Electrical and Computer Engineering Research Projects 2003

Infrastructure for Intelligent Mobile Information Systems

Winser E. Alexander, Jung H. Kim, Sung H. Yoon, John Kelly, Albert Esterline, Kenneth Williams (NCA&T)
National Science Foundation
$1,471,122
9/15/00 – 9/14/05

This is a grant to develop an infrastructure to support research and educational programs in information systems technology at North Carolina A&T State University. The emphasis of the research program is on intelligent, mobile information systems. We define intelligent mobile information systems (IMIS) as systems that use video, speech or data communications, with the capability to adapt to varying environmental conditions and data types, and that involve pattern recognition or other intelligent algorithms. These systems have application in such technologies as surveillance, teleconferencing, and the remote control of vehicles, machines or instruments.

ABB Power T&D Company/NC State Research Assistance

Winser E. Alexander
ABB Power T&D Company
$60,873
7/30/2001 – 12/31/2002

This contract provides support for a graduate research assistant to continue the development of a diagnostic database for large power transformers for ABB Power T&D Company. It also involves support in automation of test control stations, developing software for measurement system automation and providing documentation for the project.

Experimental High-Performance Computing and Communications Systems

Paul Franzon, Thomas Conte, Wentai Liu, and Winser E. Alexander
National Science Foundation
$812,988
7/1/97 – 6/30/02

This proposal provides funding to improve the current graduate research infrastructure in our department. It provides equipment that greatly enhances our ability to design, test, and experiment with complex digital systems.

Robust Control for VSC Systems

Mesut E. Baran
ABB Inc.
4/03 – 9/03
$11,931

Project involves adoption of robust control techniques to improve the robustness controllers used in VSC type power converters.

Effects of Computational Time-Delay VSC Control

Mesut E. Baran
ABB Inc.
$30,620
5/02 – 12/02

This project involves investigation of approaches to mitigate the computation induced time-delays on the performance of VSC-type power converters.

Integrated Protection and Control Schemes for Shipboard Electrical Systems

Mesut E. Baran
US Navy
$254,304
4/00 – 12/02

The project aims at development of new methods for protection and control of new generation of electrical shipboard systems the US Navy envisions. New protection and control paradigms, making use of the new communication technologies, will be explored in this investigation.

Development of GainAsN Epitaxial Films for High Efficiency Cascade Solar Cells

Salah Bedair
NREL
$267,957
1999 – 2003

This project deals with the development of a low band gap cell in the 1 to 1 eV range. This low band gap cell will then be part of a multi-junction cascade solar cell that will have potential conversion efficiency of 40 percent.

AlGaN/InGaN-Based Modulation Doped Field Effect Transistors

Salah Bedair
ARO
$305,900
1999 – 2003

This project deals with the development of MODFET structure using an InGaN channel. This will increase the two-dimensional electron gas density (2DEG) to achieve higher output power and reduce current collapse.

Room Temperature Devices Based on Spin Polarized Injection

Salah Bedair, Nadia El-Masry
DARPA
$450,000
2001 – 2004

The project deals with the development of dilute magnetic semiconductor. The addition of Mn to GaN is shown to achieve ferromagnetic properties at room temperature. We will study these magnetic properties and its device applications.

Development of Room Temperature Dilute Magnetic Semiconductors for Spin Based Devices

Salah Bedair, Nadia El-Masry
ARO
210,000
2001 – 2004

This project deals with several devices based on ferromagnetic semiconductors. These new class of devices will take advantage of both electron charge and electron spin. This will add new dimensions to several optoelectronic devices.

Yalta: A Collaborative Space for Secure Dynamic Coalitions

Gregory T. Byrd (with MCNC)
DARPA
$1.5 million
5/00 – 5/03

The purpose of this project is to develop, demonstrate and deliver a scalable, reliable, and survivable application platform that enables efficient formation, operation, and management of secure dynamic coalitions. The approach involves creating a collaborative environment using JavaSpaces technology, using threshold cryptography to build a scalable and survivable authentication service, and providing a subscription-based certificate revocation service.

New Prediction Paradigms for Parallel and Distributed Computing

Gregory T. Byrd, Eric Rotenberg
National Science Foundation
$189,035
8/01 – 8/03

The use of prediction is explored for scalable shared memory multiprocessors and distributed embedded systems. For multiprocessors, we develop slipstream multiprocessors, which use redundant execution of tasks to reduce memory and synchronization overhead. We also explore the use of message prediction to reduce network traffic in resource-constrained embedded system.

Java-Based Self-Organizing Media (JSOM)

Gregory T. Byrd
Sun Microsystems
$32,995
8/02 – 8/03

The principal idea behind JSOM is to be able to transport executable code along with a media stream. The receiver or other in-stream component to transform or process the media in the manner intended by the sender can use this code. The Sun prototype JSOM implementation will be extended to make it fully MPEG-7 compliant, and the incorporation of JSOM technology into MPEG-21 will be studied.

Biologically Inspired Intelligent Fault Diagnosis for Power Distribution Systems

Mo-Yuen Chow
National Science Foundation
$150,000
5/16/03 – 5/15/06

This project will investigate and develop a Biologically Inspired Intelligent Fault Management System using Artificial Immune System (AIS) technologies on top of a Neural Network - Fuzzy Logic (NN-FZ) structure to actively manage power distribution system faults, including diagnosis, prognosis, and data mining. This system would revolutionize the Fault Diagnosis process for power distribution systems, to significantly increase system reliability and reduce operation costs. The proposed activities and architectures are not only limited to power distribution system, but are also applicable to other industries such as communication networks and transportation system that are large scale nonlinear system with uncertain operating environments.

Hybrid Electric Vehicle Modeling, Simulation and Prognostics

Mo-Yuen Chow
US Army, TACOM TARDEC Division
$29,367
5/6/03 – 8/15/03

Modeling and simulation studies to assess potential advantages of Hybrid Electric Architecture for FCS with respect to mobility, fuel economy, and improved prognostics.

Network-Based Control

Mo-Yuen Chow
Graduate Student Fellowships from Thailand and Kuwait
~$60,000/year (full tuition and stipend for two GRAs)
1/1/00 – 8/15/03

The purpose of this research has been to investigate network delay effects on networked control systems and to develop a control methodology to handle the network delay effects using optimal gain scheduling. The proposed gain scheduling technique adapts controller gains externally by modifying a controller output to enable the controller for uses over a network. This project has investigated, analyzed, and developed real-time on-line intelligent gain adaptation scheme for a network-based controller system under normal and abnormal operating conditions to maximize the closed-loop system performance and stability.

Web-Based Virtual Unmanned Vehicle Simulator Development for Distance Learning Courses

Mo-Yuen Chow
Distance Education & Learning Technology Applications (DELTA)
$12,000
1/20/03 – 6/30/03

In this Delta Grant project, we propose to develop a Web-based Virtual Unmanned Vehicle Simulator that can be accessed through the web for the Distance Learning (DL) students to prototype (in software) their control algorithms and mechatronics circuits to control the unmanned vehicle (simulation) before they actually test their design on an actual unmanned vehicle (hardware).

Value Speculation for VLIW and EPIC Architectures

Thomas M. Conte
National Science Foundation
$200,000
9/00 – 8/03

This project addresses new techniques to break pure dependencies for horizontal (EPIC, VLIW) micro architectures. The ultimate limit to schedule length is the longest chain through the computation. The research presents techniques for dependence chain splitting, which attack pure depen-

dence chains using methods presented earlier for superscalar micro architectures. The techniques for superscalar processors are not directly applicable to VLIW or EPIC architectures, since such architectures have no or little dynamic speculation mechanisms. Issues such as register pressure impact and branch insertion for value speculation across control flow are also being explored.

A Signals Approach to Computer Architecture Prediction Mechanisms

Thomas M. Conte
National Science Foundation
$147,000
9/02 – 8/05

This research is focused on developing a new, symmetric framework for computer architecture prediction motivated by the signals approach to data analysis. The framework for this research uses styles of prediction in two dimensions: periodic vs. computational and local history vs. global history. This framework is built on top of the principles of discrete signal analysis. The initial focus of this new work will be on value prediction because it is the least well understood area. However, the framework and methodology are applicable to branch prediction, dependence prediction, etc.

Dynamic Code Evolution for EPIC Architectures

Thomas M. Conte
Intel Corporation
$61,000
2000 – 2002

This project explores techniques to optimize code in the operating system or run time environment. The specific focus is on IA-62/EPIC architectures. The anticipated results will be enhanced microprocessor performance and seamless integration of aggressive compiler optimization into existing server and workstation systems.

Traffic Shaping and Self-Sizing for Next-Generation Terabit Router Networks

M. Devetsikiotis
Alcatel
$200,000
10/01 – 12/03
The goal of this joint work is to apply the methodologies related to Effective Bandwidths and "self-sizing" to Optical Burst switching Networks (OBN).

This research will result in a number of novel and useful traffic engineering and bandwidth scheduling policies. These policies should be realized in efficient algorithms that can be implemented on network hardware. The tests and analyses must accurately portray the operation of the proposed architecture.

Adaptive Resource Management in MPLS Networks

M. Devetsikiotis
CACC - Core
$50,000
7/02 – 6/03

The project aims to achieve higher network efficiency by unifying on-line measurements with resource adaptation in MPLS (and "MPLS-like") networks, in a scalable, practical and implementable manner. Specific goals include (1) refine work on "self-sizing" of high-speed networks, to ensure its practical feasibility and scalability via distributed and hierarchical implementations; (2) study crucial issues at larger time-scales, including pricing/charging, game-theoretic aspects, the stability of the proposed adaptive networks, and the existence and nature of equilibrium points; (3) validate our on-line measurement and resource adaptation techniques in realistic environments, including, in a progressive manner, simulation, emulation, and ideally, testing with real equipment/data.

Performance of Active Queue Management Schemes in IP Networks

J.K. Townsend and M. Devetsikiotis
CACC - Core
$75,000
7/02 – 6/03

The objective of this project is to create a simulation testbed and use the testbed to investigate new active queue management (AQM) techniques in high speed network routers. Specific goals include: (1) create a simulation testbed suitable for meaningful evaluation of AQM techniques; (2) establish a systematic, simulation-based approach to determine important factors with respect to network performance; (3) utilize efficient simulation techniques to accelerate the simulations and allow exploration of a much larger set of parameters than would be possible using conventional techniques; (4) develop new AQM techniques that maximize network performance.

Long-Range Fading Prediction and Realistic Physical Modeling To Enable Adaptive Transmission for Mobile Radio Networks

A. Duel-Hallen, H. Hallen
ARO
$391,806
7/1/01 – 6/31/04

The objective of this research is to investigate feasibility of adaptive transmission for rapidly varying fading channels encountered in peer-to-peer mobile communication systems. The goal is to predict future fading conditions and to use these predictions as the basis for new adaptive transmission techniques. The project focuses on the direct sequence code division multiple access (DS/CDMA), frequency-hop (FH/CDMA) radio networks and Orthogonal Frequency Division Multiplexing (OFDM). This research is an interdisciplinary effort in communication theory, physics, and signal processing. The ultimate goal of this work is to reduce the power and bandwidth requirements for peer-to-peer mobile radio networks.

Joint Transmitter and Receiver Optimization for Fast Fading Mobile Radio Channels Using Deterministic Channel Modeling

A. Duel-Hallen, H. Hallen, B. Hughes
NSF
$325,000
6/15/99 – 12/31/02

The tremendous growth in demand for wireless communications capacity has created a need for new modulation, coding and detection methods for rapidly time variant fading mobile radio channels. In this research, a new approach to communication over wireless channels is exploited. The unifying idea is to predict future fading conditions at the receiver, and to feed these predictions to the transmitter for

the optimization of the transmitted signal. This research is an interdisciplinary effort in communication theory, physics, and signal processing that encompasses novel physical models for multipath fading, channel prediction and tracking methods, and adaptive modulation, coding and power-control algorithms.

High Performance Computer Interconnect

Paul Franzon
National Science Foundation
$360,000
9/01/02 – 8/31/05

We are determining new approaches to interconnect large systems at the system level. These approaches promise high density, low power and low cost.

AC Coupled Interconnect for Low-Power Space-Borne Electronics

Paul Franzon
Mission Research Corporation
$1,060,455
5/16/03 – 4/15/04

Demonstrate a complete AC Coupled first-level packaging solution in both Bulk CMOS and SOI. MCNC is a subcontractor performing the solder bump and package fabrication investigation.

TRIPS SystemC/En-morph Mode Specification and Implementation

Paul Franzon and Tom Conte
DARPA
$275,000
5/16/03 – 3/15/05

Investigate the implementation of programmable network processors using reconfigurable computing concepts. Aim at achieving configurable line rate (10 Gbps) solutions for network security, routing, and difserv.

Advanced Modeling of Mixed-Signal Systems

Michael Steer and Paul Franzon
DARPA
$1,665,235
8/1/01 – 7/31/04

This project addresses the computer-aided design of high-speed mixed-signal circuits with comprehensive modeling of the multi-physics phenomena that impact design functionality and performance. Future, multi-functional ULSI systems involve all electronic design technologies ranging from high-level logic synthesis, to custom digital, analog, RF design and microwave design. We propose to deliver a revolutionary modeling tool that implements new modeling and simulation abstractions, fast linear and nonlinear solvers, full-wave EM modeling for on-chip parasitics and integrated RF/microwave circuit design modeling, digital and analog behavioral modeling, optoelectronic modeling and advanced electrothermal modeling. Transim provides the core scalable, integratable platform for all the efforts described herein.

Mixed-Signal Interposer Design and Fabrication

Michael Steer, Kingon, and Paul Franzon
(subcontract to Purdue University)
$1,070,000
5/1/02 – 4/30/05

Military mixed signal systems must have performance superior to that available commercially and delivered with volumes relatively small in comparison to that in the commercial world. This puts a premium on thermally compliant three-dimensional heterogeneous integration whereby various optimized chip and component technologies can be combined to obtain superior overall performance. It is the synergistic development of RF architectures and technologies that will enable us to achieve superior performance and constrain costs while providing for multi-functionality and agility.

Network Processor Design for Just-in-Time Optical Networking Protocols

Paul Franzon
ARDA
$189,034
10/1/01 – 03/28/03

Implement a network processor for a future optical backbone protocols using Just-In-Time (JIT) Optical Burst Switching concepts. Work with MCNC to get a small JIT network up and running. Develop new hardware algorithms for critical bottlenecks, particularly the Forwarding Engine.

Molecular Interconnect Studies

Paul Franzon
Mission Research Corp. to DARPA
$533,123
7/11/2001 – 7/10/05

Work within a Naval Research Labs-led team to develop solutions for building nanoscale molecular memories using viruses as an interconnect scaffold. Perform circuit studies and characterization experiments.

Molecular Circuits II

Paul Franzon
DARPA
$500,000
3/21/01 – 3/31/02

Work within the Rice-led team to determine circuit architectures suited for molecular memories.

Inductance Control for On-Chip Signal Integrity

Franzon and Cangelleris
National Science Foundation
$420,000
8/1/00 – 7/31/03

Determine practical techniques to reduce the impact of on-chip inductance on circuit performance and design time.

SOI Deep Space Radio

Paul Franzon, Wentai Liu and Brian Hughes
NASA (subcontract through A&T)
$771,080
3/12/01 – 3/11/04

Investigate novel circuit structures for use in an ultra-low power deep space VHF radio communications system.

AC Coupled Interconnect

Paul Franzon and Wentai Liu
SRC
$321,166
9/1/99 – 8/16/03

Determine design rules and approaches for using capacitively and inductively coupled interconnect structures for between-chip communications.

Experimental High Performance Computing and Communications Systems

Paul Franzon, Tom Conte, Wen-tai Liu, Clay Gloster
NSF CISE Infrastructure Award
$1,338,283 (including $503,046 in NCSU matching)
7/1/97 – 6/30/03

Provide the research infrastructure for a variety of activities in the Computer Engineering group at NCSU-ECE.

Performance of Embedded Java

Edward F. Gehringer
Object Technology International/IBM
$40,000
1/01 – 8/02

Java is a language that has attracted increasing interest from embedded-system designers because of its small code size and cross-platform portability. Tuning programs to perform well with the limited memory size of embedded systems is challenging because traditional performance optimizations trade memory space for increased execution speed. Our study determined that significant performance gains could be had with modest increases in memory size by "ahead-of-time" compiling of the "hottest" (most frequently executed) methods.

E-Textiles

Edward Grant with Abdelfattah Seyam, Tushar Ghosh, John Muth, and Troy Nagle
DARPA MTO Distributed Robotics Program
$118,000
5/02 – 7/02

This project deals with integrating circuits and systems from engineering with textile structures. Research areas that are being worked are (1) acoustic arrays and (2) paraglider adaptive surfaces. The research is jointly shared with the Department of Textile and Apparel, Technology and Management in the College of Textiles at NC State University.

A McKibben Artificial Muscle Controlled Mechanism for Stroke Patient Rehabilitation

Edward Grant
University Undergraduate Research Award
$4,000
Spring 2002

This research deals with building generic communications frameworks and control interfaces for distributed sensing and control applications. The initial test-bed for experimentation was distributed artificial muscle control for stroke patient rehabilitation. In order to test the robustness of the generic properties the research was recently applied in the control of an autonomous distributed robot colony.

Application of Micromachines in Fabric Formation

Edward Grant, George Hodge, Williams Oxenham, Abdelfattah Seyam
National Textile Council
$162,000
8/01 – 7/02

This project is concerned with the design of micromachines that will be used in the production of fabrics. These micromachines will be made using techniques from Micro-Electrical-Mechanical-Machines (MEMS). These micromachines will then be embedded into fabric production processes. These devices will be adaptively controlled using evolutionary computing algorithms. This is a joint collaboration between the CRIM and the Textile Apparel and Textile Management Department in the College of Textiles.

Advanced Low-Power SOI CMOS Transceiver for Distributed Sensor Networks

N. Dogan, M. Bikdash, M. Ketel, NCA&T; P. Franzon, W. Liu, B. L. Hughes, NCSU
National Aeronautics and Space Administration
$1,953,991
8/00 – 8/03

Deep-Space missions require highly miniaturized microavionics systems. JPL has an ongoing effort to develop chips that incorporate system functions traditionally achieved by interconnecting many components. We propose to develop a silicon-on-insulator CMOS chip for deep-space applications. The goal is to realize a transceiver using only two or three chips and a few other components. The receiver is targeted for communications between a planetary lander, an orbiting vehicle, and data acquisition from a network of sensors. This work will be conducted by a team of faculty and students from North Carolina A&T State University, North Carolina State University, and researchers at JPL.

ITR/SII: A Unified Approach to Communication in Space and Time

Brian L. Hughes and Gianluca Lazzi
National Science Foundation
$711,062
10/1/01 – 5/30/04

The explosive growth in demand for broadband wireless data services demonstrates the importance of bandwidth-efficient communication for wireless channels. Recent results have shown that deploying multiple antennas at the transmitter and receiver can dramatically increase the capacity of wireless channels. In this work, we propose four approaches to more fully exploit the potential of these channels: (1) new antenna arrays inspired by information theory; (2) novel space-time constellations that achieve full diversity and preserve channel capacity; (3) low-complexity coding methods based on serial concatenation; and (4) scalable receiver architectures for joint iterative decoding and array processing.

ITR/SII: Differential Modulation in Space and Time

Brian L. Hughes
National Science Foundation
$309,970
9/1/00 – 5/30/04

The goal of this project is to design new space-time modulation strategies that do not require channel estimates at the transmitter or receiver. The core idea is a new and general architecture for differential modulation using multiple antennas, which can be applied to any number of antennas and any signal constellation. Modulation techniques adhering to this architecture can be demodulated coherently or incoherently. These techniques permit the receiver to exploit channel estimates when they are available, but performance degrades only slightly when estimates are unavailable. This project also addresses fundamental limits, new modulation and coding techniques, and low-complexity receivers.

Joint Transmitter and Receiver Optimization for Fast Fading Mobile Radio Channels Using Deterministic Channel Modeling

A. Duel-Hallen, H. Hallen, B. Hughes
National Science Foundation
$325,000
6/15/99 – 12/31/02

The tremendous growth in demand for wireless communications capacity has created a need for new modulation, coding and detection methods for rapidly varying fading mobile radio channels. In this research, a new approach to communication over wireless channels is exploited. The unifying idea is to predict future fading conditions at the receiver, and to feed these predictions to the transmitter for the optimization of the transmitted signal. This research is an interdisciplinary effort in communication theory, physics, and signal processing that encompasses novel physical models for multipath fading, channel prediction and tracking methods, and adaptive modulation, coding and power-control algorithms.

Quantum Transport on the Nanodimensional Scale

Gerald J. Iafrate
Office of Navy Research
$403,000
8/15/01 – 11/30/04

The objective of this effort is to explore quantum transport in solids on the nanoscale. Studies include the role of band structure and the non-perturbative competition between power absorbed from the electric field and energy dissipated to a quantized boson field (phonon or electro-dynamic field) loss mechanisms. Quantum transport theory has been applied to several problems thus far: (1) the field-dependent ionization of a localized single electron defect, (2) the spontaneous emission of Bloch oscillation radiation from a single Bloch band, and (3) a measure of phase breaking for quantum solid state transport in external electric fields.

Quantum Engineering

Gerald J. Iafrate
Internal Research
Unsponsored

Endowment funds are utilized to study the quantum mechanical behavior of realizable nanocomponents such as multi-level artificial atoms and super-lattice structures subjected to external electromagnetic fields and dissipative loss environments. Quantum characteristics such as coherence, entanglement, and quantum dynamics are studied and applied to quantum computing and nonlinear carrier diffusion through nonequilibrium ratchet motion. Issues of functional robustness, quantum control, and fundamental limitations to engineering realization are studied.

NC Photonics Initiative

Robert M. Kolbas
UNC Office of the President
$125,000 per year
Ongoing

To coordinate and accelerate the development of North Carolina's human and physical resources in photonic technologies. The goal of this initiative is to position North Carolina at the center of the emerging information economy. We propose to conduct the groundwork necessary to establish a Photonics Consortium initially comprised of the following six universities: Duke University, North Carolina Agricultural and Technical State University, North Carolina Central University, North Carolina State University, University of North Carolina at Chapel Hill and University of North Carolina at Charlotte.

Integrated Optical Pumping of Cr- and Ti-doped Sapphire Substrates with III-V Nitride Materials

Robert M. Kolbas, Co-PI with John Muth and John Roberts
Army Research Office
$232,366
9/1/00 – 2/29/04

Cr- and Ti-doped sapphire for the basis of several important laser and photonic device technologies. This program proposes to deposit III-V nitride based materials directly on Cr- and Ti-doped sapphire substrates for the purpose of direct photoexcitation of the substrate by the deposited epitaxial layers. This work involves the growth and characterization of GaN and InGaN as thin epitaxial layers and as double heterostructures. Waveguides will be fabricated and the efficiency of the photoexcitation measured.

Hybrid Molecular Flash Memory

Wentai Liu
ZettaCore Inc.
$100,000
5/02 – 4/03

Current Mode Band-Limited Signaling for Deep Submicron Global Interconnects

Wentai Liu
National Science Foundation
$150,000
5/02 – 4/05

Current Mode Band-Limited Signaling for Deep Submicron Global Interconnects

Wentai Liu
Semiconductor Research Corporation
$150,000
1/02 – 12/04

A High-Density Microelectronic Tissue Hybrid Sensor for Imaging

Wentai Liu
Department of Energy
$599,453 (total $7.7M)
10/01 – 12/04

Implantable Multiple Unit Visual Prosthesis: Towards a Third Generation

Wentai Liu
National Science Foundation
$97,489
8/01 - 2/03

It is proposed to complete the construction of a retinal prosthesis designed to provide artificial vision to people blind due to the degeneration of retinal rods and cones, experienced in diseases such as retinitis pigmentosa and age-related macular degeneration. The prosthesis is divided into two parts, one outside of the eye to acquire, code, and transmit an image, and the other inside the eye to receive and decode image data, then apply the requested stimulation pattern to the retina.

ONR Young Investigator Program: Photonic Devices for Underwater Communications

John Muth
ONR
$543,812
5/1/03 – 4/30/07

This grant is for the development of novel photonic devices to facilitate high speed short-range underwater communications, between divers, underwater autonomous vehicles and submarines.

E-Textile Acoustic Array

John Muth Co-investigator with E. Grant (ECE), A. Seyam, T Ghosh (Textiles)
DARPA/MTO Division (USA)
$243,000 (jointly, ECE and Textiles)
5/15/02 – 12/31/03

This grant is for the development of a flexible lightweight textile acoustic array. The resulting array will be lighter and easily deployed compared to conventional microphone arrays.

Integrated Optical Pumping of Cr- and Ti-Doped Sapphire Substrates

John Muth and Salah Bedair
ARO
$205,000
9/00 – 8/03

A supplemental equipment grant was also won to purchase a Prism coupling system for waveguide measurements: $37500, and software for waveguide design $8,500. The synthesis and fabrication of blue light-emitting diodes on sapphire substrates that are heavily doped with chrome (also known as Ruby) a dual wavelength light emitter that emits both blue and red light will be fabricated.

Room Temperature Devices Based on Spin Polarized Injection

John Muth, El-Masry, S.M Bedair, H. Stadelmaier
DARPA
$400,000 (includes 50 percent support for graduate student ~$25,000/year)
2002 – 2004

Investigate materials and devices that utilize the electron's spin instead of charge.

Ultraviolet Light Emitters Based on Novel III-V Nitride Heterostructures

John Muth working with Jan Schetzina, Mark Johnson
DARPA
$973,333
6/02 – 5/06

Novel device structures will be designed, synthesized and fabricated to develop UV light emitting diodes for biological and chemical agent detection systems that require compact light sources to excite fluorescence.

Center for Advanced Materials and Smart Structures

John Muth investigating with J. Narayan
NSF
$187,000
9/1/97 – 8/31/02

To perform optical characterization and device design of novel materials.

Odor Monitoring with an Electronic Nose

Troy Nagle, Susan Schiffman (Duke), Susan Blanchard (BAE)
Agricultural Research Service
$20,000/year
7/96 – present

This project is a joint effort between NC State & Duke University to develop a hand-held portable electronic odor monitoring system. At NC State, prototype versions of the electronic nose are used to measure the odors using microfabricated sensor arrays. The electronic nose has been trained to mimic the performance of the human panel. In one application of the technology, a particle impactor is being used to characterize the odor characteristics versus size distribution of dust generated in animal containment facilities.

Biomedical Sensor Array Substrates

Troy Nagle, Jerry Cuomo, Stefan Ufer, Richard Guarnieri
Industrial Partners
$100,000/yr.
1/97 – present

This project is a joint effort between the Biomedical Microsensors Laboratory, CAMP-M, and several industrial partners to develop sensor array substrates suitable for mass production of medical-grade sensor units. Photodefinable insulation layers are used to create sensor structures on silicon, glass, and Kapton® substrates. Metal layers are deposited by sputtering or evaporation and patterned by photolithography. Feature sizes to five microns have been attained. Specialized plasma-enhanced deposition methods are being employed to give the structures special chemical properties such as non-absorbance of DNA molecules and biofouling proteins.

Anti-Stuttering Therapeutic Device

Troy Nagle, Mark White
The ECU Medical Foundation
$50,000
11/99 – present

This project is developing a portable belt-worn prototype device for aiding stuttering patients. The device implements delayed auditory feedback and frequency altered feedback algorithms. Future versions of the device are envisioned to include new adaptive therapeutic algorithms based on real-time speech fluency computations.

Front End Processing Transition Center (Year 1)

C.M. Osburn
Semiconductor Research Corporation and SEMATECH
$1,500,000
4/1/03 – 3/31/04

The SRC/SEMATECH Front End Processing Transition Center supports faculty at NC State and several other universities. Its primary focus is to understand and evaluate materials and processes to be used in future CMOS devices as alternative high-k gate dielectric and metal-gate electrode materials to achieve equivalent oxide thicknesses of 1 nm and below. The emphasis of this research is on enhanced understanding of the behavior of these materials in device applications and transfer of this knowledge to the semiconductor industry.

Front End Processing Research Center (Year 5)

C.M. Osburn
Semiconductor Research Corporation and SEMATECH
$2,500,000
4/1/02 – 3/31/03

The SRC/SEMATECH Front End Processing Center supports faculty at NC State and several other universities. Its primary focus is to understand and evaluate materials and processes to be used in future CMOS devices as alternative gate dielectric and gate electrode materials to achieve equivalent oxide thicknesses of 1 nm and below. In addition, processes to form ultra-shallow junctions and low resistance contacts are being evaluated. As a final proof of concept, devices are demonstrated using these novel materials and processes.

Process Integration and Demonstration: Front End Process Research

C.M. Osburn
Semiconductor Research Corporation and SEMATECH
$150,000
4/1/02 – 3/31/03

This project supports the SRC/SEMATECH Front End Processing Center with faculty at NC State and several other universities. Its primary focus is the fabrication of CMOS devices using alternative gate dielectric and gate electrode materials to achieve equivalent oxide thicknesses of 1 nm and below. Of key interest is the development of new process architectures that employ low temperature processes as well as gate stack materials and processes capable of withstanding junction formation temperatures. Device fabrication is being conducted using the processing facilities at NC State, where reliability measurements are being made on completed devices.

Enhancing Student Graduation Success in Computer Science, Engineering and Mathematics at North Carolina State University

Sarah A. Rajala
NSF
$275,000 (supplemental funding)
6/1/01 – 5/31/04

The objective of this project is to award academic scholarships to high achieving students in engineering, mathematics and computer science, who have demonstrated financial need. This should allow us to make notable impact on the overall success of our students to complete their degree.

Enhancing Retention of Engineering Students at North Carolina State University

Sarah A. Rajala
Corning Foundation
$40,000
7/1/01 – 6/30/03

The goal of this project will be to increase the retention of and reduce the time to matriculation for the women and underrepresented minority undergraduate students in the College of Engineering

Campus Implementation Team – Year 10

Sarah A. Rajala
NSF/University of Florida
$210,000
9/1/01 – 8/31/02

The objective of the Campus Implementation Team project is to implement SUCCEED's curriculum model including scale up and institutionalization of the successful first-year courses/programs, technology-based curriculum products, outcomes assessment, and faculty development programs.

2002 Alcoa – NC State Middle School Engineering Camp

Sarah A. Rajala
Alcoa Foundation
$28,000
10/1/01 – 9/30/02

The objective of this project is to expand the middle school camp to include students and teachers from two rural counties. The camp will encourage a diverse population of students to consider careers in engineering, science and technology by providing opportunities for students and teachers to experience the excitement of engineering and computer science first hand.

A New Approach to Teaching and Learning in Introduction to Programming – JAVA

Sarah A. Rajala
Alcoa Foundation
$30,000
10/1/02 – 9/30/03

The objective of this project is to improve the learning and success of students taking CSC 116, especially women and minority students.

NC State/AT&T Solutions E-ducation Alliance – Supplement

Sarah A. Rajala
AT&T Solutions
$75,000
7/1/02 – 6/30/03

The objective of this funding is to develop an education partnership with AT&T Solutions to educate the workforce of the future.

Fault Tolerance for Mainstream Microprocessors

Eric Rotenberg
Intel Corporation
$102,759 and $17,000 in equipment donations
10/00 – 10/03

Transient faults will occur frequently in deep-submicron designs. Existing fault-tolerant techniques are either too costly (system-level replication), too intrusive (gate-level replication), or too specific (e.g., ECC on memory). A microarchitectural approach to fault tolerance is proposed. Broad coverage of transient faults is achieved, with little loss of performance and few changes to the existing microarchitecture.

NSF Career: Cooperative Redundant Threads

Eric Rotenberg
National Science Foundation
$300,000
3/01 – 3/06

Redundant execution is proposed for speeding up sequential programs on single-chip multiprocessors. The new method is called "slipstream," a term borrowed from car racing in which two cars collaborate aerodynamically to speed up both cars. A slipstream processor finishes two redundant copies of the program sooner than a conventional processor finishes a single copy. Redundant execution is also transparently leveraged for fault tolerance with no additional support. Finally, slipstream is implementable on multithreaded processors without fundamentally reorganizing their architecture. The project explores novel uses of single-chip multiprocessors and simultaneous multithreading processors.

New Prediction Paradigms for Parallel and Distributed Computing

Gregory T. Byrd, Eric Rotenberg
National Science Foundation
$189,035
08/01 – 08/03

The use of prediction is explored for scalable shared memory multiprocessors and distributed embedded systems. For multiprocessors, we develop slipstream multiprocessors, which use redundant execution of tasks to reduce memory and synchronization overhead. We also explore the use of message prediction to reduce network traffic in resource-constrained embedded systems.

Molecular Information Storage

Jon Lindsey, Veena Misra, Wentai Liu, Eric Rotenberg
Zettacore
$1,160,000
1/02 – 3/04

Molecular information storage is explored at all levels. The project encompasses molecule synthesis, device fabrication, circuit design, and computer design.

Dynamic Superpipelining: Shaping Microarchitecture for Variable Frequency

Eric Rotenberg
National Science Foundation
$229,000
7/02 – 6/05

Alternative sources of energy savings in microprocessors are investigated. Deep pipelines are designed for peak frequency and are inefficient at lower frequencies, hence dynamically scaling the pipeline depth in response to frequency adjustments can save energy. The approach can help extend battery life of laptops/portable devices and reduce power of desktop computers at a time when energy management is becoming a national issue.

Reducing Frequency via Speculation and Fall-Back Recovery

Frank Mueller, Eric Rotenberg
National Science Foundation
$300,000
7/02 – 6/05

There are two related activities. First, we developed a method for speculatively reducing frequency for lower energy consumption, while still safely meeting all hard real-time deadlines. Second, we are currently developing a radically new solution to the problem of building safe real-time systems from unsafe components. Our approach features a reconfigurable pipeline with two modes – a primary mode that is unsafe but energy-efficient and a backup mode that is safe but energy-inefficient. The dual-mode pipeline may finally resolve a long-standing problem in the discipline of worst-case timing analysis of complex pipelines.

Mesh Wireless Network Performance Evaluation

Mihail L. Sichitiu
Center for Advanced Computing and Communication
$34,651
7/1/02 – 6/30/03

The goal of this project is to establish the capacity and evaluate methods of providing fairness and quality of service for wireless mesh networks.

Testbed for Signal Strength-Based Outdoor Localization for Wireless Sensor Networks

Mihail L. Sichitiu
Faculty Research and Professional Development at NC State Universiity
$4,000
3/1/03 – 2/28/04

The objective of this proposal is to practically build a prototype of a localization system for outdoor wireless sensor networks. The testbed uses sensor nodes similar to the prototype used in the NCSU wireless networking laboratory.

Smart Automated Target Recognition Using Weighted Spectral Measurements

Wesley Snyder
*University of Tennessee (subcontract to US Army_*
$95,000
5/02 – 12/03

This project seeks to develop techniques for representing images of targets as seen by a missile approaching that target. When a target is far away, it can be characterized only by its spectral signature; when close, it is best represented by its geometric shape. The purpose of this study is to determine when and how to make the tradeoffs between shape signature and spectral signature.

Hyperspectral Volume-Based Shape Recognition

Wesley Snyder
US Army Research Office
$30,000
1/1/03 – 7/1/03

In a hyperspectral image, an entire spectral band is captured at each pixel. For example, in some hyperspectral systems, over 100 measurements are made at each pixel, representing spectral measurements (colors, but in the infrared). This data may therefore be thought of as a cube, with one spectral and two spatial dimensions. This project speculates that edges within this cube may be used to represent targets. We find edges and perform feature extraction on those edge representations.

Multispectral Infrared Cameras

Wesley Snyder
US Army Space and Missile Defense Command
$198,000
4/15/03 – 4/15/04

To build a multispectral or hyperspectral imaging sensor for use on a missile, it must be very robust to vibration and acceleration. Such a requirement almost entirely rules out conventional multispectral sensors, most of which have moving parts. In this project, we apply a technique from commercial digital cameras: mosaicking, to the acquisition and processing of target images.

Evaluating the Scalability of Asymmetric Multiprocessors

Yan Solihin
National Center for Supercomputing Applications (NCSA at UIUC)
10,000 allocation units on the 256-node SGI Origin 2000, and the 1000-node Platinum Linux Cluster
10/02 – 9/03

It has been recently demonstrated that a two-processor asymmetric multiprocessors is able to deliver speedups higher than two-processor symmetric multiprocessors by exploiting both parallelism and code's non-uniform memory requirement behavior. We would like to further evaluate the scalabilty of asymmetric multiprocessors, scaling to much more than two processors.

Active Prefetching in Intelligent Memory Systems

Yan Solihin
North Carolina Supercomputing Center'
Allocation units on the 768-processor IBM SP cluster
10/02 – 9/03

The gap in processor and memory speed has been growing at more than 45 percent per year. This has lead to a memory wall problem, where memory-speed bottleneck limits the performance of computer systems. This proposal integrates logic into the DRAM main memory. An intelligent memory system (IMS) provides the main memory with simple processing capability — a thread running in the memory autonomously prefetches data for the main program that runs in the main processor. The thread runs ahead of the actual program, generates cache miss address prediction, prefetches corresponding memory blocks, and pushes them into the main processor's caches— preventing misses.

Self-Tune: Self-Optimizing Approach to Parallel Computing

Yan Solihin
NCSU through Faculty Research and Professional Development
$4,000
3/03 – 2/04

Progress in transistor miniaturization gives rise to more parallel and powerful machines. Factors such as load imbalance, synchronization, and locality hinder present programs. Performance tuning is a time intensive task, contributing to a huge portion of time and effort in parallel programs development. To alleviate this, it is proposed to self-tune, a self-optimizing approach to high-performance computing where application programs and machines work together to automatically find the configuration that maximizes the program performance. High performance can be achieved even with varying external conditions and program behavior; optimal performance by exposing program and machine optimization opportunities are provided, and performance can be relocated.

IBM SUR Grant

Thomas Conte, co-PIs: Gregory Byrd, Alexander Dean, Eric Rotenberg, Yan Solihin
IBM
$175,000 (Equipment: 1 Power4+ 8-way SMP, 8 2-way xSeries desktop servers)
Ongoing

Remote Characterization of Electric and Electronic Devices

Michael Steer
US Army Research Office
$212,310 70470
9/1/02 – 8/31/05

Electromagnetic waves can be used to probe, identify and classify electric and electronic devices. Precise identification requires an understanding of the nature of device-field interactions, particularly with modern devices that are generally designed to have low levels of electromagnetic susceptibility. We are developing the underlying physical principles and technologies required to model the interaction of fields and circuits in electronic devices containing semiconductors and electric devices.

Equipment Supporting Multifunctional, Adaptive Radio, Radar and Sensor Research

Michael B. Steer
US Army Research Office
$259,090
5/1/02 – 4/30/03

In this proposal we are addressing the characterization of multifunctional and adaptive RF systems. Multifunctional and adaptive systems will be inherently broadband or multiband. Multifunctionality means that the hardware will need to operate on various signals at various center frequencies and so the narrow band assumption, that is inherent to our understanding of communication and radar system design, is no longer adequate. Adaptive systems will reconfigure dynamically and must sense their own performance and adjust the circuit conditions to optimize performance.

Mixed-Signal Interposer Design and Fabrication

Michael B. Steer, Paul Franzon and Angus Kingon
DARPA TEAM (as subcontract to Purdue University)
$1,070,000
5/1/02 – 4/30/05

Military mixed signal systems must have performance superior to that available commercially and delivered with volumes relatively small in comparison to that in the commercial world. This puts a premium on thermally compliant three-dimensional heterogeneous integration whereby various optimized chip and component technologies can be combined to obtain superior overall performance. It is the synergistic development of RF architectures and technologies that will enable us to achieve superior performance and constrain costs while providing for multi-functionality and agility.

Behavioral Modeling of Narrowband Radio RF Circuits

Michael B. Steer
National Science Foundation
$150,000
8/1/01 – 7/31/04

This project proposes to develop a novel RF front-end receiver architecture appropriate for multifunctional communications applications that consumes very little power, is highly compact, very low-cost and high-performance. We specifically address the behavioral modeling of the components of the RF front end of wireless systems enabling the circuit level responses to be used in system level simulations so that global optimization of RF systems can be achieved.

Advanced Modeling of Mixed-Signal Systems

Michael B. Steer, Paul Franzon
DARPA NeoCAD
$1,746,919
7/01 – 6/04

This project addresses the computer-aided design of high-speed mixed-signal circuits with comprehensive modeling of the multi-physics phenomena that impact design functionality and performance. Future, multi-functional ULSI systems involve all electronic design technologies ranging from high-level logic synthesis, to custom digital, analog, RF design and microwave design. We propose to deliver a revolutionary modeling tool that implements new modeling and simulation abstractions, fast linear and nonlinear solvers, full-wave EM modeling for on-chip parasitics and integrated RF/microwave circuit design modeling, digital and analog behavioral modeling, optoelectronic modeling and advanced electrothermal modeling. Transim provides the core scalable, integratable platform for all the efforts described herein.

Power Transmission Using Radio Waves

Michael B. Steer
National Science Foundation
$65,000
7/1/01 – 12/31/02

This project investigates the propagation of power over distance using electromagnetic waves. Transmission of power from space using microwaves and lasers has been discussed for more than thirty years. It is proposed to update the discussion, review current capabilities and relevant issues, hold a workshop of interested parties, and to develop a report outlining a possible national research agenda.

MARRS: Multifunctional Adaptive Radio Radar and Sensors

Multidisciplinary University Research Initiative
Michael B. Steer
US Army Research Office
$6,000,000
5/1/01 – 4/30/06

Advanced enabling technologies and system concepts are addresses that will lead to revolutionary innovations in multifunctional, adaptive radio, radar and sensors. Mid-range and long-range visions of advanced EM sensors are considered, and these are used to determine functional needs. Advanced RF architectural development and technology integration are explored.

Innovative Enhancements to an RF Circuit Simulator Based on a State Variable Formulation

Michael B. Steer
STAS, US Army Research Office through Batelle Corporation
$85,000
5/1/01 – 5/31/02

This proposal will exploit and further develop a transient circuit simulator using a state variable formulation. The work finalizes development of a new transient circuit simulator based on a state variable formulation, investigates nonlinear multiresolution device models, and integrates the circuit simulator with electromagnetic and circuit simulators.

Planar and Thermal Spatial Power Combining Research, Multidisciplinary University Research Initiative on Quasi-optical Power Combining

Michael B. Steer
US Army Research Office (funded as a subcontract to Clemson University)
$1,324,084
5/1/97 – 3/31/03

For many years, there has been a strong need to obtain more power from solid-state sources at microwave frequencies. This is more urgent at millimeter wave frequencies than at microwave frequencies because the performance of oscilla-

tors, amplifiers and power combiners decrease with increasing frequency. In addition, component costs at millimeter wave frequencies have been driven by the small size and tight tolerances associated with the need for hand assembly of conventional waveguide systems. This project addresses several issues in the realization of quasi-optical systems including thermal modeling, metrology development, and the development of a planar quasi-optical system.

Medium Access Control and Data Link Layer Protocols for Tactical Impulse Radio Networks

J. Keith Townsend
US Army Research Office
$227,146
11/1/99 – 12/31/02

The objective of our proposed research is to develop a new network-layer architecture and corresponding protocols for an ultra-wideband impulse radio communication system. The protocols and network architecture will emphasize

survivability, covertness, rapid deployment, and security. In particular, the network-level architecture will be designed using a peer-to-peer, physical-level architecture in which each node in the network will have distributed functionality, thus avoiding the need for base stations.

Performance of Active Queue Management Schemes in IP Networks

J.K. Townsend, M. Devetsikiotis
Center for Advanced Computing and Communications
$65,609
7/1/02 – 6/30/03

This work aims to investigate the performance of various active queue management (AQM) schemes used in TCP/IP networks to improve network throughput. A number of active queue management schemes have been proposed over the years to improve the throughput of TCP/IP networks. Examples include RED (random early detection), and REM (random exponential marking). The basic idea of these schemes is to improve overall throughput in TCP/IP networks with a large number of connections by dropping packets from sessions in a preemptive way that prevents a large number of TCP sessions at the same router to have traffic dropped in unison. Ultimately our simulation testbed will be used to calculate near-optimal settings via stochastic optimization, score function and IPA techniques.

mm-Wave AlGaN/GaN HFET's

Robert J. Trew
US Army Research Office
$156,718
9/1/01 – 12/31/04

This research is directed towards determining the physical effects that limit the operation of AlGaN/GaN HFET's at high frequencies. Advanced physical modeling techniques are being developed and applied to investigate and explain frequency limiting physical phenomena associated with charge trapping and space charge limited current flow.

Ultra-Linear AlGaN/GaN HFET Amplifiers

Robert J. Trew
US Office of Naval Research
$60,000
10/1/01 – 9/30/02

This research is directed towards determining the physical effects that limit the operation of AlGaN/GaN HFET's at high frequencies. Advanced physical modeling techniques are being developed and applied to investigate and explain frequency limiting physical phenomena associated with charge trapping and space charge limited current flow.

Ultra-Linear and Low Noise AlGaN/GaN HFET's

Robert J. Trew
US Office of Naval Research
$110,808
10/1/01 – 3/31/03

This project is directed towards investigation of physical effects that affect RF amplifier linearity. Linearity is considered for high efficiency RF amplifiers and relationships between charge storage, breakdown, space-charge limitations, and other physical effects are investigated and established.

Scientific Services Support for ARO

Robert J. Trew
Battelle
$59,334
6/1/03 – 8/31/03

This project provides planning and project management support to the U.S. Army Research Office.

Ultra-Linear and Low Noise AlGaN/GaN HFET's

Robert J. Trew
US.Office of Naval Research
$108,958
5/1/03 – 9/30/04

This project provides for continuation of the previous project on AlGaN/GaN HFET linearity and optimized device structures.

mm-Wave AlGaN/GaN HFET's

Robert Trew
US Army Research Office
$324,033
9/1/01 – 12/31/04

This project provides for continuation of the previous project on development of AlGaN/GaN HFET's that can operate with good RF performance at extended mm-wave frequencies.

Collaborative Research: Bio-Molecular Electronic Architectures for Sensing and Processing Bio-Signatures

Robert Trew
National Science Foundation
$743,079 (pending)
10/1/03 – 9/30/06

Distributed Inter-System Authentication for Seamless Roaming for Heterogeneous Mobile Networks

Janise Y. McNair (Univ. of Florida) and Wenye Wang
National Science Foundation
$297,960
07/1/03 – 06/30/05

Allowing users to roam seamlessly between multiple types of networks creates problems for network security. There is currently no means to transfer the identity or trust record of a user that roams between networks. This proposal addresses the problem of inter-system authentication in multi-network environments. The work for the project consists of the following: (1) design and architectural dimensioning of an inter-system authentication agent, (2) design of a passport and visa mechanism to issue permissions (or service denials) to roaming users, (3) development of an inter-system registration protocol based on the passport/visa system, (4) performance of a cost-benefit analysis for the ISA architecture and the passport/visa system.

MoSec: Integrated Security and Mobility Control in Wireless Networks

Wenye Wang
National Science Foundation
$1,571,139
Ongoing

We propose to design, develop, and evaluate MoSec integrated security and mobility (ISM) control mechanisms for supporting secure roaming services in heterogeneous mobile environments. The essential subject suffers from the lack of organizing principles that can unify secure and roaming services and quality constraints in system design. Traditionally, security support and mobility support are studied in separate domains, and often, security concedes to other core functionalities and comes as an afterthought. This necessitates cross-domain strategies at the network management plane to resolve the problems created by security concerns in wireless networks. Toward this goal, we propose to study and develop a unified approach through synergizing security, mobility profiles, and QoS requirements.

Authentication and Service Management in Heterogeneous Mobile Environments

Wenye Wang
NC State University CACC
$50,533
Ongoing

Convenient and reliable mobile applications services, including web-browsing, information inquires, and telephony traffic over wireless networks, requires an integrated mechanism that can support flexible service provisions without compromising quality of service (QoS) and security in wireless networks. This involves considering the location of the mobile users, the security services requirements of individual users, as well as the capability of each terminal. In addition, the dimensioning of authentication centers and the selection of an access point or a service provider among multiple choices are critical to providing intelligent network management based on mobile user profiles and network architectures.

Lithography-Independent Nanoscale Vertical Surround-Gate MOSFETs

Zhibo Zhang with Veena Misra and Mehmet Ozturk
SRC
$180,000
10/1/02 – 9/30/03

Project aims to integrate a self-assembly process with traditional microfabrication technologies to produce future generation Si nanoelectronic devices. As CMOS technology scales to and beyond 35-nm node, the double gate or surround gate fully depleted MOSFETs become very appealing due to effectiveness in suppressing short channel effects. In fully depleted MOSFETs, the Si channel thickness must be less than one-third of the channel length. A lithography independent fabrication technique utilizing naturally self-organized highly regular patterns which can achieve well controlled Si channel length and channel thickness provides a viable alternative to overcome technology barriers.

High-Performance Quantum-Dot Lasers Fabricated with a Controlled Crystal Growth Technique

Zhibo Zhang with N. El-Masry
DARPA/SPAWAR
$100,000
9/28/01 – 3/27/03

Quantum-dot lasers have attracted much research interests due to promise of achieving higher energy efficiency and lower threshold current over conventional heterostructure lasers. A controlled crystal growth technique is being developed to produce quantum-dot ensembles with excellent dot uniformity. By integrating a self-assembly, derived highly regular nanoporous thin film directly onto a compound semiconductor substrate and by employing a selective crystal growth technique, quantum-dot ensembles with excellent controls of dot uniformity can be achieved. The highly uniform quantum-dot ensembles derived by this technique can also be incorporated into other optoelectronic devices such as LEDs and photo detectors to improve their device performances.

ELECTRICAL AND COMPUTER ENGINEERING FACULTY

S. Thomas Alexander, Associate Professor of Electrical and Computer Engineering; (919-515-5127); PhD Electrical Engineering, NC State University, 1982. Adaptive signal processing and adaptive systems analysis, including the investigation of roundoff and finite precision arithmetic effects for adaptive algorithms; applications include echo cancellation for long distance, telephony and adaptive channel equalization for modern and multipath communications environments. [sta@eos.ncsu.edu]

Winser E. Alexander, Professor of Electrical and Computer Engineering; (919-515-5190); PhD Electrical Engineering, University of New Mexico, 1974. Multidimensional digital signal processing and the development of concepts, algorithms, and special purpose computer architectures for digital signal and image processing; research has included the development of a special purpose architecture for the real-time implemen-

tation of spatial domain digital filters for image processing and the design of a single chip processor to implement this architecture. [winser@eos.ncsu.edu]

B. Jayant Baliga, Distinguished University Professor of Electrical and Computer Engineering; Director, Power Semiconductor Research Center (and Founding Director); (919-515-6169); PhD Electrical Engineering, Rensselaer Polytechnic Institute, 1974. Physics/modeling of semiconductor devices, semiconductor materials/process technology, power semiconductor devices and power integrated circuits are at the center of Dr. Baliga's research. [bjbaliga@eos.ncsu.edu]

Mesut E. Baran, Associate Professor of Electrical and Computer Engineering, (919-515-5081); PhD Electrical and Computer Engineering, University of California, Berkeley, 1988. Application of computer control and system analysis techniques for analysis, planning, operation and control of electric power systems at generation, transmission and distribution levels [baran@eos.ncsu.edu]

Douglas W. Barlage, Assistant Professor of Electrical and Computer Engineering, (919-513-3018); PhD Electrical Engineering, University of Illinois-Urbana Champaign, 1997. His research concentrates on novel electronic device characterization and design that is focused on transistor amplifiers and sources for high power millimeter wave electronics. A secondary focus is the limits of low- power digital electronics. [dwbarlag@eos.ncsu.edu]

Salah M. Bedair, Professor of Electrical and Computer Engineering (919-515-5204); PhD Engineering Science, University of California, Berkeley, 1969 Semiconductor materials and devices, including new novel techniques such as atomic layer epitaxy, laser assisted deposition, MOCVD and MBE; devices such as superlattice optical sources, modulation doped field effect transistors, heterojunction bipolar transistors, solar cells and the integration of optical and microwave devices are in progress. [bedair@eos.ncsu.edu]

Griff L. Bilbro, Professor of Electrical and Computer Engineering (919-515-5101); PhD University of Illinois at Urbana, 1977 Developing global optimization algorithms for communications and signal processing, modeling electron devices in silicon carbide and diamond, and implementing nonlinear algorithms in analog integrated circuits. [griff_bilbro@ncsu.edu]

James J. Brickley, Jr., Visiting Associate Professor and Associate Department Head, Electrical and Computer Engineering (919-515-5089); PhD Biomedical Engineering, University of Virginia, 1979 Distributed real-time control systems and microprocessor-based biomedical devices and systems. [jjb@eos.ncsu.edu]

Gregory T. Byrd, Assistant Professor of Electrical and Computer Engineering (919-513-2508); PhD Electrical Engineering, Stanford University, 1998 Communication mechanisms for parallel computer systems. Other interests include computer architecture and high-performance network security. [gbyrd@eos.ncsu.edu]

Mo-Yuen Chow, Professor of Electrical and Computer Engineering (919-515-7360) PhD Electrical Engineering, Cornell University, 1987 Current research projects related to the application of control, computational intelligence, and network technology to modeling fault diagnosis and control. [chow@eos.ncsu.edu]

Thomas M. Conte, Associate Professor of Electrical and Computer Engineering, Director of the Center for Embedded Systems Research (919-515-5067); PhD Electrical Engineering, University of Illinois, Urbana-Champaign, 1992. Computer architecture, processor design, and compiler optimization, embedded computer systems are the focus of his research. [conte@eos.ncsu.edu]

Huaiyu Dai, Assistant Professor of Electrical and Computer Engineering, (919-513-0299); PhD, Electrical Engineering, Princeton University, 2002. Current research projects relate to communication systems and networks, advanced signal processing for digital communications, and communication and information theory. [huaiyu_dai@nsu.edu]

Rhett Davis, Assistant Professor of Electrical and Computer Engineering; (919-515-5857); PhD. Electrical Engineering, University of California at Berkeley, 2002. Dr. Davis' research focuses on increasing productivity in VLSI design methodologies. His systems interests include signal-processing and protocols for wireless and wired networks. [rhett_davis@ncsu.edu]

Alexander G. Dean, Assistant Professor of Electrical and Computer Engineering (919-513-4021), PhD Electrical Engineering, Carnegie Mellon University, 2000. Dean's research centers on helping people design embedded systems efficiently using standard microprocessors and drawing on computer architecture, compilation methods and real-time systems. [agdean@eos.ncsu.edu]

Mihail Devetsikiotis, Associate Professor of Electrical and Computer Engineering (919-515-5253), PhD Electrical Engineering, NC State University, 1993. Research interests are in the areas of high-speed networking modeling, performance evaluation and efficient simulation; and optimization techniques applied to the analysis and design of communication systems. [mdevets@eos.ncsu.edu]

Alexandra Duel-Hallen, Associate Professor of Electrical and Computer Engineering; (919-515-7352);. PhD Electrical Engineering, Cornell University, 1987. Digital communication systems. Specific studies include detection methods for fading multipath channels and intersymbol interference channels; applications include cellular mobile radio, voiceband communications and magnetic recording. [sasha@eos.ncsu.edu]

Do Young Eun, Assistant Professor of Electrical and Computer Engineering (919-513-7406). PhD Electrical Engineering, Purdue University, 2003. Dr. Eun's research centers around telecommunication networks, performance analysis of large networked systems, queueing networks, and ad-hoc/sensor networks. [dyeun@eos.ncsu.edu]

Paul D. Franzon, Professor of Electrical and Computer Engineering; (919-515-7351); PhD Electrical Engineering, University of Adelaide, South Australia, 1989. Microelectronics system and circuit design; design methodologies and CAD tools for high speed multichip modules, printed circuit boards and VLSI chips; design and application of MicroElectro Mechanical Systems (MEMS, or 'micromachines'); [paulf@ncsu.edu]

Kevin Gard, Pratt Professor, Assistant Professor of Electrical and Computer Engineering; (919-53-7366); PhD Electrical Engineering, University of California at San Diego, 2003. Dr. Gard's areas of research include design of radio frequency integrated circuits (RFIC) for wireless communication systems, and the study of analysis techniques for modulated waveforms passed through nonlinear circuits. [Kevin_gard@ncsu.edu]

Edward F. Gehringer, Associate Professor of Electrical and Computer Engineering and Computer Science, (919-515-

2066); PhD Computer Science, Purdue University, 1979. Object-oriented software systems, performance studies, architectural support for persistence and very large address spaces; parallel processing interests include supporting shared memory on distributed-memory machines. [efg@ncsu.edu]

Tildon H. Glisson, Professor Emeritus of Electrical and Computer Engineering, (919-515-5166); PhD Electrical Engineering, Southern Methodist University, 1968. Monte-Carlo methods applied to high-field transport in materials and devices, self-consistent simulation of transport in devices, and signal processing and system simulation. [glisson@eos.ncsu.edu]

Alfred J. Goetze, Professor Emeritus of Electrical and Computer Engineering (919-515-7359); PhD Electrical Engineering, Duke University, 1967. Electromechanical energy conversion in electric power systems and computer control of SCR motor drives are at the center of Dr. Goetze's research. . [ajgoetze@eos.ncsu.edu]

John J. Grainger, Professor of Electrical and Computer Engineering (919-515-5202), PhD Electrical Engineering, University of Wisconsin, 1968. Founding director of the Electric Power Research Center (EPRC) led its program of research in planning, design, operation, and automation of electric power transmission and distribution systems. [jjag@eos.ncsu.edu]

Edward Grant, Associate Professor of Electrical and Computer Engineering; Director of the Center for Robotics and Intelligent Machines of Electrical and Computer Engineering (919-515-7354); PhD Computer Science, University of Strathclyde, Glasgow, 1999. Knowledge based control systems working with robots and their systems. [egrant@eos.ncsu.edu]

Barton J. Green, Lecturer and Director of the ECE Design Center of Electrical and Computer Engineering (919-515-8740); MS Electrical Engineering, Purdue University, 1985. Knowledge of telecommunications, wide area networking, real-time computer architectures and product design methodologies are his research areas. [bjgreene@eos.ncsu.edu]

John R. Hauser, Distinguished Professor of Electronic Devices and Materials and Professor of Electrical and Computer Engineering (515-7350); PhD Electrical Engineering, Duke University, 1964. Research centers on semiconductor material properties, the physics of semiconductor devices, fabrication of devices and integrated circuits and the measurement and characterization of semiconductor device and IC parameters. Recent research activities include (a) semiconductor device theory and modeling and (b) single-wafer, in-situ processing techniques and approaches for silicon integrated circuits. [hauser@eos.ncsu.edu]

William C. Holton, Visiting Research Professor of Electrical and Computer Engineering (919-515-5246); PhD Physics, University of Illinois, 1960. Quantum computing, charge transport phenomena in condensed matter (including magnet materials), mathematical methods, modeling and nuclear magnetic resonance. [holton@eos.ncsu.edu]

Brian L. Hughes, Professor of Electrical and Computer Engineering (919-513-1798); PhD Electrical Engineering, University of Maryland, 1985. Digital communication, information theory and coding, and statistical signal processing with applications to wireless data networks are Dr. Hughes' research areas. Recent projects have focused on space-time coding and modulation for high-rate wireless communication, and channel modeling and signal detection in the presence of multi-user interference. [blhughes@eos.ncsu.edu]

Gerald J. Iafrate, Professor of Electrical and Computer Engineering (513-2310); PhD Physics, Polytechnic Institute of Brooklyn, 1970. His research focuses on Quantum transport in nanostructures such as resonant tunneling diodes and quantum dots and quantum dissipation with emphasis on ratchet-like transport phenomena and non-equilibrium processes in nanosystems. [gjiafrat@ncsu.edu]

J. Frank Kauffman, Professor Emeritus of Electrical and Computer Engineering (919-515-5151); PhD Electrical Engineering, NC State University, 1970. Antennas, microwave circuits and transmission media, electromagnetic scattering and diffraction and electromagnetic interference. [jfk@eos.ncsu.edu]

Ki Wook Kim, Professor of Electrical and Computer Engineering (919-515-5229); PhD Electrical Engineering, University of Illinois-Urbana, 1988. Semiconductor physics and modeling of electronic and optoelectronic devices, carrier transport in bulk and heterostructures, low dimensional effects, quantum transports theory, and Monte Carlo simulation. [kwk@eos.ncsu.edu]

Andrey A. Kiselev, Research Assistant Professor, (919-515-5080). PhD in Physics and Mathematics from A.F. Ioffe Physico-Technical Institute, St. Petersburg, Russia, 1994. Dr. Kiselev's area of research is theory of photon, electron, phonon, and exciton states in low-dimensional systems; effects of stress, confinement and external fields, quantum beats; hopping, spin effects and spintronics, de-coherence and relaxation. [kiselev@eos.ncsu.edu]

Robert M. Kolbas, Professor of Electrical and Computer Engineering (919-515-7350); PhD Physics, University of Illinois, Urbana-Champaign, 1979. Optical properties of semiconductor materials and devices, semiconductor quantum well lasers and light emitters, wide bandgap semiconductors, femtosecond spectroscopy, molecular beam epitaxy, integrated optoelectronic circuits, and photonic materials and devices. [kolbas@eos.ncsu.edu]

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ence and process technology of electronic materials; currently involved in examining process induced radiation damage phenomena, selective area chemical vapor deposition, plasma assisted oxidation, nitridization, and film deposition processes for controlled stress applications. [reisman@eos.ncsu.edu]

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