Optical Fiber Communication Systems
Sprint
R. Hui, with C. Allen, K. Demarest

Information Systems Technologies for the Earth Science Technology Office
NASA—Goddard
G. Prescott

Innovative Active Networking Services
U.S. Air Force Research Laboratory
G. Minden, J. Evans

Integrated Evaluation of Network, System, and Application Software Architecture and Performance Issues in ATM Networks
Sprint
R.D. Niehaus, with C. Tsatsoulis

Intelligent Knowledge Management Environments
U.S. Army—Center for Army Lessons Learned/ University after Next
H.S. Hinton, E. Meyen, with J. Gauch, S.Gauch

Kansas Participation in Sea Winds Instrument Activities
Oregon State University
R. K. Moore

KU Antenna Range Capability Upgrade
Honeywell/FM&T
C. Allen

Lightwave Communications Systems Research
Sprint
K. Demarest, with V. Frost, J. Evans, C. Allen, R. Hui, G. Minden

Low Coherent, High Resolution WDM Reflectometry for Fiber Length Measurement
Kansas Science and Technology Advanced Research
R. Hui, with C. Allen

Measurement of Thickness of the Greenland Ice Sheet and High Resolution Mapping of Internal Layers
NASA
S. Gogineni, with D. Braaten, J. Stiles

Modeling Ultra-Dense, Ultra-High Speed WDM Fiber Networks
Sprint
K. Demarest, with A. Agah, R. Hui

Multi-Dimensional Companding Based Sonoelasticity and Scatterer Size Imaging with the TMS320-Based System
KU Medical Center
G. Prescott

Multi-Dimensional Signal Processing Algorithms for Sparse Radar Arrays
Air Force Office of Scientific Research
J. Stiles

Multidisciplinary Research in Mine Detection and Neutralization Systems
University of Missouri—Rolla
J. Stiles, with S. Gogineni

Network Capacity Trade-Offs for Traffic Aggregation in future Networks
Sprint
V. Frost

Network Monitoring for Performance Analysis and for Enabling Network-Aware Applications
U.S. Department of Energy
J. Evans, with V. Frost

NSF Workshop for High School Teachers of Mathematics and Science
NSF
B. Pasik-Duncan

Open Control Architectures
Sprint
J. Evans

PMD Characterization on an Active Fiber Link
Sprint
C. Allen, with R. Hui, K. Demarest

Quality Access to Online Health Information Based on User Profiles ("VitalSeek")
Today Communications
S. Gauch

Quality of Service Translations
Sprint
J. Evans, with G. Minden

Remote Sensing of East Antarctic Ice Streams
NASA—Goddard
S. Gogineni

Reporting System to Improve Safety of the Blood Supply
Columbia University
C. Tsatsoulis

Rosetta Tools and Techniques IR&D-2001
EDAptive Computing
W.P. Alexander

SGER: Enhanced Scalability of Chemical Processes through Narrow-Gap Architectures
NSF—Engineering (ENG)
G. Suppes, with K. Nordheden

SOCCER Phase II
EDAptive Computing, Inc.
W.P. Alexander

Software Architectures for Autonomous Communication Systems
Kansas NASA EPSCoR
D. Andrews, with R.D. Niehaus, J. James, W.P. Alexander

Steel Girder Lateral Stability
Kansas Department of Transportation
K. Roddis

Stochastic Adaptive Control and Related Topics
NSF
T. Duncan, with B. Pasik-Duncan

Systems Level Design Languages and Notations
AverStar, Inc.
W.P. Alexander

System Support and Performance Evaluation of Conventional and Real-Time ORBs
Sprint
R.D. Niehaus

Teaching Aid: Steel Building Design Case Study
American Institute of Steel Construction, Inc.
K. Roddis

Torsion of Exterior Girders: Improved Design Aid
Kansas Department of Transportation
K. Roddis

Tracking Internal Layers of the Greenland Ice Sheet Using Airborne Radio Echo Sounder Images
NASA
J. Gauch

Wireless Network System Research
Adaptive Broadband, Ltd.
J. Evans

ITTC-Affiliated Publications, FY2001

Books and Book Chapters

Intelligent Agents in Telecommunication Networks,
L.K. Soh, C. Tsatsoulis; *Computational Intelligence in Telecommunications Networks*; eds. W. Pedrycz, A.V. Vasilakos; CRC Press, Ch. 19, 2000, pp. 480-504.

Some Stochastic Semilinear Equations in Hilbert Space with Fractional Brownian Motion,
T.E. Duncan; *Optimal Control and Partial Differential Equations*; eds. J.L. Menaldi, E. Rofman, A. Sulem; IOS Press, Amsterdam, 2000, pp. 241-247.

The VISION Digital Video Library Project,
J. Gauch, S. Gauch, K.M. Pua; *Encyclopedia of Library and Information Science*, ed. A. Kent; Marcel Dekker, Inc., Vol. 68, supplement 31, New York, 2000, pp. 366-381.

To Appear

Pre-Requirements Traceability,
W. Li, H. Saiedian, and R. Vaughn; *Encyclopedia of Software Engineering*; ed. J.J. Marciniak; Wiley, Vol. 2, Dec. 2001.

Journal Articles

Adaptive Control for Semilinear Stochastic Systems,
T. Duncan, B. Maslowski, B. Pasik-Duncan; *SIAM Journal of Control Optimization*, Vol. 38 (no. 6), Aug. 2000, pp. 1683-1706.

On Adaptive Control of Discrete Time Markov Processes by the Method of Large Deviations,
T. Duncan, B. Pasik-Duncan, L. Stettner; *Applicationes Mathematicae*, Vol. 27 (no. 3), Oct. 2000, pp. 265-285.

Biophysical and Spectral Characteristics of Cool and Warm-Season Grasslands under Three Land Management Practices in Eastern Kansas,
X. Guo, K.P. Price, J.M. Stiles; *Natural Resources Research*, Vol. 9 (no 4), 2000, pp. 321-331.

Can You Trust Sofware Capability Evaluations,
E. O'Connell, H. Saiedian; *IEEE Computer*, Vol. 23 (no. 3), 2000, pp. 28-35.

Control of a Mobile Service Robot Using Human Evaluations of Task-Related Movement Patterns,
A. Agah, J.T. Butler; *Journal of Robotics and Mechatronics, Special Issue on Intelligent Control in Coming New Generation*, Vol. 12 (no. 6), Dec. 2000, pp. 689-701.

Coordinate Transformation Learning of Hand Position Feedback Controller with Time Delay,
A. Agah, K. MacDorman, T. Maeda, E. Oyama, S. Tachi; *Neurocomputing*, Vol. 38-40, pp. 1503-09.

Design of the Kan Distributed Object System,
J. James, A.K. Singh; *Concurrency: Practice & Experience*, Vol. 12 (no. 8), July 2000, pp. 755-97.

Fatigue Crack Investigation for the Arkansas River Bridge in Hutchinson, Kansas,
W.M.K. Roddis, Y. Zhao; *Construction and Building Materials Journal*, Elsevier Science Ltd., Vol. 14 (no. 5), July 2000, pp. 287-295.

GaAsEtch Rate Enhancement with SF6 Addition to BC13 Plasmas,
S.P. Gogineni, M.-Y. Kao, K.J. Nordheden, K. Upadhyaya; *Journal of The Electrochemical Society*, Vol. 147 (no. 10), Oct. 2000, p. 3850.

Human-Computer Interaction Based Only on Auditory and Visual Information,
A. Agah, H. Sha; *Transactions on Control, Automation, and Systems Engineering*, Vol. 2 (no. 4), Dec. 2000, pp. 285-297.

Identification for Some Linear Systems with Fractional Brownian Motion,
B. Pasik-Duncan; *Optimal Control Partial Differential Equations*; eds. J.L. Menaldi, E. Rofman, A. Sulem, 200l, pp. 273-283.

Implementation of an Intelligent Force Feedback Multimedia Game,
A. Agah, F. He; *Journal of Intelligent Systems*, Vol. 11, No. 1.

Mass Balance of the Northeast Sector of the Greenland Ice Sheet: A Remote Sensing Perspective,
G. Buscarlet, B. Csatho, S.P. Gogineni, W. Krabill, E. Rignot, M. Schemetz; *Journal of Glaciology*, Vol. 46, 2000, pp. 265-273.

Mass Spectrometric Characterization of BC13/SF6 Plasmas,
Y.-S. Lee, K.J. Nordheden, J.F. Siam; *Journal of Applied Physics*, Vol. 88 (no. 8), Oct. 2000, p. 4507.

Modeling Biophysical Factors for Grasslands in Eastern Kansas Using Landsat TM Data,
X. Guo, K.P. Price, J.M. Stiles; *Transactions of the Kansas Academy of Science*, Vol. 103 (no. 3-4), 2000, pp. 122-138.

Modular Neural Network Architecture for Inverse Kinematics Model Learning,
A. Agah, K. MacDorman, T. Maeda, E. Oyama, S. Tachi; *Neurocomputing*, Vol. 38-40, 2001, pp. 797-805.

A Predictive Self-Tuning Fuzzy-Logic Feedback Rate Controller,
Q. Hu, D.W. Petr; *IEEE/ACM Transactions on Networking*, Vol. 8 (no. 6), Dec. 2000, pp. 697-709.

Psychological Effects of Behavior Patterns of a Mobile Personal Robot,
A. Agah, J.T. Butler; *Autonomous Robots Journal, Special Issue on Personal Robotics,* Vol. 10 (no. 2), pp. 185-202.

Recovering Distributed Objects,
J. James, A.K. Singh; *Information Processing Letters*, Vol. 77 (no. 2-4, special issue), Feb. 2001, pp. 143-150.

Requirements Engineering: Making the Connection between the Software Developer and Customer,
R. Dale, H. Saiedian; *Information and Software Technology*, Vol. 42 (no. 4), 2000, pp. 419-428.

Selective RIE of GaAs/ A1As in BC13/ SF6 for Gate Recess,
M.-Y. Kao, Y.-S. Lee, K.J. Nordheden, K. Upadhyaya; *Journal of Vacuum Science and Technology,* Vol. B 18 (no. 5), Sept./Oct. 2000, pp. 2505.

Structured Embedded Systems Design,
D.L. Andrews; *Computer Architecture Technical Committee Newsletter (Special Edition)*, IEEE Computer Society Technical Committee on Computer Architecture, Sept. 2000, pp. 56-62.

Substantial Thinning of a Major East Greenland Outlet Glacier,
W. Abdalati, T.L. Akins, B.M. Csatho, E.B. Frederick, S.P. Gogineni, W.B. Krabill, S.S. Manizade, E.J. Rignot, R.H. Thomas; *Geophysical Research Letters*, Vol. 27 (no. 9), May 2000, pp. 1291-1294 (FY 2000).

Three Discretization Methods for Rule Induction,
J.W. Grzymala-Busse, J. Stefanowski; *International Journal of Intelligent Systems*, #16, Jan. 2001, pp. 29-38.

To Appear

Average Cost Per Unit Time Control of Stochastic Manufacturing Systems: Revisited,
T. Duncan, B. Pasik-Duncan, L. Stettner; accepted for *Mathematical Methods of Operational Reseach*, Vol. 146.

Coherent Radar Ice Thickness Measurements over the Greenland Ice Sheet,
T. Akins, C. Allen, D. Braaten, S.P. Gogineni, K. Jezek, P. Kanagaratnam, J. Legarsky, C. Leuschen, J. Stiles, D. Tammana; accepted for *Journal of Geophysical Research (Climate & Physics of the Atmosphere) special issue on Program for Arctic Regional Climate Assessment (PARCA)*, 200l.

Comparison of Ground-Penetrating Radar Response and Rock Properties in a Sandstone-Dominated Incised Valley-Fill Deposit,
D.S. Beaty, A. Byrnes, T.R. Carr, A. Martinez, J.M. Stiles; accepted for *Geophysics*, Dec. 2000.

Comparison of Landsat TM and ERS-2 SAR Data for Discriminating among Grassland Types in Eastern Kansas,
X. Guo, K.P. Price, J.M. Stiles; accepted for a special issue of *Computers and Electronics in Agriculture*.

Contribution to the Glaciology of Northern Greenland from Satellite Radar Interferometry,
S.P. Gogenini, I. Joughin, W.B. Krabill, E. Rignot; accepted for *Journal of Geophysical Research (Climate & Physics of the Atmosphere) special issue on PARCA*, 2001.

Evolutionary Control of Distributed Robot Search Teams,
R. L. Dollarhide, A. Agah; accepted for *Computers and Electrical Engineering, An International Journal*,Elsevier Science Ltd.

High-Resolution Radar Mapping of Internal Layers at NGRIP,
S.P. Gogineni, N. Gundestrup, P. Kanagaratnam, L. Larsen; accepted for *Journal of Geophysical Research (Climate & Physics of the Atmosphere) special issue on PARCA*, 200l.

Ice-Stream Related Patterns of Ice Flow in the Interior of Northeast Greenland,
M. Fahnestock, S.P. Gogineni, A.I. Joughin, W.B. Krabill, R. Kwok, T.A. Scambos; accepted for *Journal of Geophysical Research (Climate & Physics of the Atmosphere) special issue on PARCA*, 2001.

Improvement of Radar Ice Thickness Measurements of Greenland Outlet Glaciers Using SAR Processing,
D. Braaten, S. Gogineni, K. Gurumoorthy, S.K. Namburi, D. Tammana; accepted for *Annals of Glaciology*.

Internal Layer Tracing and Age-Depth-Accumulation Relationships for the Northern Greenland Ice Sheet,
W. Abdalati, M. Fahnestock, S.P. Gogineni, S. Luo; accepted for *Journal of Geophysical Research (Climate & Physics of the Atmosphere) special issue on PARCA*, 2001.

Multi-Modal Human Interactions with an Intelligent Interface Utilizing Images, Sounds, and Force Feedback,
A. Agah, F. He; accepted for *Journal of Intelligent & Robotic Systems*.

A New Ice Thickness and Bedrock Data Set for the Greenland Ice Sheet: Part I,
J.L. Bamber, S.P. Gogineni, R.L. Layberry; accepted for *Journal of Geophysical Research (Climate & Physics of the Atmosphere) speccial issue on PARCA*, 2001.

Optimal Landsat TM Band Combinations and Vegetation Indices for Discrimination of Six Grassland Types in Eastern Kansas,
X. Guo, K.P. Price, J.M. Stiles; accepted for *International Journal on Remote Sensing*, Dec. 2000.

Prioritized Resource Allocation for Stressed Networks,
C. Beard, V.S. Frost; accepted for *IEEE/ACM Transaction on Networking*.

Program for Arctic Regional Climate Assessment (PARCA): Goals, Key Findings, and Future Directions,
S.P. Gogineni, R.H. Thomas, et al.; accepted for *Journal of Geophysical Research (Climate & Physics of the Atmosphere) special issue on PARCA*, 2001.

Quality of Service for Rapidly Deployable Radio Networks,
J.B. Evans, V.S. Frost, S. Radhakrishnan; accepted for *Telecommunications Systems Journal*.

Conference Papers and Presentations

Achievements of the Recent IDM Projects & DB/IR Fields,
S. Gauch, J. Su; NSF IDM PI Meeting, Workshop on Information and Data Management: Research Agenda for the Future, Chicago, Ill., Mar. 5-7, 2000 (FY 2000).

Active Networking at the University of Kansas,
G.J. Minden; Hitachi Research, Yokohama, Japan, Oct. 19, 2000.

Algebraic Queuing Models for Long-Range Correlated Network Traffic,
R.E. Juliano, A. van de Liefvoort, V.L. Wallace; *Proceedings of the Fourth International Workshop on Queuing Networks with Finite Capacity*, Ilkley, U.K., July 2000, #25, pp. 1-14.

Ambient Computational Environments,
J.B. Evans, G.J. Minden; IEEE International Workshop on Pervasive Computing, Toronto, Canada, Aug. 2000.

Ambient Computational Environments,
G.J. Minden; NSF Principal Investigators Meeting, Snowbird, Utah, July 7, 2000. Also, DARPA NGI Principal Investigators Meeting, Washington, D.C., Oct. 2, 2000.

Application of Covering Algorithm for Classification of Melanoid Marks on the Skin,
J.W. Grzymala-Busse, Z.S. Hippe; *Proceedings of the 10th International Conference on System-Modeling-Control*, Zakopane, Poland, May 21-25, 2001, pp. 261-265.

Approach to Imbalanced Data Sets Based on Changing Rule Strength,
L.K. Goodwin, J.W. Grzymala-Busse, W.J. Grzymala-Busse, X. Zheng; Learning from Imbalanced Data Sets, AAAI Workshop at the 17th Conference on AI, Austin, Texas, July 30-31, 2000, pp. 69-74.

Best Advice to Students for Career in Industry,
B. Pasik-Duncan; Workshop on Careers in Industry, IAM, Minneapolis, Minn., Sept. 2000.

Call Admission Control for ATM Adaptation Layer Type 2,
D.W. Petr; Electrical and Electronic Engineering Department seminar at the University of Canterbury, New Zealand, Mar. 3, 2000 (FY 2000).

Channel Estimation for 3G Wideband CDMA Systems Using the Kalman Algorithm,
M. Sanchez, K.S. Shanmugan; International Conference on Personal Wireless Communications, Hydrabad, India, December 18-20, 2000, pp. 37-42.

Classification of Natural Targets Using Millimeter-Wave Polarimetric Radar,
S. Lohmeier; Wichita State University ECE Colloquium Series, Wichita, Kan., Nov. 2000.

Comparing Different Rough Set Strategies in Using Rules Induced from Pre-Term Birth Data,
L.K. Goodwin, J.W. Grzymala-Busse, W.J. Grzymala-Busse, X. Zheng; *Proceedings of the Information Processing and Management of Uncertainty in Knowledge-Based Systems,* Madrid, Spain, July 3-7, 2000, pp. 338-394.

Comparison of Landsat TM and ERS-2 SAR Data for Discriminating among Six Grassland Types in Eastern Kansas,
X. Guo, K.P. Price, J.M. Stiles; *Proceedings of the Second International Conference on Geospatial Information in Agriculture and Forestry*, Vol. 1, Jan. 2000, pp. 265-272 (FY 2000).

Comparison of Rule Matching Methods Used in AQ15 and LERS,
J.W. Grzymala-Busse, P. Shah; *Proceedings of the Twelfth International Symposium on Methodologies for Intelligent Systems*, Charlotte, N.C., Oct. 11-14, 2000. Also, *Lecture Notes in Artificial Intelligence*, No. 1932, Springer Verlag, 2000, pp. 148-156.

Comparison of Several Approaches to Missing Attribute Values in Data Mining,
J.W. Grzymala-Busse, M. Hu; *Proceedings of the Second International Conference on Rough Sets and Current Trends in Computing*, Oct. 16-19, 2000, Banff, Canada, pp. 340-347.

Component Retrieval System Using PVS,
P. Alexander, M. Patil; Theorem Proving in Higher Order Logics, Portland, Ore., Aug. 15-16, 2000.

Composing Specifications in VSPEC,
P. Alexander, M. Rangarajan, A. Venkataraman; International Conference in Formal Engineering Methods, York, U.K., Sept. 2000.

Computing in Civil and Building Engineering,
R. Fruchter, F. Pena-Mora, W.M.K. Roddis (eds.); *Proceedings of the Eighth International Conference*, American Society of Civil Engineers, New York, N.Y., 2000.

On the Design of Orbit,
P. Alexander, R. Murali, et al.; IEEE Engineering of Computer Based Systems Workshop, Edinburgh, UK, April, 2000 (FY 2000).

Design Verification Test Generation from Rosetta Requirements,
P. Alexander, R. Murali, K. Ranganathan; VHDL International User's Forum, Orlando, Fla., Oct. 16-18, 2000.

Detection of Symmetrical Objects Using the Bistatic, Multipolarimetric, Reverse-Time Migration Technique,
C. Beh, J. Kreycik, T. Malik, J.M. Stiles; *Proceedings of the SPIE Conference on Detection and Remediation of Mines and Minelike Targets*, SPIE vol. 4038, Orlando, Fla., Apr. 2000, pp. 1019-1027 (FY 2000).

Dual Spring System Case-Study Model in Rosetta,
P. Alexander, P. Ashenden, *Proceedings of Federation on Design Languages*, Tubingen, Germany, Sept. 2000.

Effects of Team Size on the Evolution of Distributed Micro Air Vehicles,
A. Agah, D.J. Collins, A. C. Schultz, A. S. Wu; Genetic and Evolutionary Computation Conference, Las Vegas, Nev., July 2000.

Equation Discovery in Databases from Engineering,
W.M.K. Roddis, L. Zhang; Computing in Civil and Building Engineering, *Proceedings of the Eight International Conference, American Society of Civil Engineers*, Aug. 14-16, 2000, pp. 890-897.

Experimental and Theoretical Study of Refractive Indices of Wurtzite GaN Thin Film from Visible to Infrared,
A. Baldanzi, E. Bellotti, M. Goano,R. Hui, H. Jiang, K. Nordheden, J. Sia, S. Taherion; paper IWB5, *Technical Digest, OSA Integrated Photonics Research*, Monterey, Calif., June 2001.

Finding Your Shade of Grey on the Network Spectrum,
V.S. Frost, T.P.R. Nyirenda-Jere; Sprint Research Symposium 2000, Lawrence, Kansas, Mar. 8-9, 2000 (FY2000).

A First Step Towards Systems Level Design,
P. Alexander; Iowa State University, Department of Computer Science, Jan. 27, 2000 (invited) (FY 2000).

Formal Modeling of Active Network Nodes Using PVS,
P. Alexander, C. Kong; Formal Methods in Sofware Practice, Portland, Ore., Oct. 2000.

FPGA Implementation of an Adaptive Reconfigurable Image Encoder,
J.B. Evans, S. Mathen; Fourth Annual Workshop on High Performance Embedded Computing, Lexington, Mass., Sept. 2000.

Fractional Brownian Motion and its Applications,
T.E. Duncan; Stochastic Analysis and Applications (special session), American Mathematical Society Annual Meeting, New Orleans, La., Jan. 10-13, 2001.

A General Signal Processing Algorithm for MTI with Multiple Receive Apertures,
N. Goodman, J.M. Stiles; *Proceedings of the 2001 IEEE Radar Conference*, Atlanta, Ga., May 200l, pp. 315-320.

Getting to Know You—Personalizaton on the Web,
S. Gauch; KU Retirees Computer Club, Oct. 2000 (invited).

A Group Theoretic Description of Bistatic Scattering from Symmetric Subsurface Objects,
B. Beh, J.M. Stiles; *Proceedings of the SPIE Conference on Detection and Remediation of Mines and Minelike Targets*, Orlando, Fla., Apr. 2001.

High Level Abstractions for Implementation of Software Radios,
J.B. Evans, E. Komp, G.J. Minden, S. Mathen; 2000 International Conference Signal Processing Application and Technology, Dallas, Texas, Oct. 2000.

Identification of Linear Systems with Fractional Brownian Motion,
B. Pasik-Duncan; International Workshop on Mathematics of Finance, Bedlewo, Poland, June 2001.

Incorporating Quality Metrics in Centralized/Distributed Information Retrieval on the World Wide Web,
S. Gauch, X. Zhu; *Proceedings of the 23rd International ACM SIGIR Conference*, Athens, Greece, July 2000, pp. 288-295.

Integrated Communication Networks: ATM and the Internet,
D.W. Petr; seminar for joint IEEE/IEE meeting, Christchurch, New Zealand, March 1, 2000 (invited) (FY 2000). Also, Computer Science Department seminar at the University of Canterbury, Canterbury, New Zealand, Mar. 15, 2000 (FY 2000).

Intelligent Module Descriptions in the Implementation of Software Radios,
J.B. Evans, E. Komp, G.J Minden, S. Mathen; 2000 IEEE Workshop on Signal Processing Systems, Lafayette, La., Oct. 2000.

Inter Process Communications in Distributed Real Time Systems,
D.L. Andrews; Seminar #00271, Stochastic and Dynamic Real Time Systems, July 2000, Dagstuhl, Germany. Also, Sunflower Seminar Series, Wichita State University, Sept. 2000.

Inverse Kinematics Learning by Modular Architecture Neural Networks with Performance Prediction Networks,
A. Agah, N.Y. Chong, T. Maeda, E. Oyama; 2001 IEEE International Confernence on Robotics and Automation, Seoul, Korea, May 2001.

A Knowledge Engineering Software Package for Satellite Sea Ice,
L.-K. Soh, C. Tsatsoulis; *Proceedings of the 2000 International Ceoscience and Remote Sensing Symposium*, July 2000, Honolulu, Hawaii, pp. 696-698.

KURT Device, KU Real Time,
A. Parra-Briones, D. Niehaus; III Hipalinux Congress. University Carlos the 3rd, Madrid, Spain, Nov. 2000.

Learning a Coordinate Transformation for a Human Visual Feedback Controller Based on Disturbance Noise and Feedback Error Signal,
A. Agah, N. Y. Chong, K. MacDorman, E. Oyama; 2001 IEEE International Conference on Robotics and Automation, Seoul, Korea, May 2001.

Learning Methodologies and Discriminating Visual Cues for Unsupervised Image Segmentation,
L.-K. Soh, C. Tsatsoulis; *Working Notes of the 17th International Conference on Machine Learning, Workshop on Machine Learning on Spatial Knowledge*, Stanford, Calif., July 2, 2000, pp. 56-61.

Measuring (and Enhancing?) Student Confidence with Confidence Scores,
D.W. Petr; *Proceedings of the IEEE/ASEE 2000 Frontiers in Education Conference*, October 2000, pp. T4B-1 to T4B-6. Also, Electrical and Electronic Engineering department seminar at the University of Canterbury, Canterbury, New Zealand June 9, 2000 (FY 2000).

Melanoma Prediction Using k-Nearest Neighbor and LEM2 Algorithms,
J.W. Grzymala-Busse, Z.S. Hippe; *Proceedings of the Tenth International Symposium on Intelligent Information Systems*, Zakopane, Poland, June 18-22, 2001, pp. 43-55.

Message Passing in Stochastic and Dynamic Distributed Real Time Systems,
D.L. Andrews, A. Apon, L. Welch; *Proceedings of 20th IEEE International Performance, Computing, and Communications Conference*, Phoenix, Ariz., Apr. 4-6, 2001.

Minimum Mean-Squared Error GPR Processor for Resolving Shallow Objects,
N. Goodman, Guruvayurappan, and J.M. Stiles; *Proceedings of the SPIE Conference on Detection and Remediation of Mines and Minelike Targets*, Orlando, Fla., Apr. 2001.

Modeling Biophysical Factors for Grasslands Using Landsat TM Data in Eastern Kansas,
X. Guo, K.P. Price, J.M. Stiles; *Proceedings of the Second International Conference on Geospatial Information in Agriculture and Forestry*, Vol. 2, Jan. 2000, pp. 291-298 (FY 2000).

Multi-Domain Specification in Rosetta,
P. Alexander; University of California at Berkeley, Dec. 13, 2000.

Multitemporal Spectral Characteristics of Three Land Management Practices on Cool and Warm Season Grasslands in Eastern Kansas,
X. Guo, K.P. Price, J.M. Stiles; American Society of Photogrammetric Engineering and Remote Sensing Convention (ASPRS), May 2000 (FY 2000).

A New Ice Thickness and Bedrock Data Set for the Greenland Ice Sheet,
J.L. Bamber, S.P. Gogineni, R.L. Layberry; *IGARSS' 2000 Digest*, 00CH37120, Honolulu, Hawaii, July 24-28, 2000, pp. 1134-1136.

Ontology-Based Web Site Mapping for Information Exploration,
S. Gauch; Engage, Inc., visit to ITTC, April 2000 (invited).

Performance Analysis of Transmit Antenna Diversity in 3G WCDMA System,
K.S. Shanmugan; *International Conference on Personal Wireless Communications* (proceedings), Hydrabad, India, Dec. 18-20, 2000, pp. 107-109.

Performance Evaluation of Software Virtual Private Networks (VPNs),
J.B. Evans, C.J. Pena; 25th Annual IEEE Conference Local Computer Networks, Tampa, Fla., Nov. 2000.

Personal Ontologies for Web Navigation,
Jason Chaffee, Susan Gauch; *Ninth International Conference on Information and Knowledge Management* (proceedings), McLean, Va., Nov. 2000, pp. 227-234.

Personal Ontologies for Web Search and Caching,
S. Gauch; Sprint Research Symposium, ITTC, Mar. 8, 2000 (invited) (FY 2000).

PHP: the Server Side Scripting Tool for Dynamic HTML,
D.L. Andrews, R. Crisp, M. Romine; *Proceedings of SSGRR2000, International Conference on Advances in Infrastructure for Electronic Business, Science, and Education on the Internet*, L'Aquila, Italy, July 31-Aug. 6, 2000.

Poincare Sphere Method for Measuring Polarization-Mode Dispersion Using Four-Wave Mixing (FWM) in Single-Mode Optical Fiber,
B. Allen, K. Demarest, S. Song; *Symposium on Optical Fiber Measurements* (proceedings), Boulder, Colo., pp.79-82, Sept. 26-8, 2000.

Processing of Multi-Aperture SAR to Produce Fine-Resolution Images of Arbitrarily Large Extent,
N. Goodman, J.M. Stiles; *Proceedings of the 2001 IEEE Radar Conference*, Atlanta, Ga., May 2001, pp. 451-456.

Randomness in Telecommunications,
D.W. Petr; talk directed to Freshman Honors Tutorial class, Randomness in the Modern World, University of Kansas (invited), Nov. 14, 2000.

Rapidly Deployable Radio Network ATM/IP Analysis,
G.J. Minden; DARPA Global Mobile Principal Investigators Meeting, Red Bank, N.J., July 12, 2000.

Rapidly Deployable Radio Network Beam Steered Antennas,
G.J. Minden; DARPA Global Mobile Principal Investigators Meeting, Red Bank, N.J., July 12, 2000.

Rapidly Deployable Radio Network—Integrated Demonstration,
G.J. Minden; DARPA Global Mobile Principal Investigators Meeting, Red Bank, N.J., July 12, 2000 (invited).

On the Real Time Implementation of the Turbo Decoder in a 3G Mobile Communication System,
K.S. Shanmugan; the Personal Indoor and Mobile Radio Communications Conference, London, England, Sept. 18-21, 2000 (invited).

Recent Advances in Stochastic Calculus,
B. Pasik-Duncan; The Institute of Mathematics of Polish Academy of Sciences, Warsaw, Poland, Mar. 2001.

On Recent Applications of Fractional Brownian Motion,
B. Pasik-Duncan; International Conference on Applied Mathematics, Zakopane, Poland, Sept. 2000.

Repair of Fatigue Cracking Due to Out of-Plane Distortion,
W.M.K. Roddis, Y. Zhao; Retrofit of Existing Bridges Session, 200l Structures Congress, Washington D.C., American Society of Civil Engineers, Washington, D.C., May 21-23, 2001.

Rosetta Functional Requirements Specification Domains,
P. Alexander, D. Barton, C. Kong; Hardware Description Language Conference, Los Angeles, Calif., Mar. 2000 (FY 2000).

Rosetta: Language Support for Systems Level Design,
P. Alexander; Design for Safety Workshop, NASA Ames Research Center, Oct. 13, 2000 (invited).

SAR Processing of Radar Echo Sounder Data,
S.P. Gogineni, C. Leuschen, D. Tammana; *IGARSS' 2000 Digest*, 00CH37120, Honolulu, Hawaii, July 24-28, 2000, pp. 2570-2572.

Searching the Net with Bots,
S. Guach; Bot2000, New York, N.Y., Sept. 13, 2000 (invited).

Self-Injurious Behavior Data Set Analyzed by Data Mining System LERS,
R.L. Freeman, J.W. Grzymala-Busse, L.A. Riffel, S.R. Schroeder; *Proceedings of the Japanese Society for Artificial Inelligence International Workshop on Rough Set Theory and Granular Computing*, Matsue, Shimane, Japan, May 20-22, 2001, pp. 195-200.

Simulation of Communication Systems,
K.S. Shanmugan; two-day short course, University of South Australia, Adelaide, April 2000 (FY 2000).

Simulation of Communication Systems,
K.S. Shanmugan; International Conference on Personal Wireless Communications, Hydrabad, India, Dec. 18-20, 2000, pp. 107-109.

Simulation of TCP/IP Networks Using Proportional Time,
A. Parra-Briones, D. Niehaus; X International Congress of Electronics, Communications and Computers, University of the Americas, Puebla, Mexico, Feb. 2001.

Software Engineering Body of Knowledge,
D. Bagert, R. Dupuis, P. Freeman, H. Saiedian, M. Shaw, and J. Thompson; *Proceedings of the 23rd International Conference on Software Engineering*, Toronto, Canada, May 2001, pp. 693-696.

Some Applications of Fractional Brownian Motion,
T.E. Duncan; IMA Hot Topics Workshop, Modeling and Analysis of Noise in Integrated Circuits and Systems, Minneapolis, Minn., Aug. 29-30, 2000.

Some Aspects of Fractional Brownian Motion,
T.E. Duncan; Third World Congress of Nonlinear Analysts, Catania, Italy, July 19-26, 2000.

On Stochastic Adaptive Control,
B. Pasik-Duncan; Third World Congress of Nonlinear Analysts, Catarina, Italy, July 2000.

Stochastic Calculus for Fractional Brownian Motion I Theory,
T.E. Duncan, B. Pasik-Duncan, Y. Hu; Proceedings of 39th Conference on Decision and Control, Sydney, Australia, Dec. 12-15, 2000.

Structured Embedded Systems Design,
D.L. Andrews; Workshop on Computer Architecture Education, ISCA Vancover, B.C., June 2000 (FY 2000).

Study of a Class of ''Smart'' Conformal Array Architectures,
S. Chakrabarti, D. Chatterjee, G. Prescott; *Proceedings of the 2000 IEEE International Conference on Phased Array Systems & Technology*, Dana Point, Calif., May 21-25, 2000, pp.251-254 (FY 2000).

Synchronous Fine-Grain Distributed Computations,
S.B. House, D. Niehaus; *Proceedings of the Real-Time Technology and Applications Symposium*, Washington D.C., June 2000 (FY 2000).

System Specification in Rosetta,
P. Alexander, D. Barton, R. Kamath; IEEE Engineering of Computer Based Systems Workshop and Symposium, Edinburgh, U.K., Apr. 2000 (FY 2000).

System Specification in Rosetta,
P. Alexander; VHDL International User's Forum, Orlando, Fla, Oct. 18, 2000 (invited).

Teaching Formal Methods to Undergraduate Students,
P. Alexander; Working Group on Software Engineering Education and Training, Oct. 17, 2000 (invited, keynote address).

A Technology-Enhanced Learning Environment for a Graduate/Undergraduate Course on Optical Fiber Communications,
H. Behl, R. Gonzalez, M. Gordon, H.S. Hinton, J. Humphrey, S. Karandikar, M. Lightner, P.C. Smith, L.L. Tedder, J. Wilbanks; *Proceedings of the 30th ASEE/IEEE Frontiers in Educations Conference*, Kansas City, Mo., Oct. 18-21, 2000. Also accepted for *ASEE Journal of Engineering Education*, October 2001.

Telecommunications Research at the University of Kansas,
K.S. Shanmugan; EE Department Seminar, University of Canterbury, Christchurch, New Zealand, 2000.

10 Gb/s SCM System Using Optical Single-Side Band Modulation,
C. Allen, K. Demarest, R. Huang, R. Hui, and D. Roberts; paper MM4, *Technical Digest, Optical Fiber Communication Conference*, Anaheim, Calif., Mar. 19-21, 2001.

Theorem Proving in Higher Order Logic: What You Need to Learn,
P. Alexander; Theorem Proving in Higher Order Logics, Aug. 16, 2000 (invited).

Ticket Server Performance Evaluation Using a Hybrid Simulation Approach,
C.C. Beard, V.S. Frost; *Proceedings of the SCS 2001 Applied Telecommunications Symposium*, Seattle, Wash., Apr. 2001.

Using Learning by Discovery to Segment Remotely Sensed Images.
L.-K. Soh, C. Tsatsoulis; *Proceedings of the 17th International Conference on Machine Learning*, Stanford, Calif., June 29-July 2, 2000, pp. 919-926.

Virtual Circuit Laboratory,
H.S. Hinton, H. Hodge, M. Lightner; *Proceedings of the 30th ASEE/IEEE Frontiers in Educations Conference*, Kansas City, Mo., Oct. 18-21, 2000. Also accepted for *ASEE Journal of Engineering Education*, Oct. 2001.

To Appear

The Design of a Web-based Computer Proficiency Examination,
H.S. Hinton, H. Kinnersley; ASEE/IEEE Frontiers in Educations Conference, 2001.

Engineering Togetherness (An Incentive System for Interdisciplinary Research),
R.E. Barnhill, J.A. Roberts; *Proceedings of the IEEE/ASEE 2001 Frontiers in Education Conference*, Reno, Nev., Oct. 10-13, 2001.

Impact of Traffic Handling on Internet Capacity,
N. Akar, V.S. Frost, T.P.R. Nyirenda-Jere; SPIE ITCom 2001, Denver, Colo., Aug. 20-24, 2001.

Patents

Real-Time Featured-Based Video Stream Distortion Analysis,
J. Gauch; U.S. Patent Number 6,246,803; issued June 12, 2001.

Transmission System with Cross-Phase Modulation Compensation,
R. Hui; U.S. Patent # 09124960, issued September 26, 2000.

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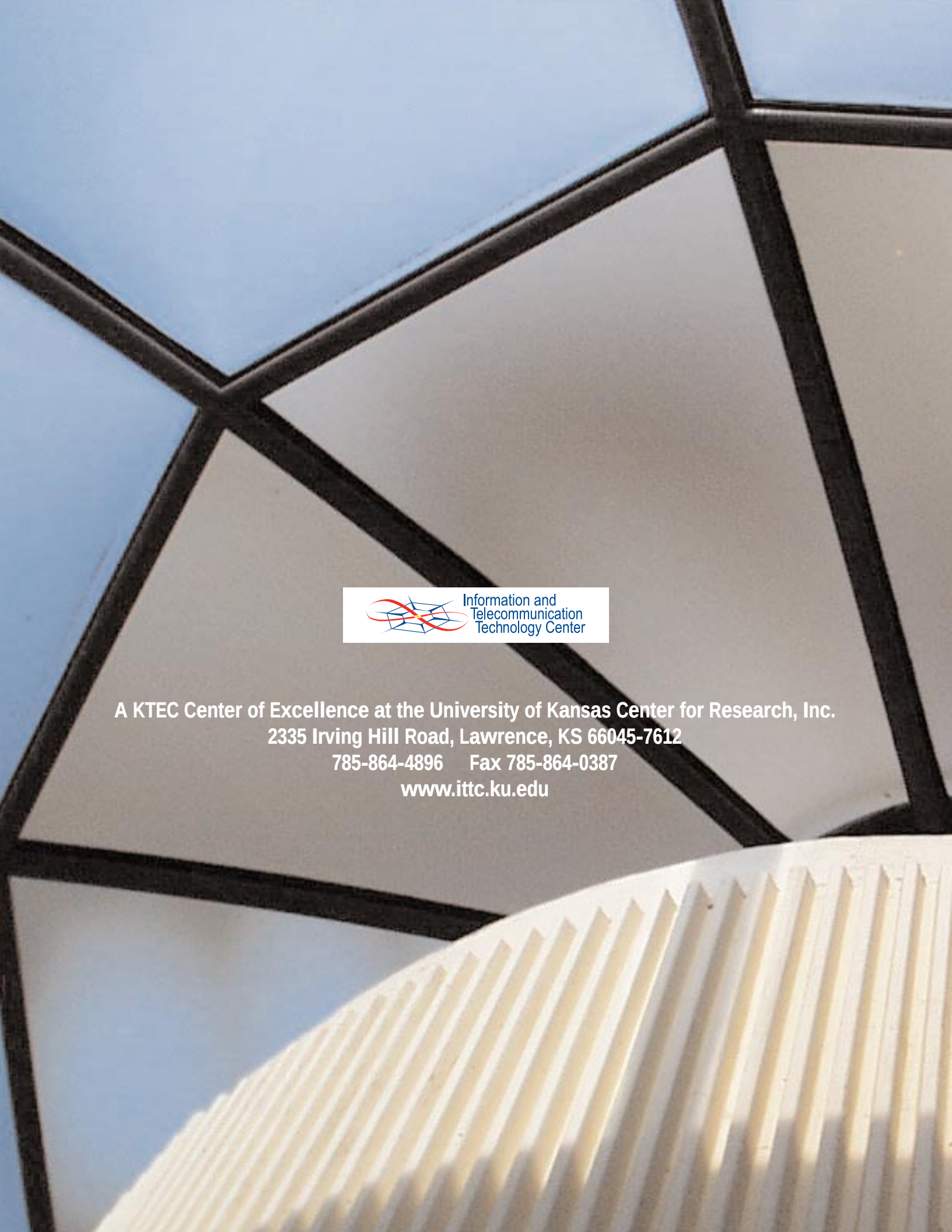

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