

2003 Summary of Engineering Research

A Report of Activities During 2002

This pdf is part of the larger *2003 Summary of Engineering Research*, available on the Web at www.engr.uiuc.edu/research and on CD-ROM. The *Summary of Engineering Research* represents the extensive engineering research program conducted in 2002 at the University of Illinois at Urbana-Champaign.

Detailed statistics about research in the College of Engineering are included in the *Directory of Engineering and Engineering Technology Programs and Research*, published by the American Society for Engineering Education, Washington, D.C.

How to Use The *Summary of Engineering Research*: Research projects are listed by title, followed by the names of the investigators and the sponsoring agencies. Projects are sorted by major topic areas. Project descriptions are brief. Additional information on each project may be obtained from the investigator in charge (denoted by an asterisk). Mailing addresses are provided on the introductory page.

How to Obtain Publications: Please consult academic and public libraries for the journals articles, papers, and books listed in this report. Information about technical reports is available from the Engineering Documents Center, 157 Grainger Engineering Library Information Center, 1301 West Springfield Avenue, Urbana, IL 61801, USA, <http://shiva.grainger.uiuc.edu/engdoc>. Copies of Ph.D. theses can be found at the University of Illinois Library, www.library.uiuc.edu, or may be purchased from University Microfilms, 300 Zeeb Road, Ann Arbor, MI 48106, USA, www.umi.com.

The *2003 Summary of Engineering Research* is produced by the Office of Engineering Publications, University of Illinois at Urbana-Champaign.

Tina M. Prow: Editor and Coordinator

Peggy Currid: Freelance Editor, Publications Sections

Jim Vattano: Graphic Designer

Thomas Habing: Research Programmer, Grainger Engineering Library Information Center

Bill Mischo: Engineering Librarian, Grainger Engineering Library Information Center

Please send queries and comments about the *2003 Summary of Engineering Research* to the Engineering Publications Office, 303 Engineering Hall, MC-266, 1308 West Green Street, Urbana, IL 61801 USA, or email research@engr.uiuc.edu.

Agricultural and Biological Engineering

L. E. Bode, Head
338 Agricultural Engineering Sciences Building
1304 W. Pennsylvania Ave., MC-644
Urbana, IL 61801-4797
(217) 333-3570
www.age.uiuc.edu
age@uiuc.edu

Principles from many scientific and engineering disciplines are applied to address opportunities and problems of agricultural production, processing, and utilization. Food and agribusiness industries account directly or indirectly for more than 20 percent of the U.S. Gross National Product and are the world's largest industries. Illinois is ranked second nationally in the value of food processed and fifth in total value of agricultural products.

The research program areas of the department include environmental protection of air, soil, and water resources; bioenvironmental engineering of plant and animal production facilities; off-road equipment design; and food and bioprocess engineering. Alternative energy technologies, such as ethanol, biomass conversion, solar, vegetable oil, and agricultural waste utilization, continue to be explored along with efficient management of conventional energy sources.

More cooperation with industries that purchase, transport, process, and package agricultural commodities has broadened the scope of agricultural engineering research, especially in the development of monitoring sensors and process control systems using machine vision and other sensors. Research aimed at improving performance and reducing cost at all levels of production with minimal environmental impact is receiving considerable attention in an attempt to keep U.S. agricultural products competitive in the world market. Additionally, new markets, new products, and new uses are being sought for overly abundant agricultural commodities.

Geographically located in an area of intense agricultural production, with access to good transportation facilities and surrounded by a large concentration of agricultural and industrial equipment manufacturers and food processors, the department is in an enviable position to serve all areas of the agricultural community. Many agricultural engineering graduates who have been educated and trained in the modern teaching facilities and research laboratories of the University of Illinois Agricultural Engineering

Sciences Building are employed throughout the nation. Interaction and cooperation with these graduates and other alumni scattered throughout the world help maintain a viable, useful research program.

Faculty and Their Interests

Robert A. Aherin
Safety

Loren E. Bode
Chemical application

Philip Buriak
Technical systems management

Leslie L. Christianson
Indoor air quality

Richard C. Coddington
Engineering Career Services Office

Richard A. Cooke
Water quality and management

Steven R. Eckhoff
Corn fractionation, wet and dry milling

Ted L. Funk
Livestock structures, waste management, grain drying

Tony E. Grift
Sensors and controls, mathematical modeling

Alan C. Hansen
Biofuels, engines, off-road equipment performance

Joe G. Harper
Technical systems management

Michael C. Hirschi
Water quality and management

Prasanta K. Kalita
Water quality and management

J. Bruce Litchfield

Food engineering

Marvin R. Paulsen

Grain quality, drying, storage, and handling

Roscoe L. Pershing

Computer simulation, undergraduate education

Kent D. Rausch

Food and bioprocess engineering and design

Vijay Singh

Food and bioprocess engineering and design

Lei Tian

Instrumentation and chemical application

Xinlei Wang

Air quality, environment, waste management

Yuanhui Zhang

Air quality, environment, waste management, ventilation

Qin Zhang

Mechatronics, electrohydraulics, controls

Agricultural Infotronic Systems

Development of an “On-Tractor” Information Manager for Crop Production Operations

Q. Zhang*

Illinois Council on Food and Agricultural Research

The objective of this research is to develop a farmer-oriented information management tool for crop production. Research is focused on the development of an “on-tractor” information management system that will be capable of integrating precision agriculture devices, synthesizing available information, and support operation decision-making. It will also be capable of linking the tractor to the Internet for receiving and transmitting operational information. This technology will utilize the current research results from precision agriculture, sensor and infotronic technology, and information management. This system will be evaluated under typical crop production conditions in Illinois.

In-Season, Site-Specific Nitrogen**Management for Corn**

Q. Zhang,* R. G. Hoefl, E. D. Nafziger, S. Han

Illinois Council on Food and Agricultural Research

This research is to develop an on-machinery corn nitrogen deficiency sensor and evaluate its potential for site-specific nitrogen management. Objectives are to investigate a multispectral image sensor technology for detecting corn nitrogen deficiency; to develop a calibration method for real-time sensor calibration; and to explore the feasibility of machinery-based, in-season, site-specific nitrogen management. Variable-rate nitrogen application technology can reduce the nitrogen rate and therefore reduce nitrogen leaching into groundwater. It will benefit corn growers by increasing profitability while reducing nitrogen contamination in surface and ground waters.

Agricultural Safety

Disabled Farmers Project

R. A. Aherin,* R. E. Petrea

University of Illinois; U.S. Department of Agriculture

The primary objective of this project is to develop a model program that will provide comprehensive assistance to Illinois farmers with physical disabilities. This includes conducting research to identify the level of need for assistance among farmers in the state and the impact of services provided.

Farm Injury Medical System Surveillance

R. A. Aherin*

Carle Foundation Hospital Center for Rural Health and Farm Safety

The purpose of this project is to develop and test a farm injury and illness surveillance system for three primary sources of data within a medical system. These include patient admittance to emergency rooms, hospitals, and clinics. The systems developed will be evaluated for reliability and ease of use by admittance personnel.

Respiratory Health of Swine Workers Pilot Study

R. A. Aherin,* D. Main

National Institute for Occupational Safety and Health; National Farm Medicine Center; Carle Foundation Hospital Center for Rural Health and Farm Safety

The first year of the project is a pilot study that may lead to a more comprehensive four-year study. The long-term objective is to safeguard respiratory health of confinement

workers by developing technologies to measure, predict, and control airborne contaminants in swine production facilities. The objectives of the first-year pilot project are to evaluate the risk level by surveying the respiratory health history and the exposure to airborne contaminants of swine confinement workers and to measure the acute respiratory responses (FEV1, FEF25-75, FEF75, and FVC) of swine confinement workers who are exposed to the environments of confinement livestock facilities.

Reducing Eye Injuries and Illnesses in Latino Farm Workers

L. Forst,* S. Scimshaw, D. Hryhorczuk, R. Petrea, S. Bauer, T. Booker, L. Nickels, R. Kerzee
Centers for Disease Control and Prevention

This is a study to develop and assess intervention strategies designed to reduce the incidences and severity of work-related eye injuries and illnesses in Latino farm workers in Illinois and Michigan. Goals are to describe the current control methods utilized; determine the intentions and prominent beliefs toward utilizing control strategies during farm work; deliver an intervention program based on those intentions and prominent beliefs; evaluate the effects of the intervention program; establish a long-range eye injury and illness prevention program; and build partnerships among university researchers, advocacy groups, service providers, Latino farm workers, and local health care professions.

Coordinator for the Agricultural Safety and Health Network (ASH-NET)

R. E. Petrea*
W. K. Kellogg Foundation

This study uses qualitative methods to assess the group processes and leadership development strategies effective in continuing a national network of individual agricultural safety- and health-related projects. The coordinator role serves to facilitate the activities of a variety of university, medical center, and community-based entities in jointly addressing safety and health issues and catalyzing grassroots efforts to educate policy makers relevant to this arena.

Using History and Accomplishments to Plan for the Future: A Summary of 15 Years in Agricultural Safety and Health and Action Steps for Future Directions

R. E. Petrea*
Multiple Funding Agencies

This three-year project uses a conference in year one and a consensus building process in years two and three to provide content for a published document. This document on agricultural safety and health will summarize recent past activities, describe progress made, identify current gaps and needs, anticipate changes in the future for the public record, and serve as a resource in national policy discussions.

Alternative Fuels

Evaluation of “E-diesel” as an Alternative Fuel for Diesel Engines

A. C. Hansen,* Q. Zhang
Illinois Department of Commerce and Community Affairs

The purpose of this project was to perform a 500-hour engine durability test in the laboratory to evaluate the effect of E-diesel, a blend of ethanol and diesel fuel, on the performance of an engine and on the life of the fuel system and engine components. The test procedure was developed in cooperation with International Engine and Truck Corporation, the manufacturer of the test engine, for comparison with the standardized data available for the same test using #2 diesel as the fuel. The potential benefits of using E-diesel are both economic and environmental.

Evaluation of “E-diesel” as an Alternative Fuel in Agricultural Machinery

A. C. Hansen,* Q. Zhang, R. H. Hornbaker
Illinois Council on Food and Agricultural Research; Great Lakes Regional Biomass Energy Program

The objective of this project is to determine the suitability of E-diesel, a blend of ethanol and diesel fuel, for on-farm use, including its performance, fuel interchangeability, and serviceability characteristics as well as its economic impact. Testing will take place on the farms of participating farmers with two tractors and two combines being monitored for performance and condition. A standard test procedure for on-farm fuel evaluation will be developed in the course of the research. The Illinois Corn Marketing Board, Deere & Company, and Caterpillar Inc. are the industrial partners in conducting this research.

*Denotes principal investigator.

Evaluation of Biomass-Derived Alternative Fuels for Off-Road Vehicles

A. C. Hansen*

U.S. Department of Agriculture Hatch Funds

More stringent emissions regulations and increasing reliance on imported crude oil has renewed interest in biofuels. The objective of this project is to evaluate selected biomass-derived fuels in off-road vehicles in terms of engine performance, durability, and emissions. Fuel blends will be tested in the laboratory and field. Laboratory tests will include the optimization of engine parameters so as to minimize emissions and maximize performance.

Bioenvironmental Engineering

Bioenvironmental Engineering Research Laboratory

L. L. Christianson,* M. E. Tumbleson, R. J. Adrian, M. Ellis, S. M. Larson, R. I. Mackie, M. T. McCulley, T. A. Newell, M. J. Rood, W. B. Rose, M. A. Smith, L. A. Spomer

National Science Foundation; U.S. Environmental Protection Agency; American Society of Heating, Refrigerating and Air-Conditioning Engineers; Center for Indoor Air Quality Research; U.S. Department of Agriculture; U.S. Department of Energy; University of Illinois

In cooperation with the departments of Animal Sciences, Natural Resources and Environmental Sciences, Civil and Environmental Engineering, Mechanical and Industrial Engineering, Nuclear, Plasma and Radiological Engineering, and Theoretical and Applied Mechanics; College of Veterinary Medicine; and the Small Homes Council/Building Research Council

An interdisciplinary research laboratory was established involving faculty from engineering and biological sciences. The purposes are to characterize and assess the microenvironment and its effects on organisms and biological products. Focus areas include animal and plant interactions with their microenvironments, sensors and instrumentation, indoor air quality, air and air contaminant movement, environmental conditioning equipment, and building materials.

Variable Rate Technology Slurry Applicator

T. L. Funk,* M. J. Robert, Y. Zhang

Illinois Council on Food and Agricultural Research

In Illinois, the most popular way of spreading swine manure, by slurry tank, has a serious shortcoming: it is very difficult to estimate and control the rate at which the slurry flows from the tank to the soil-injection equipment. Without better controls, the producer cannot assure the public that manure is being applied to land at environmentally acceptable rates. This project will develop a simplified, accurate system for controlling flow rate and the ability to couple the control with other hardware and software related to site-specific precision agriculture methods.

Aerial Pollutant Emissions from Animal Confinement Buildings

Y. Zhang,* J. W. McClure, S. Jerez, M. J. Robert

U.S. Department of Agriculture

Adverse impacts of target air pollutants including odor, particulate matter, ammonia, hydrogen, carbon dioxide, methane and nitrous oxide emitted from animal production facilities have created significant public concerns. A mobile laboratory on an 8 x 14 trailer has been developed with the capacity to measure the following real-time variables: PM10, ammonia, hydrogen sulfide, carbon dioxide, methane, ventilation rate, and other environmental variables including temperatures, humidities, radiation, and wind speed. Other variables measured include odor and total suspended particles. The mobile lab has been set up on a commercial swine farm in Illinois.

Analysis and Development of a Noncontact Aerodynamic Deduster

Y. Zhang,* Z. Tan, J. Ni

American Society of Heating, Refrigerating and Air-Conditioning Engineers; Illinois Council on Food and Agricultural Research

Existing dust removal equipment is limited in application, especially in farm animal buildings, as the equipment requires frequent cleaning and/or replacement of filters. This limitation is primarily due to the contact filtration process. In this study, a prototype of a noncontact, aerodynamic deduster has been developed to separate dust particles from the air. Theory of particle cut-size will be reviewed and modified. Parameters such as the deduster configurations and turbulence intensity affecting the cut size and particle separation efficiency will be determined. Data collected will be used to validate the theory.

Characterization of Dust Particles from Animal Buildings

Y. Zhang,* J. W. McClure, Z. Tan
Cooperative State Research Service, U.S. Department of Agriculture; University of Illinois

An air quality laboratory was established in the Department of Agricultural Engineering, University of Illinois. Grants from several agencies enabled the department to acquire a state-of-the-art Aerodynamic Particle Sizer. Particle size distribution, number and mass concentrations, and microbiological composition of dust from animal buildings will be characterized to aid in developing air quality control strategies. Together with gas chromatography, mass spectrometry, and such instrumentation as a multipoint air sampler, a laser particle counter, and an Anderson sampler, the air quality laboratory has become one of the best equipped for air quality research in the nation.

Development of 3-D Particle Image Velocimetry (PIV) Technology for Measurement and Analysis of Flow Patterns and Particle Distribution

Y. Zhang,* S. Zhang, Y. Sun, X. Wang, L. Y. Zhao
Illinois Council on Food and Agricultural Research

The long-term goal of the investigators is to develop technologies to measure and predict particulate contaminant spatial distribution for better design and management of air handling and distribution systems. In this study, the objectives are to develop a three-dimensional Stereoscopic Particle Imaging Velocimetry (SPIV) System for measurement of low-speed airflow and particulate air contaminant transport and distribution and to evaluate the ventilation efficiency, particle removal effectiveness, and nonuniformity of indoor thermal environments in animal buildings. This project will provide fundamental measurement methodologies and techniques for other future studies. Data collected will be used to develop and evaluate a particulate spatial distribution model. Alternative air distribution systems and air quality control strategies will then be evaluated.

Development of an Aerodynamic Air Cleaning System to Improve Cooling Efficiencies for Combine Engines

Y. Zhang,* Z. Tan, S. E. Ford, A. C. Hansen, J. F. Reid
Deere & Company

Dust can reduce the cooling efficiency of existing combine engines up to 30%, and in extreme circumstances, may cause overheating of engines. The research goal of this project is to improve cooling efficiency by developing an efficient and economical air cleaning technology and

reducing the maintenance of cooling systems on off-road engines. The objective of this project is to develop an aerodynamic-deduster system that provides clean cooling air for the radiator. To date, three prototypes have been developed and tested.

Experimental Characterization of Airflows in Aircraft Cabins

Y. Zhang,* Y. Sun, A. Wang
Centers for Disease Control and Prevention; The Boeing Company

Nonintrusive, full-scale, quantitative and instantaneous measurement techniques for airflow in aircraft cabins (versus single-point measurements) are needed, especially for developing CFD models. For this project, a full-scale Boeing 767 aircraft cabin section, including 35 mannequins, has been developed. A 17.5 kw chiller cools the fuselage internal surface to simulate actual high-altitude flight situations. A 3-D stereoscopic particle imaging velocimetry (SPIV) technology has been developed to measure the cabin airflow under iso- and nonisothermal conditions, and various obstruction conditions.

Illinois Odor and Nutrient Control Proving Center (ION-PC)

Y. Zhang,* M. E. Ellis, A. Mutlu, T. L. Funk, A. Williams, G. Hollis
Illinois Council on Food and Agricultural Research

The primary goal of this project is to demonstrate odor control strategies to end-users. Most odor control technologies are tested in small-scale studies with most of the interactive variables controlled. These tests do not provide assurance that the technology will work in production swine facilities. In many situations, more than one technology and/or practice will be needed at the same time to control all sources of odor. The proving center is able to develop and test all the required abatement methods simultaneously.

Stereoscopic Particle Image Velocimetry (SPIV) Technology for Measurement and Analysis of Flow Patterns and Particle Distribution

Y. Zhang,* Y. Sun, X. Wang
Illinois Council on Food and Agriculture Research

The long-term goal of this project is to develop technology to measure and predict the spatial distribution of particulate contaminants for better design and management of air handling and distribution systems. In this study, the objectives are to develop a 3-dimensional Stereoscopic

*Denotes principal investigator.

Particle Imaging Velocimetry (SPIV) System for measurement of low-speed airflow and particulate air contaminant transport and distribution, and to evaluate the ventilation efficiency.

Thermochemical Conversion (TCC) of Swine Manure to Produce Fuel and Reduce Odor

Y. Zhang,* K. C. Ocfemia, T. L. Funk, B. J. He
Illinois Council on Food and Agricultural Research

Thermochemical conversion (TCC) is a chemical reforming reaction of organic compounds in a heated enclosure. Swine manure with 5% to 20% solid matter was processed in a scale batch TCC reactor, which converted 70% of volatile solids into a crude oil. Based on the batch reactor results, a continuous thermochemical conversion (CTCC) reactor that has a capacity of processing 50 liters of slurry and producing 5 liters of crude oil per day has been developed.

Ventilation Equipment Testing Program in BESS Laboratory

Y. Zhang,* S. E. Ford, L. L. Christianson,
T. L. Funk, X. Wang
Ventilation Equipment Industry

More than 95% of agricultural ventilation fan manufacturers and many other ventilation equipment companies test their products at the University of Illinois Bioenvironmental Structure and Systems (BESS) Laboratory. The lab publishes all fan data annually and conducts industry research related to ventilation, airflow characterization, and equipment development. This long-standing program is managed through the Bioenvironmental Engineering Division and conducted within the BESS Laboratory. The program has resulted in a 25% increase in fan efficiency across the United States in the past decade. The program is self-supporting.

Food and Bioprocess Engineering

The “Quick Protein” Process to Enhance Dry-Grind Ethanol Plant Profitability

S. R. Eckhoff,* D. Gupta, L. Dickey, K. D. Rausch,
V. Singh, M. E. Tumbleson
Illinois Corn Marketing Board

The objective of the study is to produce a protein-rich fraction from corn that has already gone through the quick-germ and quick-fiber processes. This protein-rich fraction will be looked at for the amount of zein that can be extracted. A new process was developed based on

preliminary data that provides both a starch stream suitable for ethanol production and a starch stream suitable for starch production. A provisional patent has been applied for the process. A modification to the process using novel technology increases starch yield.

Development of Processes to Recover and Utilize Agricultural Biosolids

K. D. Rausch,* S. R. Eckhoff, M. R. Paulsen,
M. E. Tumbleson
U.S. Department of Agriculture Hatch Funds

Coproducts contribute greatly to economic viability of the ethanol industry. Two streams, light gluten (LG) and light steepwater (LSW), are affected by processing conditions during wet milling of corn and vary in composition. These streams are precursors of corn gluten meal and corn gluten feed coproducts, which are used as animal foods. Variation in LG and LSW affect nutritional quality and market value of both coproducts. Materials not usable in LG or LSW streams become wastewater (WW) stream and incur costs. This study was to determine variation in composition of LG, LSW, and WW within and among processing days.

Influence of Corn Hybrid on Dry Milling and Extrusion Product Performance

K. D. Rausch,* J. F. Faller, S. R. Eckhoff
Illinois Council on Food and Agricultural Research

Commercial corn hybrids available in the market impact processing. Understanding the magnitude of variability caused by commercial hybrids would allow producers, millers, and processors to increase quality and value. Goals of this work were to evaluate the effect of hybrid on dry milling and extrusion variability and to identify added value that processing specific hybrids can provide to the final products. Hybrids grown on research plots were dry milled to obtain meal for subsequent extrusion. Differences in RVA characteristics were found between tail and through meal samples. Some differences in extruded products due to hybrid were detected.

Process Research to Enhance Nutritional Value of Corn Wet Milling Coproducts

K. D. Rausch,* S. R. Eckhoff, V. Singh,
M. E. Tumbleson
Illinois Council on Food and Agricultural Research

Coproducts from corn wet milling must be dewatered and dried to allow economical and safe storage and handling prior to use in animal food. Currently, protein and other nutrients are recovered as low-valued animal food

ingredients from wet milling. Microfiltration of coproduct streams is being investigated as a feasible alternative to centrifugation, evaporation, and vacuum belt filtration, and for reducing high capital and energy costs with these processes. The goals of this study are to investigate methods of recovering more nutrients and determining changes in value using microfiltration compared to conventional methods to allow industry to be more sustainable and efficient.

Relating Corn Hybrids to Enhanced Starch Processing Efficiency

K. D. Rausch,* P. Buriak, M. R. Paulsen, S. R. Eckhoff
Illinois Council on Food and Agricultural Research

Raw material variability is common for starch processors and is believed to be responsible for increased processing costs. These increased costs result from excess capacity and reduced processing rates to account for fluctuation in raw material quality. Reduction of variability in raw materials would enable processors to design modification processes that run efficiently with increased final product quality. In this study, the variability of starch modifications due to the influence of hybrid was quantified. It was found that effect of crop year appears larger than effect of hybrid on modified waxy starch properties.

Modified Milling Technologies for Dry-Grind Ethanol

V. Singh,* K. D. Rausch, D. B. Johnston
Eastern Regional Research Center, U.S. Department of Agriculture, Agricultural Research Service

The objective of this research is to develop new or modify existing corn milling technologies that allow value-added processing and lower the capital and operating costs of ethanol production facilities. The project involves recovering multiple coproducts and improving the efficiency of dry-grind corn processing. Economic assessment of process improvements will be done by process simulation and economic modeling.

Use of Enzymes to Reduce Steep Time, Reduce SO₂ Emissions and Improve Product Yield in the Corn Wet-Milling Process

V. Singh,* D. B. Johnston
Initiative for Future Food and Agriculture Service, Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture

This research involves developing an enzymatic corn wet milling process that reduces or eliminates sulfur dioxide (SO₂) requirements during steeping, reduces steep time, and produces starch yields comparable to conventional

processes. This change in wet milling of corn would reduce environmental and health risks associated with use of SO₂. Currently, this research team is working with corn wet milling companies to evaluate this process at full-plant capacity.

Grain Qualities and Properties

Corn Starch Yield Calibrations with NIR

M. R. Paulsen,* M. Singh
Illinois Council on Food and Agricultural Research; U.S. Department of Agriculture; DuPont; Monsanto

A calibration for extractable starch in corn was developed for an Infratec 1229 NIT grain analyzer based 2200 samples collected from 1997-2001. Extractable starch was predicted with a standard error of prediction (SEP) of 1.34, R² of 0.8, and RPD of 2.2. The calibration was used on samples from 640 subplots that were planted with two varieties at four populations and five nitrogen levels. NIT protein increased significantly while extractable starch, ranging from 63% to 72%, decreased significantly as nitrogen rate increased. A 1% point gain in extractable starch is worth about 4 cents to 6 cents per bushel of corn.

Off-Road Equipment Engineering

Dynamic Performance Evaluation of GPS Receivers and GPS Guidance Systems

S. Han,* Q. Zhang
Deere & Company

This project is to provide an independent performance evaluation of commercial DGPS receivers and to develop a testing procedure for DGPS receiver performance evaluation. DGPS receivers are an essential component for precision agriculture operations and for off-road vehicle automated guidance. The evaluation of DGPS receiver performance consists of stationary positioning accuracy and dynamic positioning accuracy.

Simulation of In-Field Grain Handling Systems

A. C. Hansen,* R. H. Hornbaker
Deere & Company

Grain harvesting and handling operations have increased in complexity as a result of higher combine work rates requiring more efficient transfer and transport of grain out of the field. The objective of this project is to develop a model for simulating multivehicle grain handling processes in the field. Combines, grain wagons and

*Denotes principal investigator.

semitrucks were fitted with data loggers for tracking their movement in the field and the transfer of grain between vehicles. These data are being used to verify the model for both wheat and corn harvesting.

Fuzzy Controls for Mechatronized Off-Road Equipment

Q. Zhang*

U.S. Department of Agriculture Hatch Funds

This research is to develop automated guidance control systems for off-road equipment. The hypothesis is that human operators, using their experience, common-sense, and intelligence, can maneuver off-road equipment well, and an intelligent control system could do the same. The specific objectives of this program are to develop redundant guidance sensing technology, vehicle path planning technology, sensor fusion technology, and fuzzy controls for electrohydraulic steering control. This guidance control system has been partially developed and implemented on an agricultural tractor on crop production fields. Further efforts will be focused on developing a sensor fusion path planner.

Vision Guidance for Wheel-Type Agricultural Tractors

Q. Zhang*

Deere & Company

The objective of this research is to develop machine-vision navigation sensing capability for guiding agricultural tractors to follow row crops in the field. The study will address challenging technical problems in developing vision-based navigation sensing technology capable of detecting crop rows or edges in typical farming operation conditions. The lack of skillful operators, the aging of the farm labor force, and the application of new agricultural technology make this research technologically significant and important.

Wavelet-based Fault Diagnosis for Pump Health Assessment

Q. Zhang,* D. He

Caterpillar Inc.

The research objective is to develop a wavelet-based fault diagnostic tool for hydraulic pump health assessment. In this investigation, an automatic feature signal extraction method is developed for mining feature signatures of healthy, worn, and damaged pumps by means of decomposing the pump vibration signals. This technology will provide a sensitive and robust means for equipment health online assessment, which could lead to improved productivity and operational safety.

Site-Specific Agriculture

Data Collection and Analysis for Future Farms

L. Tian,* G. Schnitkey, M. Welge

Dudley Smith Foundations

High-quality data are essential for future crop management. Site-specific information will have higher value when the sensing system is optimized and error is minimized. This project is a pilot study to see what the future data set might be and how researchers could best plan to analyze it. The team will use state-of-the-art technologies in the development of sensing systems for future farms. High-performance computing systems will be used in the data management study. A prescriptive study will be conducted concerning the value of information from site-specific technologies.

Developing an Agricultural Remote Sensing Program at the University of Illinois

L. Tian,* D. Bullock, J. Westervelt

Sentinel Program of Illinois Council on Food and Agricultural Research

Cooperating with NASA researchers, University of Illinois scientists are expanding the agricultural remote sensing program at the U of I. Program objectives are to develop the key technologies needed for NASA remote sensing data applications in precision agriculture settings; design and develop new courses in the area of agricultural remote sensing, spatial data management, and precision agriculture; foster cooperation among scientists from universities, government agencies, and industry working in precision agriculture and remote sensing; and bring new technologies to farmers, assess their needs, target research to address those needs, and maximize the relevancy of the program.

Development of a Precision Herbicide Application System

L. F. Tian,* J. W. Hummel

University of Illinois

The goal of this project is to develop a precision herbicide application (robotic) system for low-input pest control strategies in soybean and maize production. Specific objectives include evaluating the agronomic and environmental benefits of low-input herbicide applications and the status of current technology in this area; developing practical, real-time prototype systems for individual plant sensing and equipment control; and conducting on-farm trials to evaluate the prototype

under the constraints of normal farm operation. With this precision system, herbicide would be applied only to the target weeds in the fields.

Hyperspectral Imaging System for SSCM and High-Density Data Analysis Technology with Supercomputer

L. F. Tian*

*National Center for Supercomputing Applications
Faculty Fellowship Program*

Precision farming, or site-specific crop management (SSCM) technology, affords an opportunity for the producer to optimize crop input, increase crop quality, and reduce negative impacts on the environment. Researchers are integrating and evaluating a near-real-time agricultural remote sensing system, which includes real-time multifunction field property remote sensing, data processing, and a map generating system. The team is utilizing NCSA's computing and information technology to develop remote-sensing-based tools and procedures to map (diagnose) within-field variability. The research areas are remote sensing data visualization, variability data (map) mining, Web-based object relational databases, artificial intelligence, and decision support.

Improved Application of Pest Control Substances

L. Tian*

University of Illinois; U.S. Department of Agriculture

Equipment and techniques are being developed to improve the application efficiency of agricultural chemicals. Droplet size spectra from various atomizers are measured to determine target coverage versus spray drift potential. Field studies of spray drift deposits are used to verify the droplet size evaluations. Sensors and automatic control systems are being developed to apply pest control substances as a function of soil organic matter, travel speed, and other input variables. Techniques for incorporation of herbicides in the soil profile of conservation tillage systems are being developed and evaluated.

Using Remotely Sensed Data to Diagnose Soybean Yield Limiting Factors

L. Tian,* D. Bullock

North Central Soybean Research Program

Procedures to accurately explain crop yield variation are needed to provide crop consultants, producers, and researchers with the necessary information to interpret yield maps and develop the most appropriate site-specific management options for a given field. These site-specific

options, based on factors that affect crop yield, will improve profitability. The objective of this project is to develop sensor-based procedures to map within-field weed, disease, and nutrient deficiencies in order to diagnose their presence in the field and evaluate their contribution to yield variation. This could lead to development of site-specific management options for crop production.

Variable Rate Herbicide Applications Using Remotely Sensed Imagery

L. Tian,* L. Wax, C. Sprague

NASA CRSP Ag20/20 Initiative

An estimated \$6.1 billion was spent by farmers on herbicides in 1997. Current methodology for weed control is to apply the herbicide uniformly throughout the field. However, weeds do not grow uniformly in the field, but often grow in patches with up to 90% of the field being weed-free. This means that a major portion of the field may not need to be sprayed. The goal of the variable-rate technology using remote sensing is to evaluate the effectiveness of remote-sensing-based, variable-rate herbicide in terms of cost savings, effectiveness in eliminating weeds, and ability to maintain acceptable yield levels compared to traditional, conventional application of herbicide.

Soil and Water Resources

Incorporation of the Effect of Artificial Subsurface Drainage into Surface Water Quality Models

R. A. Cooke*

University of Illinois

Most of the agricultural lands in central Illinois are drained by artificial subsurface drains. These drainage systems provide pathways for solute movement to rivers and streams. The goal of this project is to incorporate the effects of these systems into watershed-scale flow and transport models.

DHARMA: Domain Specific Metaware for Hydrologic Applications

P. K. Kalita,* M. C. Hirschi

National Science Foundation

Many hydrologic models at the watershed scale are limited in resolution and scope by their computational demands. A goal of this project is to build a middleware layer to provide the resources for revolutionizing hydrologic modeling. The required resources range from local data

*Denotes principal investigator.

to the supercomputing power on the national computational grid. Researchers intend to expand the applicability of the Water Erosion Prediction Project model to large watersheds, specifically applying the extended model to the Lake Decatur Watershed in Illinois, and enable the model for predicting erosion within the watershed by allowing significantly easier access to the computational power and data acquisition capabilities.

Understanding and Modeling the Hydrology of Tile-Drained Watersheds

P. K. Kalita,* R. A. Cooke, M. C. Hirschi, J. K. Mitchell
Illinois Council on Food and Agricultural Research; University of Illinois

The overall objective of the study is to develop strategies that mutually benefit both agriculture and water quality in regions where hydrology is strongly influenced by subsurface drainage. Researchers have been monitoring flow and water quality from the subsurface tile drains in the Little Vermilion River Watershed in Illinois. Results from field observations have been used to develop fundamental relationships describing flow components to incorporate in computer simulation models. These data have been used to calibrate and validate these models. Work is in progress to develop watershed-scale model(s) to evaluate the effects of Best Management Practices on watershed water quality.

An Integrated Approach to Reduce Pathogen and Nutrients in Runoff from Animal Production Systems

P. K. Kalita,* M. S. Kuhlenschmidt, R. D. Smith, T. L. Funk
Illinois Council on Food and Agricultural Research; University of Illinois

Microbial pathogens such as *Cryptosporidium parvum* and *Escherichia coli* from animal production facilities have threatened rural health and environment. The goal of this study is to limit the delivery of microbial pathogens and nutrients from animal production facilities and to provide a healthy and sustainable environment to small and mid-size farmers. This study is investigating the fate and transport of *C. parvum* and *E. coli* in surface and near-surface water to develop management strategies to limit their transport. A microbial transport predictive model will be developed with goals of understanding, predicting, and limiting movement of microbial pathogens to the water supply.

Water Quality

Effect of Drainage System Layout on Yield, Yield Uniformity, and Water Quality

R. A. Cooke,* P. K. Kalita
Case Corp.; Illinois Council on Food and Agricultural Research

The overall goal of this research is to improve the characterization of subsurface drainage processes in tile-drained watersheds and to quantify the effect of several depth and spacing combinations on yield, yield uniformity, and water quality. In the long run, the results can be used to select subsurface drainage management practices that optimize yield, water quality, or both.

Passive Subsurface Bioreactors for Enhanced Edge-of-Field Treatment of Tile Outflow

R. A. Cooke,* M. C. Hirschi
Illinois Council on Food and Agricultural Research

This research project is designed to test the hypothesis that the installation of passive subsurface bioreactors on tile outlets will reduce the levels of nutrients and pesticides in streams and rivers. Research involves a laboratory study to determine the substrate (carbon source) that results in the highest removal efficiencies for nitrates and phosphorus, and the establishment of a pilot system for field validation and for demonstration purposes.

Understanding Hydrologic and Water Quality Response of a Tiled Watershed

P. K. Kalita,* R. A. Cooke, M. C. Hirschi, R. J. Hudson
U.S. Department of Agriculture, National Research Initiative Competitive Grants Program

Tile-drained watersheds contain much of the productive agricultural land in the north central United States, yet the hydrology of these watersheds is not well understood. This study will initiate a new dimension for watershed management to improve water quality in tile-drained watersheds. Once the techniques and relationships are validated, an estimate of total maximum daily load (TMDL) to a surface water source will be available through simple and accurate means. Overall, the results of this study will be utilized for better management of agricultural practices in east central Illinois and similar areas with tile-drained watersheds.

Journal Articles

Agricultural Infotronic Systems

Guo, L., Q. Zhang, and S. Han. **Agricultural machinery safety alert system using ultrasonic sensors.** *J. Agr. Safety Health*, 84:4, 385-396 (2002).

Guo, L., Y. He, Q. Zhang, and S. Han. **Real-time tractor position estimation system using a Kalman filter.** *Trans. CSAE*, 18:5, 96-101 (2002).

Zhang, Q. and S. Han. **An information table for yield data analysis and management.** *Biosyst. Eng.*, 83:3, 299-306 (2002).

Bioenvironmental Engineering

Tan, Z. C. and Y. Zhang. **Advances in centrifugal separators for particulate matter control from stationary sources.** *J. Thermal Sci.*, 11:3, 382-288 (2002).

Wang, X., Y. Zhang, G. L. Riskowski, and M. Ellis. **Measurement and analysis of dust spatial distribution in a mechanically ventilated swine building.** *Biosyst. Eng.*, 81:2, 225-236 (2002).

Engineering Education

Schmidt, S. J., P. Buriak, C. J. D'Arcy, J. B. Litchfield, J. S. Javenkoski, and R. K. Barrick. **The teaching college course: a faculty, staff, and graduate student development program to enhance teaching quality.** *Natl. Assoc. Colleges Teachers Agr. J.*, 46:2, 18-27 (2002).

Food and Bioprocess Engineering

Dien, B. S., R. J. Bothast, L. B. Iten, L. Barrios, and S. R. Eckhoff. **Fate of *Bt* protein and influence of corn hybrid on ethanol production.** *Cereal Chem.*, 79:4, 582-585 (2002).

Mbuvi, S. and S. R. Eckhoff. **Effect of stress cracks on corn wet-milling yields.** *Cereal Chem.*, 79:5, 695-696 (2002).

Rausch, K. D. **Front end to backpipe: membrane technology in the starch processing industry.** *Starch/Staerke*, 54, 273-284 (2002).

Singh, V. and D. B. Johnston. **Pasting properties and surface characteristics of starch obtained from an enzymatic corn wet milling process.** *Cereal Chem.*, 79:4, 523-527 (2002).

Singh, V., R. A. Moreau, K. B. Hicks, R. L. Belyea, and C. Staff. **Removal of fiber from distiller dried grains with solubles (DDGS) to increase its value.** *Trans. ASAE*, 45:2, 389-392 (2002).

Grain Qualities and Properties

Paulsen, M. R., S. R. Eckhoff, L. Obaldo, E. Jones, D. Eustace, B. Ye, and J. Liu. **Measurement and removal of garlic in wheat.** *Appl. Eng. Agr.*, 18:3, 313-324 (2002).

Mechatronics

Hu, H. and Q. Zhang. **Realization of programmable control using a set of individually controlled electrohydraulic valves.** *Int. J. Fluid Power*, 3:2, 29-34 (2002).

Zhang, Q., D. Wu, J. F. Reid, and E. R. Benson. **Using model recognition to design an electrohydraulic steering controller for off-road vehicles.** *Mechatronics*, 12:6, 845-858 (2002).

Off-Road Equipment Engineering

Grift, T. E. **Cluster criteria.** *ASAE Resource*, 9:5, 9-10 (2002).

Grift, T. E. and J. W. Hofstee. **Testing an online spread pattern determination sensor on a broadcast fertilizer spreader.** *Trans. ASAE*, 45:3, 561-567 (2002).

Han, S., Q. Zhang, and H. Noh. **Kalman filtering of DGPS positions for parallel tracking application.** *Trans. ASAE*, 45:3, 553-559 (2002).

Hansen, A. C., A. J. Barnes, and P. W. L. Lyne. **Simulation modelling of sugarcane harvest-to-mill delivery systems.** *Trans. ASAE*, 45:3, 531-538 (2002).

Raper, R. L. and T. E. Grift. **Land laser.** *ASAE Resource*, 9:4, 7-8 (2002).

Wu, K., Q. Zhang, A. C. Hansen, and A. Alleyne. **A multiple locally-linearized diesel engine model.** *Trans. ASAE*, 45:2, 273-280 (2002).

Site-Specific Agriculture

Bajwa, S. G. and L. Tian. **Multispectral CIR image calibration for cloud shadow and soil background influence using intensity normalization.** *Appl. Eng. Agr.*, 18:5, 627-635 (2002).

Tian, L. **Sensor-based precision chemical application system.** *J. Comput. Electron. Agr.*, 36:2-3, 133-149 (2002).

Soil and Water Resources

Northcott, W. J., R. A. Cooke, S. E. Walker, J. K. Mitchell, and M. C. Hirschi. **Modeling flow on a tile drained watershed using a GIS integrated DRAINMOD.** *Trans. ASAE*, 45:5, 1405-1413 (2002).

Water Quality

Bhuyan, S. J., P. K. Kalita, K. A. Jensen, and P. L. Barnes. **Soil loss predictions with three erosion simulation models.** *J. Environ. Model. Software*, 17, 137-146 (2002).

Lander K. S. and P. K. Kalita. **Old drains, new challenges—study of base flow in tile-drained watersheds.** *ASAE Resource*, 9:5, 7-8 (2002).

Miller, P. S., J. K. Mitchell, R. A. Cooke, and B. A. Engel. **A wetland to improve agricultural subsurface drainage water quality.** *Trans. ASAE*, 45:5, 1305-1317 (2002).

Papers Presented at Conferences and Symposia

Agricultural Infotronic Systems

Guo, L. and Q. Zhang. **A wireless LAN for collaborative off-road vehicle automation.** Automation Technology for Off-Road Equipment (Chicago, IL, Jul. 2002) Proc. Automation Technology for Off-Road Equipment 51-58 (2002).

Will, J. D., J. F. Reid, N. Noguchi, and Q. Zhang. **Software architecture design for automation of off-road equipment.** Automation Technology for Off-Road Equipment (Chicago, IL, Jul. 2002) Proc. Automation Technology for Off-Road Equipment 43-50 (2002).

Agricultural Safety

Petrea, R. E. **Factors associated with agricultural safety and health incidents.** Ann. Mtg. Kentucky Partnership (Bowling Green, KY, Mar. 2002).

Petrea, R. E. **Using history and accomplishments to plan for the future: a summary of first- and second-year activities.** Ann. Mtg. Natl. Inst. for Farm Safety (Ponte Vedra Beach, FL, Jun. 2002).

Petrea, R. E. and C. Lehtola. **NASD: an Internet-accessed farm worker injury prevention tool.** 12th Ann. Midwest Migrant Stream Forum (New Orleans, LA, Nov. 2002).

Petrea, R. E., L. Forst, S. Skinner, and S. Bauer. **Reducing eye injuries and illnesses in Latino farmworkers: partnership evaluation findings.** 12th Ann. Midwest Migrant Stream Forum (New Orleans, LA, Nov. 2002).

Bioenvironmental Engineering

Funk, T. L., M. J. Robert, and Y. Zhang. **Development of a practical variable rate system for vacuum-loaded slurry tankers.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

He, B., Y. Zhang, T. L. Funk, and G. L. Riskowski. **Renewable energy from swine manure.** 10th Biennial Bioenergy 2002 Conf. (Boise, ID, Sep. 2002) Proc. 10th Biennial Bioenergy 2002 Conf.

Mutlu, A., Y. Zhang, G. L. Riskowski, and M. Ellis. **Evaluation of a negatively pressurized swine lagoon cover to reduce odor emissions.** ASAE Ann. Intl. Mtg (Chicago, IL, Jul. 2002).

Ni, J., Z. C. Tan, and Y. Zhang. **Evaluation of a large concentric deduster for dust and ammonia emission control from swine buildings.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Sun, Y. and Y. Zhang. **Development of a stereoscopic particle image velocimetry system for full-scale room airflow studies. Part II: validation of algorithms.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Tan, Z. C. and Y. Zhang. **Advances in centrifugal separators for particulate matter control from stationary sources.** Intl. Conf. on Thermal Engineering and Air-Cleaning Technology (Beijing, China, Oct. 2002).

Zhao, L. Y., Y. Zhang, X. Wang, G. L. Riskowski, and L. L. Christianson. **Analysis of non-isothermal flow field in a full-scale ventilated room using PIV techniques.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Zhao, L. Y., Y. Zhang, X. Wang, G. L. Riskowski, and L. L. Christianson. **Effects of ventilation systems on air velocity distribution in a ventilated airspace.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Engineering Education

Buriak, P. and J. G. Harper. **Make it real: experiential learning.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Hansen, A. C., P. Kalita, P. W. L. Lyne, and L. E. Bode. **Introducing engineering design concepts with a micro steam car project.** ASEE Ann. Intl. Conf. (Montreal, QB, Jun. 2002).

Food and Bioprocess Engineering

Agbisit, R. M., B. J. Daugherty, R. L. Belyea, T. E. Clevenger, L. M. Raskin, M. E. Tumbleson, and K. D. Rausch. **Characterization and nutrient balance of corn wet milling streams.** ASAE Ann. Intl. Mtg (Chicago, IL, Jul. 2002).

Daugherty, B. J., L. T. Angenent, J. Champion, R. M. Agbisit, K. D. Rausch, M. E. Tumbleson, and L. M. Raskin. **Using biological processes to recover sulfur from corn wet milling industry waste streams.** 74th Ann. Conf. of the Water Environment Federation (WEFTEC) (Chicago, IL, Oct. 2002).

Hicks, K., R. A. Moreau, D. B. Johnston, L. W. Doner, and V. Singh. **Potential new uses of corn fiber.** Corn Utilization and Technology Conf. (Kansas City, MO, Jun. 2002) Proc. Corn Utilization and Technology Conf. (2002).

Lemuz, C. R., P. Buriak, J. F. Faller, M. E. Tumbleson, and K. D. Rausch. **Extrusion performance and product characterization as influenced by corn hybrid.** ASAE Ann. Intl. Mtg (Chicago, IL, Jul. 2002).

Raskin, L. M., K. D. Rausch, M. E. Tumbleson, B. J. Daugherty, L. T. Angenent, R. M. Agbisit, and R. L. Belyea. **Nutrient recovery from food processing industry waste streams.** Corn Utilization and Technology Conf. (Kansas City, MO, Jun. 2002) Proc. Corn Utilization and Technology Conf. 66-68 (2002).

Rausch, K. D., M. R. Wilkins, V. Singh, M. E. Tumbleson, and R. L. Belyea. **Improvement of coproducts from the dry grind ethanol process.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Singh, V. and D. Johnston. **Enzymatic milling process.** Corn Utilization and Technology Conf. (Kansas City, MO, Jun. 2002) Proc. Corn Utilization and Technology Conf. (2002).

Singh, V., D. Johnston, R. A. Moreau, K. B. Hicks, B. S. Dien, and R. J. Bothast. **Pretreatment of corn fiber to enrich corn fiber oil and its phytosterol compounds.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Templin, T. L., D. Johnston, V. Singh, M. E. Tumbleson, and K. D. Rausch. **Membrane separations for added value in the enzymatic corn wet milling process.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Templin, T. L., D. Johnston, V. Singh, M. E. Tumbleson, and K. D. Rausch. **Membrane separations for added value in the enzymatic corn wet milling process.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Wilkins, M. R., P. Wang, L. Xu, Y. Niu, M. E. Tumbleson, and K. D. Rausch. **Hybrid effect on the properties of dent corn starch acetates.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Grain Qualities and Properties

Paulsen, M. R. and M. Singh. **Development of NIT calibration for extractable starch in maize.** Intl. Conf. on Agricultural Engineering (Budapest, Hungary, Jul. 2002).

Singh, M., M. R. Paulsen, L. Tian, and H. Yao. **Site-specific study of corn protein, oil, and extractable starch variability using NIT spectroscopy.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Yao, H., L. Tian, M. R. Paulsen, A. L. Kaleita, and M. Singh. **Hyperspectral imagery for various crop growth information extraction.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Instrumentation and Control

Tang, L. and L. Tian. **Machine vision for automated corn plant spacing, growth stage, and population measurements. Part I: real-time image-sequencing.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Tang, L. and L. Tian. **Machine vision for automated corn plant spacing, growth state, and population measurements. Part II: plant identification.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Mechatronics

Gao, Y., X. Kong, and Q. Zhang. **Wavelet analysis for piston pump fault diagnosis.** 49th Natl. Conf. of Fluid Power (Las Vegas, NV, Mar. 2002) Proc. 49th Natl. Conf. of Fluid Power 183-188 (2002).

He, D., X. Wang, A. Babayan, and Q. Zhang. **Intelligent equipment health diagnosis and prognosis using wavelet.** Automation Technology for Off-Road Equipment (Chicago, IL, Jul. 2002) Proc. Automation Technology for Off-Road Equipment 77-88 (2002).

He, Y., Q. Zhang, and L. Feng. **Diesel injection system faults diagnosis based on fuzzy pattern recognition.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

He, Y., Q. Zhang, and L. Feng. **Engine real-time fault diagnosis using neural networks.** Automation Technology for Off-Road Equipment (Chicago, IL, Jul. 2002) Proc. Automation Technology for Off-Road Equipment 89-95 (2002).

Hu, H. and Q. Zhang. **Development of a programmable E/H valve with a hybrid control algorithm.** 49th Natl. Conf. of Fluid Power (Las Vegas, NV, Mar. 2002) Proc. 49th Natl. Conf. of Fluid Power 731-736 (2002).

Jiang, W., X. Kong, and Q. Zhang. **Chaotic signal pattern recognition using orthogonal wavelet packet method.** 49th Natl. Conf. of Fluid Power (Las Vegas, NV, Mar. 2002) Proc. 49th Natl. Conf. of Fluid Power 363-368 (2002).

Norris, W. R., R. Sreenivas, and Q. Zhang. **A novel approach using a neural network-based adaptive filter for performing real-time, on-line qualitative system design.** Automation Technology for Off-Road Equipment (Chicago, IL, Jul. 2002) Proc. Automation Technology for Off-Road Equipment 288-296 (2002).

Norris, W. R., R. Sreenivas, and Q. Zhang. **A real-time human operator performance model for performing adaptive control system design.** Automation Technology for Off-Road Equipment (Chicago, IL, Jul. 2002) Proc. Automation Technology for Off-Road Equipment 297-306 (2002).

Off-Road Equipment Engineering

Adams, B. T., J. F. Reid, J. W. Hummel, Q. Zhang, and R. G. Hoelt. **Impact of a central tire inflation system on ride quality of agricultural vehicles.** ASAE Ann. Intl. Mtg. (Chicago, IL, July 2002) (2002).

Adams, B. T., J. F. Reid, J. W. Hummel, Q. Zhang, and R. G. Hoelt. **Impact of a central tire inflation system on traction and compaction of agricultural vehicles.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Benson, E. R., A. C. Hansen, J. F. Reid, B. L. Warman, and M.A. Brand. **Development of an in-field grain handling simulation in ARENA.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Dong, Z. and Q. Zhang. **The evaluation of electrohydraulic steering control algorithm.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Dong, Z., Q. Zhang, and S. Han. **Control an electrohydraulic steering system using a PID controller with a nonlinear compensation algorithm.** SPIE: Unmanned Ground Vehicle Technology IV (Orlando, FL, Apr. 2002) Proc. SPIE: Unmanned Ground Vehicle Technology IV 97-95 (2002).

Guo, L. S., Q. Zhang, and S. Han. **Position estimate of off-road vehicles using a low-cost GPS and IMU.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Guo, L., Q. Zhang, and S. Han. **A sensor fusion method for off-road vehicle position estimation.** SPIE: Unmanned Ground Vehicle Technology IV (Orlando, FL, Apr. 2002) Proc. SPIE: Unmanned Ground Vehicle Technology IV 238-247 (2002).

Han, S., H. K. Noh, Q. Zhang, and B. S. Shin. **Dynamic performance evaluation of DGPS receivers for parallel tracking.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Han, S., M. A. Dickson, B. Ni, J. F. Reid, and Q. Zhang. **A robust procedure to obtain a guidance directrix for vision-based vehicle guidance systems.** Automation Technology for Off-Road Equipment (Chicago, IL, Jul. 2002) Proc. Automation Technology for Off-Road Equipment 317-326 (2002).

Hansen, A. C., E. R. Benson, J. F. Reid, and R. H. Hornbaker. **Evaluation and use of an in-field grain-handling simulation.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Hansen, A. C., Q. Zhang, and R. H. Hornbaker. **Engine fuel system durability with ethanol-diesel blends.** 10th Biennial Bioenergy Conf. (Boise, ID, Sep. 2002).

Hornbaker, R. H., R. Rejesus, and A. C. Hansen. **Precision technologies as an on-farm research tool: the case of e-diesel fuel assessment.** 6th Intl. Conf. on Precision Agr. (Minneapolis, MN, 2002).

Raper, R. L., T. E. Grift, and M. Z. Tekeste. **A portable tillage profiler for measuring subsoiling effectiveness.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Rovira Más, F., Q. Zhang, J. F. Reid, and J. D. Will. **Machine vision algorithm for automatic guidance of an agricultural tractor.** Intelligent Engineering Systems through Artificial Neural Networks 12 (St. Louis, MO, Nov. 2002) Proc. Intelligent Engineering Systems through Artificial Neural Networks 12 607-612 (2002).

Rovira Más, F., Q. Zhang, J. F. Reid, and J. D. Will. **Machine vision row crop detection using blob analysis and the Hough transform.** Automation Technology for Off-Road Equipment (Chicago, IL, Jul. 2002) Proc. Automation Technology for Off-Road Equipment 327-336 (2002).

Tekeste, M. Z., T. E. Grift, and R. L. Raper. **Acoustic compaction layer detection.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Yuan, W., A. C. Hansen, and Q. Zhang. **Combustion optimization of biodiesel for diesel engines with the aid of KIVA-3 code.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Site-Specific Agriculture

Kaleita, A. L. and L. Tian. **Remote sensing of site-specific soil characteristics for precision farming.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Singh, M., M. R. Paulsen, L. Tian, and H. Yao. **Site-specific study of corn protein, oil, and extractable starch variability using NIT spectroscopy.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Thorp, K. and L. Tian. **Development of vegetation indices for hyperspectral data.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Tian, L. **On the development of quantitative remote-sensing systems for precision farming of major crops in the USA.** Intl. Conf. on Remote Sensing, GIS and GPS in Human Settlement Planning (Hyderabad, India, Jan. 2002).

Tian, L. **Study on selective herbicide application systems.** North Central Weed Scientist Soc. Ann. Conf. (St. Louis, MO, Dec. 2002).

Yao, H., L. Tian, and K. Thorp. **Hyperspectral imagery for various crop growth information extraction.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Yao, H., L. Tian, L. Tang, and K. Thorp. **Corn canopy reflectance study with a real-time high-density spectral-image mapping system.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Soil and Water Resources

Cooke, R. A., J. Nehmelman, and P. Kalita. **Effect of tile depth on nitrate transport from tile drainage systems.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Lander, K. S., P. K. Kalita, J. K. Mitchell, R. A. Cooke, and M. C. Hirschi. **Base flow determination in a ditch off a tile-drained watershed.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Mitchell, J. K., P. K. Kalita, K. Banasik, M. C. Hirschi, and R. A. Cooke. **Upland drainage-watershed hydrology consideration.** 5th Intl. Conf. on Hydro-Science and Engineering (Warsaw, Poland, Sep. 2002) Proc. 5th Intl. Conf. on Hydro-Science and Engineering (2002).

Northcott, W., R. A. Cooke, S. E. Walker, J. K. Mitchell, and M. C. Hirschi. **Modeling tile flow on a tile-drained watershed using a GIS integrated DRAINMOD.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Singh, J., R. J. Hudson, R. A. Cooke, M. C. Hirschi, T. R. Ellsworth, and G. Z. Gertner. **Automatic calibration of a subsurface drainage model.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Water Quality

Andresen, D., M. Nielsen, G. Singh, and P. K. Kalita. **Domain-specific metaware for hydrologic applications.** Intl. Conf. of Parallel and Distributed Computing and Systems (Cambridge, MA, Nov. 2002) Proc. Intl. Conf. of Parallel and Distributed Computing and Systems (2002).

Barnes, P. L. and P. K. Kalita. **Monitoring Delaware River watershed to locate contaminant sources and assessment systems remediation of contaminant impairments.** Total Maximum Daily Load Conf. (Ft. Worth, TX, Mar. 2002) Proc. Total Maximum Daily Load Conf. (2002).

Kalita, P. K., J. R. Trask, and M. S. Kuhlenschmidt. **Runoff, sediment, and pathogen transport patterns with varying rainfall and slope conditions.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Kalita, P. K., J. R. Trask, M. S. Kuhlenschmidt, and S. J. McLaughlin. **Controlling pathogens and nutrients in runoff from animal production facilities.** Animal Residuals 2002 Conf. (Washington, DC, May 2002) Proc. Animal Residuals 2002 Conf. (2002).

Kim, K. and P. K. Kalita. **The influence of temporal observation scale in TOPMODEL application.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Miller, P. S., B. A. Engel, R. H. Mohter, J. K. Mitchell, and P. K. Kalita. **A data-mining approach to assessing scale response in water-quality constituent evolution.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Mitchell, J. K., P. K. Kalita, R. A. Cooke, and M. C. Hirschi. **Surface runoff occurs only occasionally from an upland drainage watershed.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Singh, J., R. J. Hudson, R. A. Cooke, M. C. Hirschi, T. R. Ellsworth, and G. Z. Gertner. **Simulating hydrology and water quality from unmonitored tile-drained fields.** ASAE Ann. Intl. Mtg. (Chicago, IL, Jul. 2002).

Theses

Food and Bioprocess Engineering

Cabrales, L. **Starch hydrolytic rates and glucose yield of selected corn hybrids.** M.S. thesis, S. R. Eckhoff, advisor (2002).

Lopez, Y. **Evaluation of corn hybrid testing for masa products.** M.S. thesis, S. R. Eckhoff, advisor (2002).

Templin, T. **Membrane filtration of coproduct streams from laboratory scale enzymatic wet milling.** M.S. thesis, K. D. Rausch, advisor (2002).

Instrumentation and Control

Tang, L. **Machine vision systems for real-time plant variability sensing and in-field application.** Ph.D. thesis, L. Tian, advisor (2002).

Off-Road Equipment Engineering

Adams, B. **Central tire inflation for agricultural vehicles.** Ph.D. thesis, J. F. Reid, advisor (2002).

Kim, Y. **Real-time nitrogen detection system of corn crop using a multi-spectral imaging sensor.** Ph.D. thesis, J. F. Reid, advisor (2002).

O'Brien, J. **Intelligent vision system for detection of protozoa on microscope slides.** Ph.D. thesis, J. F. Reid, advisor (2002).

Qiu, H. **Navigation control for autonomous tractor guidance.** Ph.D. thesis, Q. Zhang, advisor (2002).

Site-Specific Agriculture

Thorp, K. **Remote-sensing-based herbicide application.** M.S. thesis, L. Tian, advisor (2002).

Soil and Water Resources

Trask, J. **Transport of *Cryptosporidium parvum* in overland and near-surface flow.** M.S. thesis, P. K. Kalita, advisor (2002).

Wildman, T. **Design of field-scale bioreactors for bioremediation of nitrate-N in tile drainage effluent.** M.S. thesis, R. A. Cooke, advisor (2002).

Water Quality

Harbourt, C. **A vadose zone field study: subsurface tile drainage, hydrology, and variability.** Ph.D. thesis, M. C. Hirschi, advisor (2002).

Awards and Honors

Robert A. Aherin

Educational Aids Competition Blue Ribbons, American Society of Agricultural Engineers, 1980 (3), 1981 (4), 1982 (3), 1984 (3), 1986 (2), 1988, 1989, 1990
Maynard Coe National Agriculture Safety Award, National Institute for Farm Safety, 1980
Outstanding Young Men of America Award, National Jaycees, 1981
Honorary State Farmer Degree, Minnesota FFA Association, 1983
Outstanding Service Award, American Lung Association, 1983
Agriculture Safety Professional-of-the-Year Award, Minnesota Safety Council, 1983
Packer Engineering Safety Award, American Society of Agricultural Engineering, 1987
Teaching Award, Program, American Society of Agricultural Engineers, 1989
Young Faculty Award for Excellence in Extension, University of Illinois College of Agriculture, 1993
Outstanding Alumni Award, College of Applied Sciences and Technology, Illinois State University, 2002

Loren E. Bode

Fellow, American Society of Agricultural Engineers, 1992
Educational Aids Competition Blue Ribbons, American Society of Agricultural Engineers, 1976, 1981, 1982, 1985, 1986, 1988, 1993
Paper Award, Honorable Mention, American Society of Agricultural Engineers, 1982
Young Extension Worker Award, American Society of Agricultural Engineers, 1983
Senior Faculty Award for Excellence in Extension, University of Illinois College of Agriculture, 1990
Midwest Agricultural Chemical Association Educator's Award, 1991
Paul A. Funk Achievement Award, University of Illinois College of Agriculture, 1993

Douglas L. Bosworth

Fellow, American Society of Agricultural Engineers
President, American Society of Agricultural Engineers, 1992-1993
General Electric Scholar, University of Illinois College of Engineering, 1998-2000

Philip Buriak

Teaching Award of Merit, National Association of College Teachers of Agriculture, 1986
Honorary American Farmer Degree, National FFA Organization, 1987
Paper Award, Outstanding Research Presentation, National Agricultural Education Research Meeting, 1988
Teaching Excellence Award, University of Illinois Department of Agricultural Engineering, 1989, 1992, 1994
Karl E. Gardener Outstanding Undergraduate Advising Award, University of Illinois College of Agriculture, 1993
Author of the Year, 1st Runner Up, *Journal of Agriculture Education*, 1994
Author of the Year, 2nd Runner Up, *Journal of Agricultural Education*, 1997
Honorary Illinois Farmer Degree, Illinois Association FFA, 1997
Teaching Academy of Excellence, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 1997-2002
Teaching Award of Excellence, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 1997
Senior Teaching Award of Excellence, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 1999
Campus Award for Excellence in Undergraduate Teaching, University of Illinois, 1999
National Award for Excellence in College and University Teaching, U.S. Department of Agriculture, 1999
Distinguished Teacher/Scholar, University of Illinois, 2000
Paul A. Funk Recognition Award, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2001

Leslie L. Christianson

Teaching Excellence Award, University of Illinois Department of Agricultural Engineering, 1987, 1991
Andersen Consulting Award for Excellence in Advising, University of Illinois College of Engineering, 1989, 1990, 1991
Stanley H. Pierce Award, University of Illinois College of Engineering, 1989
Paper Award, American Society of Agricultural Engineers, 1994

Richard C. Coddington

Teaching Excellence Award, University of Illinois Department of Agricultural Engineering, 1988, 1992
Amoco Award for Innovative Teaching, 1991

Richard A. Cooke

Dissertation Research Award, Virginia Polytechnic Institute and State University Chapter of Sigma Xi, 1995

James O. Curtis, Emeritus

Fellow, American Society of Agricultural Engineers

Donald L. Day, Emeritus

Fellow, American Society of Agricultural Engineers
Paper Reviewers Award, American Society of Agricultural Engineers, 1989
Certificate for Distinguished Paper, University of Guadalajara, Mexico, 1990
Research Fellowship, Japan Society for Promotion of Science Travel, 1992

Steven R. Eckhoff

Dow Outstanding Young Educator Award in the Midwest Region, American Society for Engineering Education, 1986
Kansas State University Presidential Lecturer, 1986, 1987
Outstanding Paper in Cereal Chemistry Award, Corn Refiners Association, 1989
Research Fellowship, Corn Refiners Association, 1990, 1991
Teaching Excellence Award, University of Illinois Department of Agricultural Engineering, 1993
Excellence in Teaching Award, American Association of Cereal Chemists, 1999

Ted L. Funk

Outstanding Program Team Award in Extension, University of Illinois College of Agriculture, Consumer and Environmental Sciences, 1999
Sustained Excellence in Extension Programming, University of Illinois College of Agriculture, Consumer and Environmental Sciences, 1999

Carroll E. Goering, Emeritus

Fellow, American Society of Agricultural Engineers
Outstanding Technical Paper Awards, American Society of Agricultural Engineers, 1985, 1990, 1992; honorable mention, 1986, 1989
Everitt Award for Teaching Excellence, University of Illinois College of Engineering, 1986

Senior Faculty Award for Teaching Excellence,
University of Illinois College of Agriculture, 1994
Paul A. Funk Recognition Award, University of Illinois
College of Agricultural, Consumer and Environmental
Sciences, 1996
Massey-Ferguson Award, American Society of
Agricultural Engineers, 2001

Tony E. Grift

Superior Paper Award, American Society of Agricultural
Engineers, 2002

Alan C. Hansen

Paper Award, Outstanding Technical, American Society
of Agricultural Engineers, 1990
Silver Medal for Academic Achievement, South African
Institute of Agricultural Engineers, 1990
Silver Medal for Best Publication of the Year, South
African Institution of Mechanical Engineers, 1992
Silver Medal for Best Paper Published, South African
Institute of Agricultural Engineers, 1992
Faculty Award for Excellence in Teaching, University of
Natal, Faculty of Engineering, South Africa, 1994,
1996
Teaching Excellence Award, American Society of
Agricultural Engineers Student Branch, University of
Illinois, 2002

Michael C. Hirschi

Paper Reviewers Award, American Society of
Agricultural Engineers, 1988
Educational Aids Competition Blue Ribbons (5), American
Society of Agricultural Engineers, 1991 (3), 1994, 1998
Early Career Award, Epsilon Sigma Phi Alpha Nu
Chapter, 1992
Young Faculty Award for Excellence in Extension,
University of Illinois College of Agricultural,
Consumer and Environmental Sciences, 1995
Teaching Excellence Award, University of Illinois
Department of Agricultural Engineering, 1997
Certificate of Excellence, American Society of
Agronomy Education Materials Contest, 1998
Accenture Consulting Outstanding Advisor Award,
University of Illinois College of Engineering,
2000, 2001

Donnell R. Hunt, Emeritus

Fellow, American Society of Agricultural Engineers

Donald G. Jedele, Emeritus

Fellow, American Society of Agricultural Engineers
Rural Builder Hall of Fame, Rural Building News, 1987
Certificate of Merit, Illinois Farm Electrification
Council, 1988

Benjamin A. Jones, Jr., Emeritus

Fellow, American Society of Agricultural Engineers

Prasanta K. Kalita

Research Excellence Award, Iowa State University,
1992
Advisor of the Year, Kansas State University College of
Engineering, 1996
Who's Who in Science and Engineering, 1996
Most Outstanding Advisor of the Year, Kansas State
University BAE Department, 1997
Outstanding Kansas State University Instructor and
Advisor by K-State Mortar Board, 1997
Who's Who Among America's Teachers, 1998, 2000
Finalist, President's Outstanding Advisor Award, Kansas
State University, 1999
Collins Scholar, The Academy for Excellence in
Engineering Education, University of Illinois, 2000,
2001
Teaching Excellence Award, American Society of
Agricultural Engineering Student Branch, University
of Illinois, 2002
Outstanding Engineering Advisor, University of Illinois
College of Engineering, 2002

J. Bruce Litchfield

Andersen Consulting Award for Excellence in Advising,
University of Illinois College of Engineering, 1989,
1993
Teaching Excellence Award, University of Illinois
Department of Agricultural Engineering, 1990
Everitt Award for Teaching Excellence, University of
Illinois College of Engineering, 1991
Research Fellowship, Corn Refiners Association, 1991
Young Faculty Award for Excellence in Teaching,
University of Illinois College of Agriculture, 1992
A. W. Farrall Young Educator Award, American Society
of Agricultural Engineers, 1993
University Scholar, University of Illinois, 1994
Engineering Council Advisors List for Outstanding
Advising, University of Illinois, 1995
Faculty Award for Excellence in Research, University of
Illinois College of Agricultural, Consumer and
Environmental Sciences, 1996
Collins Award for Innovative Teaching, University of
Illinois College of Engineering, 1997
Harriet and Charles Luckman Undergraduate
Distinguished Teaching Award, University of Illinois,
1997

J. Kent Mitchell, Emeritus

Fellow, American Society of Agricultural Engineering
Educational Aids Competition Blue Ribbons, American Society of Agricultural Engineers, 1972, 1975, 1979, 1984

Alpha Zeta Outstanding Instructor, University of Illinois College of Agriculture, 1986

Teaching Excellence Award, University of Illinois Department of Agricultural Engineering, 1986

Everitt Award for Teaching Excellence, University of Illinois College of Engineering, 1987

Faculty Award for Excellence in Teaching, University of Illinois College of Agriculture, 1989

Paul A. Funk Recognition Award, University of Illinois College of Agriculture, 1994

Honorary Badge, Warsaw Agricultural University (Warsaw, Poland), 2001

Hancor Soil and Water Engineering Award, American Society of Agricultural Engineers, 2002

Arthur J. Muehling, Emeritus

Fellow, American Society of Agricultural Engineers
Educational Award, Illinois Pork Producers Association, 1974

Paul A. Funk Award, University of Illinois College of Agriculture, 1979

Farm Builder Hall of Fame, Rural Builder Magazine, 1984

University of Illinois Cooperative Extension Award for Sustained Excellence, 1985

Bernon G. Perkins Award, National Farm Builders Association, 1993

Elwood F. Olver, Emeritus

Fellow, American Society of Agricultural Engineers

Marvin R. Paulsen

Fellow, Committee on Institutional Cooperation, 2000-2001

Fellow, American Society of Agricultural Engineers, 2002

Andersons/NC-213 Grain Quality Research Award, 2002

Roscoe L. Pershing

Fellow, American Society of Agricultural Engineering

William H. Peterson, Emeritus

Appreciation Plaque, South Dakota Rural Electric Member Services Association, 1977

Certificate of Appreciation, Illinois Farm Electric Council, 1981

Educational Aids Competition Blue Ribbons, American Society of Agricultural Engineers, 1981, 1983, 1987
Certificate of Merit, Illinois Electric Council, 1996

Hoyle B. Puckett, Emeritus

Fellow, American Society of Agricultural Engineers

Errol D. Rodda, Emeritus

Stanley H. Pierce Award, University of Illinois College of Engineering, 1977

John C. Siemens, Emeritus

Educational Aids Competition Blue Ribbon, American Society of Agricultural Engineers, 1985

Agronomic Educational Material Publication, American Society of Agricultural Engineers, 1992

Senior Faculty Award for Excellence in Extension, University of Illinois College of Agriculture, 1993

John Deere Gold Medal Award, American Society of Agricultural Engineers, 1999

Lei Tian

Novel Academic Idea Award for Young Faculty, Jilin University of Technology, 1988

Recipient, Novel Academic Idea Award for Young Educator, Jilin University of Technology, 1989

Nominee, CGS Award for Most Distinguished Dissertation of the Program, Department of Biological and Agricultural Engineering, University of California at Davis, 1995

Nominee, Kinsella Memorial Prize, University of California at Davis, 1995

Nominee, University Microfilms International Distinguished Dissertation Award in Mathematics and Physics and Engineering, University of California for National Council of Graduate Schools, 1995

Outstanding Accomplishment of Training on Teaching College, University of Illinois College of Agricultural, Consumer and Environmental Sciences Academy of Teaching Excellence, 1997

Honorable Mention for the Graduate College of Outstanding Mentor Award, University of Illinois College of Graduate Studies, 1999-2000

Superior Paper Award, American Society of Agricultural Engineers, 1999-2000

Faculty Fellow, National Center for Supercomputing Applications, University of Illinois, 2000-2001

Roger R. Yoerger, Emeritus

Fellow, American Society of Agricultural Engineers

Past National President, Phi Kappa Phi

Massey-Ferguson Award, American Society of Agricultural Engineers, 1989

Qin Zhang

General Electric Scholar, University of Illinois College of Engineering, 1998

Collins Award for Innovative Teaching, University of Illinois College of Engineering, 1999

Information and Electrical Technologies (IET) Division Select Paper Award, American Society of Engineers, 2001

SCI Control Systems Best Paper Award, World Multi-Conference on Systemics, Cybernetics and Information (SCI), 2001

Fellow, National Center for Supercomputing Applications, 2002

Yuanhui Zhang

Outstanding Paper Award, American Society of Agricultural Engineers, 1989

Honorarium Professorship, Beijing University of Agricultural Engineering, China, 1994

Honorarium Professorship, Shandong Institute of Technology, China, 1994

Everitt Award for Teaching Excellence, University of Illinois College of Engineering, 1997

General Electric Scholar, University of Illinois College of Engineering, 1997

Blue Ribbon Award, American Society of Agricultural Engineers, 1998

Teaching Excellence Award, University of Illinois Department of Agricultural Engineering, 1999