

2008 SUMMARY OF ENGINEERING RESEARCH

A Report of Activities during 2007

This report is part of the larger *2008 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 2007 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 journal articles, papers, and books listed in this report. Information about technical reports is available from the Engineering Documents Center, Grainger Engineering Library Information Center, 1301 West Springfield Avenue, Urbana, IL 61801, USA. To search the center's collection on the Internet, please visit the website at search.grainger.uiuc.edu/top. Copies of these 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.

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Abbreviation key for College of Engineering departments and major labs:

- Aerospace Engineering (Aerosp. Engr.)
- Agricultural and Biological Engineering (Ag. & Biol. Engr.)
- Bioengineering (Bioenr.)
- Chemical and Biomolecular Engineering (Chem. & Biomol. Engr.)
- Civil and Environmental Engineering (Civil & Environ. Engr.)
- Computer Science (Comput. Sci.)
- Coordinated Science Laboratory (CSL)
- Electrical and Computer Engineering (Elect. & Comput. Engr.)
- Frederick Seitz Materials Research Laboratory (FS-MRL)
- General Engineering (Gen. Engr.) or Industrial & Enterprise Systems Engineering (Indus. & Enter. Syst. Engr.)*
- Information Trust Institute (ITI)
- Materials Science and Engineering (Mat. Sci. & Engr.)
- Mechanical and Industrial Engineering (Mech. & Indus. Engr.) or Mechanical Science and Engineering (Mech. Sci. & Engr.)*
- Micro and Nanotechnology Laboratory (MNTL)
- Nuclear, Plasma, and Radiological Engineering (Nucl., Plasma, & Radiol. Engr.)
- Physics
- Theoretical and Applied Mechanics (Theoret. & Appl. Mech.)*

*In August 2006, the Industrial Engineering program was merged with the General Engineering Department, which became the Industrial and Enterprise Systems Engineering Department. The Theoretical and Applied Mechanics Department merged with the Mechanical and Industrial Engineering Department, which became the Mechanical Science and Engineering Department. Please check department links at www.engr.uiuc.edu for current faculty lists.



Agricultural and Biological Engineering

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Principles from many scientific and engineering disciplines are applied to address opportunities and problems of agricultural and biological productions, processing, and utilization. Life and engineering sciences are developed, applied, and integrated for analyzing and designing bio-based systems (the concept of “integrating life and engineering,” i.e., using life sciences as resources for engineering work and vice versa). The overarching goal of agricultural and biological engineering work is to “enhance complex living systems” involving agriculture, food, environment, and energy.

The department is organized into five sections: Bioenvironmental Engineering, Food and Bioprocess Engineering, Off-Road Equipment Engineering, Soil and Water Resources Engineering, and Biological Engineering. The research program areas of the department include Bio-Based Processing and Production Systems; Biomass and Renewable Energy; Precision and Information Agriculture; Agricultural and Biosystems Management; Agricultural Safety and Health; Food Quality and Safety; Environmental Stewardship; Land and Water Resources; Spatially Distributed Systems; Structure and Facilities for Living Systems; Indoor Environmental Control; Bio-sensors, Bio-instrumentation, Bio-informatics, and Bio-nanotechnology; Intelligent Machinery Systems; Automation of Biological Systems; and Advanced Life Support Systems.

More cooperation with industries that purchase, transport, process, and package agricultural commodities has broadened the scope of agricultural and biological engineering research, especially in the development of intelligent monitoring sensors and process control systems. 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 the U.S. food and agricultural system competitive in the world market. Additionally, new processes, new products, new uses, and new markets are being sought for

using abundant agricultural commodities in achieving sustainable energy utilization and environmental quality.

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

Agricultural safety and health, safety behavior analysis, confined space safety, using sensors in safety systems, older farm safety issues, disabled farmers

Kaustubh D. Bhalerao

Biological nanotechnology, probabilistic methods, synthetic biology

Loren E. Bode

Spray atomization, transport, and deposition; spray nozzle design, spray drift reduction

Philip Buriak, Emeritus

Technical systems management, learning theory, implications to college teaching

Leslie L. Christianson, Emeritus

New product development; engineering design; agricultural buildings; heating, ventilation, and air-conditioning; air quality; swine facilities

Richard A. Cooke

Subsurface drainage, vadose zone water and contaminant transport, modeling of watershed-scale drainage systems

Mary-Grace Danao

Biosensor technology, biocatalysis and optics

Steven R. Eckhoff

Corn fractionation, wet milling, dry milling, ethanol production, hybrid specific processing, process economics, biomass storage and processing

Bruce Elliott-Litchfield

Food engineering

Ted L. Funk

Livestock confinement structures, indoor climate control systems for livestock, manure management systems, residential housing structures, indoor air quality

Tony E. Grift

Sensors and controls in biosystems automation, machine vision systems, agricultural data acquisition systems, mathematical modeling and control, granular mass flow measurement

Alan C. Hansen

Biofuels for diesel engines, simulation modeling of material handling systems, off-road machinery systems, precision agriculture

Joe G. Harper

Technical systems management

Michael C. Hirschi

Erosion and sediment control, water quality

Prasanta K. Kalita

Hydrology, watershed-water quality modeling, pathogen transport, erosion and sediment control

Marvin R. Paulsen

Food and bioprocess applications, grain quality measurements, near-infrared and FT-NIR spectroscopy

Kent D. Rausch

Recovery of nutrients from bioprocesses, corn quality effect on co-product value, variability of co-product quality, co-product quality for human and animal consumption

Luis F. Rodriguez

Modeling and analysis of biological systems, reliability and sustainability, decision support, life support systems, integrated controls

Lance C. Schideman

Water and wastewater treatment, adsorption and membrane bioreactor processes, integrated water reuse systems, algae-based bio-energy, intelligent water infrastructure, pharmaceuticals and other emerging water contaminants

Vijay Singh

Engineering economic analysis and modeling of bioprocesses, design of processes for corn fractionation and ethanol production, recovery and concentration of nutraceuticals and biobased products

Lei Tian

Sensors and information systems for precision agriculture, applied machine vision, remote sensing, variable-rate technology

K. C. Ting

Automation; systems informatics and analysis; biomass production engineering; bioenergy; computerized simulation, optimization, and decision support

Xinlei Wang

Air quality, diesel engine emission control, renewable energy, building environment control and energy efficiency, system modeling

Yuanhui Zhang

Indoor air quality; effect of indoor air quality on occupants; sensor technology for bioenvironmental systems; heating, ventilation, and air-conditioning control; waste treatment

Qin Zhang

Off-road vehicle mechatronics, machinery systems for bioproduction, electrohydraulic systems control, computer-integrated agricultural systems, sensors and instrumentation

Advanced Life Support Systems

Coupled Analysis of Life Support Systems Reliability Modeling for Robustness and Cost

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Reliability is a major issue in the design of long-term space missions. Reliability and stochastic performance of life support unit processes have been modeled and integrated into a system simulation to study their effect on system

* Denotes principal investigator.

design. Several preventive and corrective maintenance plans are considered with various contingency plans currently proposed for long-term space missions. The objective will be to determine the relationship of system cost with improvements in system reliability. Validation is sought through the development of new theoretical models for reliability prediction.

Validation of Life Support System Optimization Result

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*National Aeronautics and Space Administration,
University of Illinois*

Validation of optimization techniques is a key step toward providing a robust infrastructure for future life support systems. The complexity of the system and the enormous search space create some inherent challenges to finding reliable optima. Heuristic tools are proposed for optimization by leveraging expert knowledge in identifying where in the search space optima exist. The focus of this work is to demonstrate that the application of heuristic tools on life support problems will find optima that are as useful as those identified using traditional analytical approaches.

Agricultural Infotronic Systems

Research on Agricultural Infotronic Systems

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U.S. Department of Agriculture Hatch Funds

This research is to establish an agricultural infotronics technology for production agriculture. This technology is aimed at providing farmers with “actionable” information for performing precision farming operations, such as “where and how much nitrogen to apply” while operating a sprayer in the field. Specific objectives include: design of a general framework of an agricultural infotronic system, which will consist of data collection, operation planning, and automatic implementation modules; development of core information processing algorithms, including information classification, fusion, and attributes tracking algorithms for handling production information; and validation of the developed agricultural systems in precision farming operations.

Agricultural Safety

Confined Space Entry Training for Agricultural Environments

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University of Iowa Great Planes Center for Agricultural Health; University School of Public Health; Carle Center for Rural Health and Farm Safety

This project will revise a confined space training one-day short course that was developed by the University of Illinois approximately ten years ago. The program will be evaluated for knowledge transfer, format acceptability and safe practice improvement. The course will be offered in the states of Illinois, Iowa, Missouri, and Nebraska. The primary audience will be agricultural businesses that service silos, grain storage structures, and livestock waste handling facilities.

Disabled Farmers Project

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University of Illinois; State of Illinois

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 Safety Mobile Program for Rural Youth

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National Children’s Center for Rural and Agricultural Safety and Health; Carle Center for Rural Health and Farm Safety

The project involves the development and evaluation of interactive agricultural safety and health training modules that are transported to rural communities in a converted mini bus. Community instructors will be trained in the second year of the project. The goal is to reach rural area youth who are not readily exposed to farm safety training. One targeted group is Amish youth. Approximately 12 training modules were developed for pilot testing. Project team members consulted with the Amish safety committee in Douglas and Moultrie counties in the development of the Amish portion of the project. Amish instructors were trained to deliver programs to Amish youth.

* Denotes principal investigator.

Occupational Exposures and Health Outcomes in Swine Confinement Facilities

L. Conroy,* R. A. Aherin, T. Schoonover, P. Scheff, S. Dorevitch, S. Erdal, D. Tessier, J. Franke, L. Forst, R. Cohen, L. Berman, D. Vinson, T. L. Funk, Y. Zhang
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*National Institute for Occupational Safety and Health;
University of Illinois School of Public Health*

The study evaluated worker's exposure to airborne contaminants, such as dust, bacteria, and ammonia, in a swine confinement facility. Measurements were taken that evaluated exposures by looking at symptoms and biological markers of inflammation before and after work. Each worker and control group participants completed a health history questionnaire. Each participant provided blood samples, exhaled air samples, and performed a lung function test. Tests were conducted before and after work for two consecutive workdays in the winter. Participants wore air-sampling devices that measured for dust, bacteria, and ammonia during their work shift. Data analysis is being completed.

Assistant Director for Agricultural Continuing Education

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Great Lakes Centers for Occupational and Environmental Safety and Health; University of Illinois–Chicago

This project is to assist in the assessment, planning, and implementation of agriculturally related health and safety programs and training that meet the Great Lakes Centers goals of providing graduate and professional education in occupational safety and health and continuing education.

Secretary–Administration

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National Institute for Farm Safety

This project is to assist the Board of Directors of the National Institute for Farm Safety by performing administrative functions as needed and as directed by the board. Assistance activities include minutes of board meetings, board member communications, board communications with members, member-to-member communications, and board and member communications as needed to outside entities.

* Denotes principal investigator.

Alternative Fuels

Impact of Biofuels on Emissions Reducing Technologies for Off-Road Diesel Engines

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U.S. Department of Agriculture Hatch Funds

Emissions reducing strategies and technologies are at the forefront of research and development efforts of all major diesel engine manufacturers in order to meet future Environmental Protection Agency regulations. Very little work has been done to investigate the use of these technologies in conjunction with biofuels such as biodiesel and E-diesel (ethanol-diesel blended) fuels. The purpose of this study is to evaluate the impact of biofuels on both present and emerging emissions reducing technologies for diesel engines. Preliminary results with the exhaust gas recirculation NOx emissions reducing strategy show that a greater rate of emissions reduction occurs with biodiesel fuel.

Graduate Automotive Technology Education (GATE) Center of Excellence: Advanced Automotive Bio-Fuel Combustion Engines

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U.S. Department of Energy

Increasingly stringent emissions regulations and concerns about U.S. dependence on foreign oil have generated an urgency to seek new technologies and fuels for automotive engines. The objective of this Center of Excellence is to create an education and research program that provides automotive engineers with knowledge and skills to be able to develop advanced engines for the future that can run on renewable biofuels such as ethanol and biodiesel. The curriculum will be based on courses drawn from both the mechanical engineering and agricultural and biological engineering disciplines with research projects relying on interdisciplinary expertise and facilities.

Investigation of Biodiesel Fueled Engines under Low Temperature Combustion Strategies

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U.S. Department of Energy

There is considerable interest in reducing U.S. reliance on imported petroleum. Biodiesel manufactured from vegetable oil is seen as a viable alternative to regular diesel. The objective of this research is to investigate a novel low-temperature combustion (LTC) strategy with biodiesel that

is able to simultaneously reduce regulated NO_x and particulate emissions while achieving high combustion efficiency. LTC combustion with biodiesel will be investigated via laser diagnostic and multidimensional modeling techniques. Experiments will be conducted in both optical and metal engines. Optimum strategies for reducing exhaust emissions and increasing the efficiency of biodiesel LTC engines will also be investigated.

Autonomy of Biological Systems

Holistic Modeling, Analysis, and Control of Modern Production Systems

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Dudley Smith Institute

The business of modern agricultural systems is increasingly complex. A preliminary model based on the existing cattle–corn rotation on the Dudley Smith Farm shall be developed to consider these complex interactions. From a systems perspective, this is a good candidate for several reasons. By rotating cattle onto the lands, diversity is introduced into the system. System diversity is likely to be beneficial to overall system stability by offering more opportunities. Effectively, the producer will have more options. Profits can be assured more reliably. However, managing a complex system has trade-offs, including requiring tighter system controls and better decision making.

Bottom-Up Models of the Photosynthesis from the Molecular Scale to Canopy Scale

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University of Illinois

The modeling of biosystems at all scales has been initiated with the developments of pathway models of photosynthesis. The intention is to integrate these molecular scale models with existing leaf and canopy scale models. The integrated multiscale model should improve the ability to simulate crop biosystems at different levels such as molecular, organelle, cellular, tissue, organism, and community. The immediate challenge here includes the identification of critical information that must be exchanged between models at different scales, while the long term goal is the integration within a large complex model such as an agroecosystem model.

Bioenvironmental Engineering

Development of Improved Trailer Designs and Transport Management Practices to Improve the Microenvironment

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National Pork Board

Transport is the most influential pre-slaughter treatment because it affects both meat quality and profit in pork production. It is estimated that 80,000 pigs die annually during transport, at a cost of 8 million dollars to the industry. The objectives of this project are to measure the environmental conditions experienced by finishing pigs under typical transport conditions and to develop a model to predict the changes in microenvironment. This study will provide the basis for new trailer designs and management practices that will lead to improved environmental conditions during transport. Ultimately, this will reduce losses and improve animal welfare in transit.

Effect of Variability in Gestation Stall Micro Environment on Sow Well-Being, Physiology, and Productivity

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Illinois Council for Food and Agricultural Research

Variations in the microenvironment in commercial sow gestation facilities have an adverse impact on the well-being of the sow, which in turn affects the reproductive success and overall profitability and sustainability of the industry. Understanding the relationships between microenvironmental exposure of the sow and its impact on well-being, as measured by physiological, immunological, reproductive, and behavioral responses will directly benefit the pork industry in Illinois and the nation. A unique research facility will be developed to allow us to pursue scientific questions related to animal production facilities and translate the results into producer profitability.

Development of a New Low-Reynolds-Number Turbulence Model for Indoor Air Flows

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U.S. Department of Agriculture; University of Illinois

Information on air motion in a ventilated room is very important for study of contaminant transport and indoor air quality. During the past several decades, computational fluid dynamics (CFD) based on turbulence modeling has

* Denotes principal investigator.

become a very powerful tool in the prediction of indoor airflows. However, their applications are limited due to low Reynolds number effects that are very common in full-scale indoor airflows. In this project, low-Reynolds effects are combined into RANS turbulence models by introducing the intermittency factor that reflects the ratio of turbulence and nonturbulence. The model will predict the transitional flow behaviors.

Diesel Emission Reduction for Champaign-Urbana MTD

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U.S. Environmental Protection Agency; Champaign-Urbana Mass Transit District (CUMTD)

In this project, we work with CUMTD, EPA, and Cummins to develop technology for retrofitting public transit buses to reduce diesel emissions in the metropolitan area of Champaign-Urbana. This project will develop a program appropriate for midwestern conditions that can be replicated to retrofit other mass transit fleets in other cities. These activities will increase public understanding of the environmental or economic effectiveness of the demonstrated clean diesel technology. More importantly, this project will improve ambient air quality and achieve significant health benefits to the public by reducing the number of illnesses, health care costs, and missed work/school days.

Engine Emission Control and Aftertreatment On-Board Diagnosis

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International Truck and Engine Corporation

In order to meet the EPA emission regulations, some control devices, such as an oxygen catalytic converter, diesel particulate filter, and lean NO_x trap (LNT), will be required. However, such “add-on” devices can experience deterioration and malfunction that can go unnoticed by both the driver and repair technician. Those types of malfunctions could result in high emissions without a corresponding adverse drivability or fuel economy impact. This problem could be avoided by incorporating a well-designed OBD-II system to detect emission system malfunctions. In this project, we are investigating various diagnostic methods to develop an aftertreatment OBD-II system for 2010 applications.

Evaluate Occupational Exposure to Contaminants in Truck Cabins

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National Institute for Occupational Safety and Health (NIOSH); Illinois Occupational and Environmental Health and Safety Education and Research Center (Illinois ERC)

Trucking has become one of the most important industries in the United States. There were over 3 million truck drivers in the United States in 2004. Concerns about the occupational health and safety of truck drivers are rising as more and more professional drivers join the trucking industry. This project is to study the air quality in truck cabins to improve the understanding of a major occupational health and safety issue confronting truck drivers. It could ensure a healthy and productive work force in the commercial transport sector and lower health care costs.

Hydrogen Production from Animal Manure by Using Mediator-Less Microbial Fuel Cell

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University of Illinois Campus Research Board; U.S. Department of Agriculture

One big challenge to keeping the livestock industry sustainable is to utilize animal manure as an alternative energy source instead of an environmental liability. In this project, we investigate the feasibility of hydrogen production from animal manure by using mediator-less microbial fuel cells. We apply microbial fuel cells (MFCs) to generate hydrogen from the animal manure. Unlike previous researchers, our focus particularly will be on the engineering aspects including reactor design, operating conditions, and mass transfer. The final objective is to develop an optimum reactor design and efficient operating conditions for future applications.

Modeling of Dust Spatial Distribution in Indoor Environment

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One of the challenges in indoor air quality research is to study the dust spatial distribution so that the nature of dust transport can be better understood and appropriate control strategies can be implemented. Numerical modeling will enhance the understanding of the mechanisms of dust transport and provide useful information to control dust sources, improve the design of ventilation systems, and

* Denotes principal investigator.

implement the mitigation technologies. A mathematical model was developed based on mass-balance of particulate matter. The numerical simulation indicated that the dust spatial distribution was highly related with the airflow pattern, dust source strength, and gravitational sedimentation of particles.

Physical, Chemical, and Biological Characterizations of Particulate Matter from Confinement Livestock Buildings

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U.S. Department of Agriculture, National Research Initiative

Particulate matter (PM) emitted from confinement animal feeding operations (CAFOs) contains harmful components that can have an adverse influence on human and animal health as well as the environment. The objective of this project is to characterize the physical, chemical, and biological properties of PM from CAFOs and to establish a comprehensive database of PM properties so that adverse health and environmental effects can be assessed, and appropriate mitigation technologies can be developed and deployed. This database will also provide useful data for the development of regulations on PM emissions from confinement livestock buildings.

Quantification of Ventilation Effectiveness for Air Quality Control

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American Society of Heating, Refrigeration and Air Conditioning Engineers

The existing methods or procedures used to determine ventilation effectiveness are primarily for researchers to use, usually require sophisticated instrumentation, and are labor intensive. There is a lack of practical and economical methods for field engineers and researchers to quickly determine the ventilation effectiveness for zones of concern. The focus of this project is to analyze the existing ventilation effectiveness measurement techniques or procedures for production animal facilities and then to develop a practical method of measuring the ventilation effectiveness in animal facilities.

Aerodynamic Dust Collection System for Federal Signal Environmental Products

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Federal Signal Corporation

The goal of this project is to improve the dust collection efficiency so as to comply with the increasingly stringent EPA PM emission requirement. The immediate objectives of this project are focused on system analysis and simulation and prototype design. Analysis includes examining the existing design and performance, and simulation includes CFD and particle separation efficiency of the proposed prototype, in accordance to the design parameters and limitations provided by EPG. Considering results of the system analysis and simulation, the prototype design will be developed and evaluated in terms of dust collection efficiency (particle cutsize), pressure drop (power consumption), and dust loading capacity (maintenance requirement).

Continuous Thermochemical Conversion (TCC) of Livestock Manure to Produce Oil

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Council for Food and Agriculture Research of Illinois

A continuous TCC process is in development. This technology involves major changes in conventional waste handling processes, and there are no manufacturers currently supplying the systems needed for the process. We envision a single unit CTCC system being able to process manure of a 2,000 hog farm or an equivalent amount, and the unit should be no larger than a hot-water boiler in a residential house. The crude oil produced on the farm can be trucked to a central refinery for further process. This research can have important benefits to society.

Development of an Aerodynamic Deduster to Enhance Existing CP-CBR Filters and Reduce the CPS Logistics Burden

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United States Navy

The Navy has experienced deficiencies with shipboard CPS that lead to increased logistical burden and reduced protection capability. The CPS pre-filters, which under normal conditions require a change out every 3-6 months, become clogged within 1-2 weeks in dusty conditions. This project is aimed at further developing an aerodynamic air-cleaning device, called an aerodynamic deduster, to

* Denotes principal investigator.

address current capability gaps in CP. Applying an aerodynamic deduster system to CP can eliminate the current issues experienced in dusty environments, reduce maintenance cost, and provide enhanced capabilities to CBR filters.

Experimental and Numerical Investigation of Pollutants Transmission by Coughing or Sneezing in a Boeing 767 Cabin Mockup

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The National Institute for Occupational Safety and Health

In this project, we have developed a full-scale Boeing 767 aircraft cabin section, containing 35 dummies and capable of simulating the cabin environment under tarmac and cruise conditions. We have developed a 3-D volumetric particle tracking velocimetry (VPTV) technology to measure the cabin airflow under iso- and non-isothermal conditions and various obstruction conditions. We are focusing on measuring pollutant trajectories generated by coughing or sneezing from point-to-point in a spatial-temporal domain. The outcome of the study will allow scientists to gain a better understanding of airflow and pollutant transmission and, ultimately, to improve the air quality and human health within aircraft cabins.

Hydrothermal Process for Fiber Stream

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Archer Daniel Midland; Illinois Council for Food and Agricultural Research; U.S. Department of Energy

The long-term goal of this subproject is to develop and pilot-test the continuous thermal hydrolysis process and operating parameters to convert the fiber stream from corn milling and miscanthus into value-added products, or products that can be easily further processed (such as fermentation or thermochemical conversion). The short-term goal is to define key parameters for the fiber feeding system and the reactor for pilot plant development. A batch reactor and a laboratory-scale continuous reactor have been developed for the study.

Particle Characterization for Off-Road Machinery Cooling Systems

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Deere & Company

Dust and debris properties vary with different machine working environments, including harvesting different crops and construction. It is critical to have a clearer understanding of the physical properties, mechanical

behavior, and testing procedures to evaluate the performance of the air cleaning and cooling system. The objectives of this project are to characterize the physical properties and plugging mechanisms of different types of debris.

Physical Properties and Clogging Mechanisms of Typical Particles Encountered in Heat Exchangers

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Modine Manufacturing Co. United States Army

In order to improve the design and performance of heat exchangers, this study investigates the physics of different types of particles and their clogging mechanisms with typical coil fin configurations. At this phase of study, we aimed at determining physical properties (particle size, density, shape factors, bulk adhesion and/or shear stress) of typical types of reference particles (Arizona coarse dust, BEE testing dust, limestone, and a sandy-dust from the conflict regions), and develop a recipe for particles of interest for clogging tests. A wind tunnel that can measure clogging rate and heat transfer efficiency of cooling coils will be developed. Preliminary data of clogging for typical heat exchangers are also collected.

Size Distribution and Its Effect on Sampling Performance of Particulate Matter in Concentrated Animal Feeding Operations

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U.S. Department of Agriculture National Research Initiative

Particulate matter (PM) emitted from confined animal feeding operations (CAFOs) has increasingly become subject to state and federal air quality regulations. However, fundamental data regarding PM, such as particle size distributions (PSDs), do not exist or are not representative of CAFOs. This project is aimed at answering two fundamental questions: What are the PSDs in typical CAFOs? How does particle size distribution affect the existing particle sampling methods and regulations of agricultural operations? The expected outcome from this project will be a preliminary database for particle size distributions for concentrated animal feeding operations and a protocol to evaluate the performance of samplers used in agricultural operations.

* Denotes principal investigator.

Thermochemical Conversion Process to Produce Oil from Swine Manure

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National Pork Board

The ultimate goal of the proposed project is to commercialize the thermochemical conversion (TCC) process as a method to treat swine manure and to produce bio-oil. This proposed work investigates how swine manure type, source, and age affect oil yield and quality. Practical application of TCC to convert swine manure to oil requires direct integration of the process to existing swine facilities. This entails the use of manure from various sources depending on the manure handling and storage system available. Since feedstock composition is an important factor in the TCC process, it is important to assess any changes that may result from variations in swine manure composition. The results from this proposed work will provide critical information on how to integrate a farm-scale TCC unit to an actual swine farm and how to best process the manure generated from the farm.

Ventilation Equipment Testing Program in BESS Laboratory

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Ventilation Equipment Industry

This continuous program attracts more than 95% of agricultural ventilation fan manufacturers, and many other ventilation equipment companies test their products at the University of Illinois. An annual fan book is produced to report on research related to ventilation, airflow characterization, and equipment development. The program is managed through the Bioenvironmental Engineering Division and conducted within the Bioenvironmental Structure and Systems (BESS) Laboratory. The program has resulted in a 25% increase in fan efficiency across the United States in the past decade, and the income supports a full-time research engineer and several research assistants.

Biological Nanotechnology

Protein Biophysics

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Zein, a complex biopolymer from corn is an excellent example of the realities of working with biological materials. We are developing new light scattering tools and methodologies to probe some of the basic phenomena related to the aggregation of zein in various solvent conditions. This work will lead to an increased understanding of the nanoscale structure and colloidal properties of hydrophobic proteins.

Synthetic Biology

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The idea of manipulating gene expression networks at the sub cellular level has led to an unprecedented, rational, systems-based approach to designing genetic "circuits" in simple unicellular organisms. This opportunity will be made possible only through the development of suitable molecular tools and processes to effectively perturb, study, and reprogram genetic networks. Using novel synthetic networks, we are actively developing programmable gene expression systems that may be used in fundamental life sciences research and industrial biotechnology.

Biomass and Renewable Energy

Engineering–Economic System Models for Rural Ethanol Production Facilities

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The rural economy is bolstered by the explosion of small dry grind ethanol facilities in the size range of 35-70 million gallons per year. However, following the recent rapid increase in number of these small-sized dry grind facilities, extra care is required to confidently design and implement a sustainable ethanol production facility. A model is proposed to capture each of these aspects at the facility level and integrate them in a package capable of assisting decision making at two key levels: technology decisions for cooperative board members; and tax

* Denotes principal investigator.

incentive decisions in the legislature for handling of potential pollutants.

Biomass Production Engineering

Engineering Solutions for Biomass Feedstock Production

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This is a research program within the BP funded Energy Biosciences Institute at the University of California, Berkeley, University of Illinois at Urbana-Champaign, and Lawrence Berkeley National Laboratory. The program includes five interrelated tasks: pre-harvest crop production; harvesting; transportation; storage; and systems informatics and analysis. Systematic approaches are taken to evaluate existing technologies, characterize task features, identify information needs and researchable questions, develop prototypes and computer models, conduct experiments and computer simulations, analyze experimental data and simulation output, and deliver results in the forms of operational machinery design/prototype and decision support information/tools.

Food and Bioprocess Engineering

Optimizing Food and Fuel Production

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Concern over the use of corn for fuel at the expense of animal feed can be partially mitigated by harvesting the corn near physiological maturity (35-40% moisture, wb), where the stover has higher digestibility than in field dried corn. The study will compare ruminant digestibility corn stover harvested at different corn moistures and will evaluate methods to dry or preserve the high moisture corn.

Evaluation of Ethanol Production Technologies

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The fuel ethanol industry is rapidly growing and becoming more competitive. As a result, more value needs to be extracted from coproducts made with ethanol. This collaborative project seeks to understand the role of raw material (corn) in optimally producing ethanol and other bioproducts and to identify process methods that generate multiple coproducts with increased value. A small-scale (25g) dry grind procedure is being developed and evaluated to serve as a reference for the fuel ethanol and corn genetics industries. As new sources of genetic material are developed, the procedure will determine ethanol yields accurately.

Fractionation of Thin Stillage from the Dry Grind Process to Improve Water Recycling Rates and Heat Transfer Properties

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The dry grind process is used to produce fuel ethanol and results in one coproduct, distillers dried grains with solubles (DDGS). Knowledge is limited on thin stillage and wet grains that are used to produce DDGS; effects of process modifications on these process streams are unknown. Compositions of the thin stillage streams from modified processes will be affected; membrane filtration and heat transfer fouling characteristics are expected to be different. Our overall goal is to determine membrane filtration and heat transfer fouling characteristics to identify potential for increasing water recycle and reducing energy requirements during ethanol production.

Process Development to Recover Nutrients from Agricultural Solids

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Bioprocessing of agricultural materials typically uses an intensive amount of water. As a result, bioprocess streams carry nutrients in dilute quantities, causing difficult recovery and low or negative economic value of recovered solids. Conventional drying methods are inherently energy-intensive because of evaporation of water and other

* Denotes principal investigator.

solvents. This project investigates emerging technologies or technologies from other industries for use in bioprocesses that dewater, dry, or convert solids into higher valued products. Currently, work has applied membrane filtration technology to corn processes to conserve water and recover nutrients.

Altered Plant Compositions for Improved Biofuels Production

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This project involves developing improved cellulosic biomass to increase fermentable substrate and overcoming recalcitrance. Advanced saccharification and fermentation techniques will be used for converting this biomass into ethanol.

Commercial Trial of Enzymatic Wet Milling Process

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An enzymatic corn wet milling process being developed to reduce or eliminate sulfur dioxide (SO₂) requirements during steeping reduces steep time and produces starch yields comparable to conventional processes. Enzymatic milling reduces process time by 70% while maintaining product yields and quality. This technology has been licensed by Genencor International. Currently, we are working with corn wet milling processors in Malaysia, India, and Turkey to conduct commercial trials for enzymatic corn wet milling.

Developing Corn Hybrids for Dry Grind Ethanol Fermentation Processes

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Effect of corn genetics, planting population and post harvest conditions on modified dry grind processes will be evaluated for coproduct yields and fermentation profiles.

Enhanced DDGS from the Elusieve Process: Foodstuff for Nonruminants

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DDGS produced from the elusieve process as a foodstuff for nonruminants will be investigated. A process called elusieve has been developed to separate fiber from

distillers dried grains with solubles (DDGS). This process uses sieving and elutriation to separate fiber from DDGS. Separation in a dry grind ethanol plant increases protein and fat content and reduces fiber content in the resulting DDGS (enhanced DDGS). Enhanced and original DDGS will be evaluated by precision-fed rooster assay to determine total metabolized energy and true digestibility of amino acids. Digestible energy values of enhanced and original DDGS in 30-kg pigs will be measured.

Evaluation and Development of Enzymes for Modified Corn Dry Grind Processes

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In the proposed study, we will evaluate use of amylases and proteases in dry grind corn fractionation processes to improve rate of fermentation and increase ethanol yield. Use of corn fiber as feedstock for ethanol production will also be evaluated.

Evaluation and Scale Up Research Capability for Ethanol Processes

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In the proposed study, we will develop capabilities to evaluate several innovative dry grind ethanol processes such as use of granular starch hydrolyzing enzymes, corn fractionation prior to fermentation, use of transgenic corn with endogenous alpha amylases, and a simultaneous fermentation and distillation process at a pilot plant scale. We will generate coproducts for conducting poultry and swine feeding studies.

Modified Milling Technologies for Dry-Grind Ethanol

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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.

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Use of Transgenic Corn for Processing Facilities

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Syngenta Biotechnology, Inc.

A transgenic corn that produces high levels of endogenous amylase is being evaluated for dry grind corn processing. The enzyme is activated in the presence of water and high temperature. In a conventional process, exogenous alpha amylase enzymes are added during liquefaction to break down starch into dextrins. In this study, liquefaction and fermentation properties of transgenic corn are being tested using a small-scale laboratory dry grind procedure and compared to the fermentation properties of a control sample of isogenic corn.

Grain Qualities and Properties

Monitoring of Liquefaction in Dry Grind Ethanol Production with FT-NIR

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The objective of this study was to determine the effect of reaction time, initial enzyme dose, and corn hybrid on DE values at the end of liquefaction; and to investigate the feasibility of developing calibrations for predicting DE values using a Fourier-Transform Near-Infrared (FT-NIR) spectrometer. About 230 samples were scanned in duplicate in the range of 12000 to 4000 cm^{-1} (833 to 2500 nm) with a 2 cm^{-1} interval. Most of the variations in the spectra were in the region 7500 to 5500 cm^{-1} (1333 to 1818 nm) and 5200 to 4000 cm^{-1} (1923 to 2500 nm). The Unscrambler © (CAMO Software AS) software was used for regression analysis, and PLS1 and PCR methods were used for building the calibration. The model with lowest RMSEP (1.5% DE) was found by using the raw spectra with PLS1. Its offset was smallest with 1.4, and slope (0.89) was closest to 1.0 over the DE range from 5.4 to 22.4%. The PLS1 model had a RPD value of 2.7.

Life Support Systems Reliability and Sustainability

Early Life Testing for Costly Life Support Systems

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Conducting life testing and addressing reliability of life support systems are frequently challenging due to extremely high cost of test items, the scarcity of test items, or the risk of endangering test subjects. When considering implementation of life testing, it is critical to control costs and risks. Furthermore, it is possible that the subsequent analysis of test data may not yield worthwhile results unless careful experimental designs and controls are utilized. To address this need, a new statistical model for use with the design of experiments is under development that is suited to the life testing of high-cost, high-risk hardware and systems.

Integrated Modeling of Life Support Systems Modeling for Reliability and Robustness

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Robustness is often reduced to hardware reliability. However, the operation of a system has a great deal of impact on its robustness. Robust operation will be a combination of manual operations supported by software and automated operations supported by people. We will look at increasing the robustness of life support systems by applying the appropriate mix of people and software; model-based techniques for diagnosis, prognosis and control; and procedural techniques for support manual operations. Integrated models will be developed to analyze a wide array of design architectures for the consideration of their inherent reliability and robustness.

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Modeling and Analysis of Biological Systems

Wetland Modeling Frameworks

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The study of wetland microbial community dynamics involves monitoring and controlling the composition of the microbial community (MCC). The MCC is affected by climatic, meteorological, physical, and chemical changes. Some of these changes could be developed, not only by the ecosystem forces of the lakes, but also by anthropogenic disturbances and global change issues. Little is known about changes in community composition over annual time scales due to their interaction with ecological factors. Modeling frameworks are under development to predict the behavior of the microbial communities over different time scales for the purpose of designing and controlling ecosystem services.

Off-Road Equipment Engineering

Corn Root Evaluation System

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Pioneer Hi-Bred International, Inc.

A system was developed to efficiently image a large number of corn roots. The images were stored and characterized using qualifiers such as fractal dimension and entropy. The qualifiers allow for distinguishing among corn genotypes, and it is anticipated that they can be used to identify genetic markers that have distinct effects on the root development of corn plants under varying soil conditions. A database was developed containing root morphology images featuring a wide spectrum of corn genotypes grown under diverse field conditions (e.g., different plant densities, altered nutritional status, drought, flooding, presence of soil borne diseases, and pests).

Investigation on Automatic Tuning and Adaptive Control Technologies for Intelligent Vehicle Path Tracking

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To obtain a high maneuvering performance on ground vehicles, researchers have developed many high-level controllers, including but not limited to PID, feedforward-

PID, fuzzy, sliding mode, and LQR. This study intends to identify relevant approaches and research results of a few selective controllers; identify the strengths and weaknesses of each candidate; and recommend approaches and construct guidelines for vehicle controllers. Some representative controllers will be implemented on a laboratory-scale, hardware-in-the-loop control system simulator to provide preliminary validation on the results.

Study of Control Methods on Electrohydraulic System Performance

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The primary goal of this project is to study the influences of various system parameters on the responses and overall performance of a typical electrohydraulic control system. More specifically, the influences of a few variable delays, such as sensor delay and loop time delay, are targeted to be studied on a hardware-in-the-loop electrohydraulic simulator. In addition, the simulation-experiment integrated system can be modified and adopted as a laboratory exercise module in teaching an undergraduate and graduate electrohydraulic system controls course at the Department of Agricultural and Biological Engineering, University of Illinois at Urbana-Champaign.

Robotics

Development and Evaluation of High Efficiency, Flexible, Intelligent Farming Tools: Phase I—Autonomous Weed Control

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We propose to develop a flexible weeding system that is capable of identifying weeds and treating them according to their response to glyphosate (Roundup). Weeds that are responsive to glyphosate will be treated chemically, whereas resistant weeds (in particular waterhemp) will be treated mechanically. The operations will be carried out by autonomous robots that have wireless Internet connectivity to facilitate access to a weed image database as well as miscellaneous data gathering (for instance weather data) and remote monitoring of performance.

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Modeling and Analysis for High Efficiency, Flexible, Intelligent Farming Tools: Phase I—Autonomous Weed Control

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The purpose of this project is to supplement weed control methods as an alternative in scenarios where chemical usage is no longer feasible. This work will focus on the identification of a key set of novel robotic and agronomical innovations through iterative simulation and experimentation aimed at improving agricultural production systems by increasing efficiency, reducing manpower needs and energy requirements, and increasing environmental and economic sustainability. A meta-data analysis is the current focus of this work, leading to the provision of an infrastructure for a flexible modeling platform capturing the stated issues.

Site-Specific Agriculture

Precise Application of Agricultural Chemicals

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Improvements in the application of agricultural chemicals are needed to improve the safe and efficient application of agricultural chemicals. New nozzle designs, sensors and control systems for agricultural sprayers have the potential to improve deposition efficiency with a corresponding decrease in spray drift. The objective of this project is to develop new technology, techniques, and practices that improve the efficiency of applying substances used for control of pests. Specific goals are to characterize new nozzle designs for increasing chemical deposition on plant and pest targets while reducing off-target spray drift.

Data Collection and Analysis for Future Farms

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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

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Sentinel Program of Illinois Council for Food and Agricultural Research

Cooperating with NASA researchers, University of Illinois scientists are expanding the agricultural remote sensing program at the University of Illinois. 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.

Improved Application of Pest Control Substances

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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.

Soil and Water Resources

Evaluation of Range Design Relative to Combat Readiness and Environmental Risks

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Training and testing ranges on U.S. Army installations are essential for combat readiness of military personnel. A wide variety of range types are needed to provide realistic

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training conditions. Problems such as soil erosion and water quality degradation, poor air quality from dust, wildfires, smokes, and obscurants, and heavy metal accumulation that result from live fire activities are environmental risks that can affect training and testing activities on U.S. Army installations. The objectives of this project are to analyze training and testing range design elements with respect to mission, environmental degradation and regulatory noncompliance, and long-term operations and maintenance requirements.

Development of a Framework to Model Microbial Communities in Humic Lakes

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In comparison to ecology on a macroscopic level, microbial ecology is a relatively underdeveloped field. There have been few attempts to model microbial communities and their dynamic behavior in response to changes in meteorological, physical, and chemical conditions. The opportunity to design such models at varying levels of resolution is generated by the availability of data from long term ecological research stations such as NTL (North Temperate Lakes) using both conventional and emerging molecular techniques. Predictions from these models could help shape effective environmental policies and management decisions related to ecosystem functions controlled by microbial processes.

Microbial Community Analysis of Denitrifying Biofilters

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Biofilters designed to remove nitrates from subsurface tile drain effluent have been developed at the University of Illinois. These biofilters have been shown to successfully remove 60% of nitrates on average in field trials, but relatively little is known about the microbial community that mediates denitrification. Several molecular DNA and RNA methods are used to characterize the microbial community composition and variation of several field biofilters. A time-series study linking microbial community to biofilter performance is planned, and this is hoped to give insight into potential biofilter design improvements.

Evaluation of Granular Activated Carbon (GAC) Filter Caps for Control of Disinfection Byproducts and Emerging Trace Organic Contaminants

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AWWA Research Foundation Project 4101

This project will evaluate the feasibility of using GAC for removal of important new classes of contaminants including endocrine disrupting compounds (EDCs), pharmaceutically active compounds (PhACs), and potential homeland security threats as well as regulated organic contaminants such as pesticides and disinfection byproduct precursors. The project includes a survey of industry treatment practices and significant bench-scale testing to determine the level of removal for a broad range of potential water contaminants. Novel adsorbents, regeneration techniques, and predictive modeling tools will also be developed and tested in this study.

Evaluation of the Performance of Hydrogen-Enhanced Reactor Treating Perchlorate and RDX

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U.S. Army Corp of Engineers CERL (W9132T-06-SOI-0004)

This project compares a pilot-scale anaerobic membrane bioreactor with two other bioreactor technologies to treat complex munitions industry wastewaters containing perchlorate, RDX, and other explosives. The novel membrane bioreactor uses hydrogen gas to stimulate autotrophic growth that has demonstrated higher degradation rates, lower residuals production, and improved effluent quality. These achievements facilitate water reuse in the industrial process that saves money and reduces environmental impacts.

MEM-BRAIN Intelligent Infrastructure System for Real-Time Optimization of Membrane Treatment Systems

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Camp, Dresser, and McKee

This research effort combines the use of genetic algorithms and expert systems to develop an automated optimization protocol that continually evaluates and updates operational setpoints in response to variable influent conditions and other dynamic factors typical of membrane systems used for water purification. Application of the intelligent infrastructure concepts developed in this project can be used to reduce operating costs, increase reliability, and extend equipment life.

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Technology-Based Instruction

Innovative Technology-Based Instructional Strategies and Techniques

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The overall objective of this research project is to provide information regarding technology education and the relative effectiveness of technology-based instruction upon learning. This study investigates aspects of experiential learning systems, perceptions and attitudes concerning the effectiveness and adoption of innovative educational technologies, and perceived barriers and limitations for the adoption of instructional technologies. It provides suggestions for improving instruction. Expected outcomes include the development of curriculum, instructional activities, and teaching and learning models.

Water Quality

Amount, Timing, and Quality of Water Coming from Managed (Controlled) and Unmanaged Drainage Systems in Illinois

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This research project is designed to quantify and compare the amount, timing, and quality of water discharging from managed and unmanaged drainage systems in Illinois. It involves monitoring flow and obtaining flow-weighted water quality samples from managed and free drainage systems on a range of soil types in various locations in the state. The resulting data will be used for developing management criteria for drainage water management systems in Illinois.

Combined Drainage Water Management/Bioreactor System for Improving the Quality of Tile Outflow

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Agricultural Watershed Institute

The goal of this project is to evaluate the effectiveness and cost efficiency of bioreactors, either as stand-alone practices or in combination with drainage water management systems, in reducing nitrogen discharge from agricultural fields with subsurface tile drainage. This

information will be helpful in scaling up a regional initiative to reduce nitrogen and other discharges from agricultural lands and to reduce environmental impacts and protect and possibly enhance income to rural communities and landowners.

Development of Conservation Drainage in Illinois

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University of Illinois

The objectives of this project are to test the hypothesis that while different drainage practices may result in the same intensity of drainage, thereby producing the same production benefits, they differ in their effect on water quality; to determine the design configurations that optimize production benefits while having the least deleterious impact on the environment; and to involve producers, drainage contractors, educators, and local conservation personnel in drainage research.

Illinois Conservation Drainage Research and Demonstration Watershed Project

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The project was established to provide a showcase watershed for drainage water management and other environmentally friendly drainage practices; to conduct research on stream flow, water quality, controlled drainage, and bioreactors; to collect data that can be used to model flow and transport in a tile-drained watershed; and to work in conjunction with local stakeholders to promote conservation drainage.

Understanding Hydrologic and Water Quality Response of a Tiled Watershed

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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

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study will be utilized for better management of agricultural practices in east central Illinois and similar areas with tile-drained watersheds.

Vegetative Treatment System Technology

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The performance evaluation of a vegetative treatment area (VTA) for beef feedlot runoff management is being investigated. This is probably the southernmost site among all the other experimental sites in a multistate effort with significantly different climate, hydrologic, and soil conditions. The overall objective of this investigation is to evaluate through field monitoring the performance of nonbasin (noncontainment) technologies for the treatment of open feedlot runoff in several beef operations in different midwestern states. Two nonbasin technologies under consideration are infiltration basin followed by vegetative treatment area, and vegetative treatment area only.

An Innovative System for Bioremediation of Agricultural Chemicals for Environmental Sustainability

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U.S. Environmental Protection Agency

The overall objective of this research project is to design, implement, and evaluate a renewable, naturally available biofilter to minimize the transport of chemicals from agricultural fields into surface water sources. A cost-effective design for minimizing the chemical leaching from agricultural fields would be preferred to any reduction in pesticide and nutrient application. In addition, this design will allow for sustainable agricultural production and technology, while being environmentally beneficial to surrounding areas.

International Water Management Program

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U.S. Department of Agriculture-Foreign Agriculture Service; National Association of State Universities and Land-Grant Colleges; Government of India - AKI (Agricultural Knowledge Initiative) Program

The project builds expertise and human capacity and involves both priority areas of the U.S.-India Agricultural

Knowledge Initiative (AKI) Competitive Grants Program: capacity building and water management. The short-term and long-term goals of this proposal are threefold: to develop a consortium of U.S. and Indian Universities/Research Institutes/NGOs; to develop MS and PhD sandwich degree programs in "International Water Management;" and to develop collaborative research programs on the use of biodrainage for salinity control and water harvesting techniques for groundwater recharge.

Control of Cryptosporidium and Rotavirus Contamination

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U.S. Department of Agriculture, National Research Initiative

The goal of this research is to prevent microbial contamination of water resources and provide a safe and sustainable environment for animal production facilities. In order to design and implement field-applicable technology for prevention of microbial contamination, the processes of microbial transport in surface and near-surface runoff need to be understood and quantified. Furthermore, the critical factors that affect microbe transport rates and viability, for example, soil composition, vegetation, rainfall, and land slope, must be identified and characterized. This current study seeks to identify these critical factors.

Journal Articles

Agricultural Infotronic Systems

Reum, D. and Zhang, Q. **Wavelet based multi-spectral image analysis of maize leaf chlorophyll content.**
Computers and Electronics in Agriculture, 56:1, 60-71 (Mar. 2007).

Agricultural Safety

Lizer, S. K. and Petrea, R. E. **Health and safety needs of older farmers, Part I: Work habits and health status.**
American Association of Occupational Health Nursing Journal, 55:12, 485-491 (2007).

* Denotes principal investigator.

Bioenvironmental Engineering

Casey, K. D., Ford, S. E., McClure, J. W., Zhang, Y., and Gates, R. S. **Determining fan performance using FANS: An investigation of performance impacts.** *Applied Engineering in Agriculture*, 23:3, 333-338 (May 2007).

Jerez, S. B., Zhang, Y., and Wang, X. **Ventilation effectiveness criteria and measurement methods applicable to animal buildings—A review.** *Transactions of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers*, 113:1, 400-407 (2007).

Jiang, J., Wang, X., and Zhang, Y. **Numerical study of air movement in a slot-ventilated enclosure.** *Transactions of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers*, 113:1, 408-413 (2007).

Sun, H., Zhao, L., and Zhang, Y. **Evaluating RNG k-e models using PIV data for airflow in animal buildings at different ventilation rates.** *Transactions of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers*, 113:1, 358-365 (2007).

Sun, H., Zhao, L., and Zhang, Y. **Evaluation of RNG k-e and LES non-isothermal models for indoor airflow using PIV measurement data.** *Transactions of the American Society of Agricultural and Biological Engineers*, 50:2, 621-631 (2007).

Sun, Y. and Zhang, Y. **An overview of room air motion measurement: Technology and application.** *Journal of Heating, Ventilation, Air Conditioning and Refrigeration Research*, 13:6, 929-950 (2007).

Zhao, L., Zhang, Y., Wang, X., and Riskowski, G. L. **Analysis of airflow in a full-scale room with non-isothermal jet ventilation using PTV techniques.** *Transactions of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers*, 113, 414-425 (2007).

Biological Nanotechnology

Bhalerao, K. D., Lee, S. C., Soboyejo, W. O., and Soboyejo, A. B. O. **A folic acid-based functionalized surface for biosensor systems.** *Journal of Materials Science: Materials in Medicine*, 18:1, 3-8 (Jan. 2007) (<http://dx.doi.org/10.1007/s10856-006-0657-x>).

Steeves, C. A., Young, Y. L., Liu, Z., Bapat, A., Bhalerao, K., Soboyejo, A. B. O., and Soboyejo, W. O. **Membrane thickness design of implantable bio-MEMS sensors for the in-situ monitoring of blood flow.** *Journal of Materials Science: Materials in Medicine*, 18:1, 25-37 (Jan. 2007).

Food and Bioprocess Engineering

Briones, A. M., Daugherty, B. J., Angenent, L. T., Rausch, K. D., Tumbleson, M. E., and Raskin, L. **Microbial diversity and dynamics in multi- and single-compartment anaerobic bioreactors processing sulfate-rich waste streams.** *Environmental Microbiology*, 9:1, 93-106 (Jan. 2007).

Muley, N. S., van Huegten, E., Moeser, A. J., Rausch, K. D., and van Kempen, T. A. T. G. **Nutritional value for swine of extruded corn and corn fractions obtained after dry milling.** *Journal of Animal Science*, 85:7, 1695-1701 (2007).

Naidu, K., Singh, V., Johnston, D. B., Rausch, K. D., and Tumbleson, M. E. **Effects of ground corn particle size on ethanol yield and thin stillage soluble solids.** *Cereal Chemistry*, 84:1, 6-9 (Jan.-Feb. 2007).

Sharma, V., Rausch, K. D., Tumbleson, M. E., and Singh, V. **Comparison between granular starch hydrolyzing enzyme and conventional enzymes for ethanol production from maize starch with different amylose:amylopectin ratios.** *Starch-Starke*, 59:11, 549-556 (Nov. 2007) (<http://dx.doi.org/10.1002/star.200700631>).

Singh, V., Parsons, C., and Pettigrew, J. **Distiller dried grains with solubles.** *Inform*, 18:10, 658-660 (2007).

Srinivasan, R., Dien, B. S., Rausch, K. D., Tumbleson, M. E., and Singh, V. **Fiber separated from distillers dried grains with solubles as a feedstock for ethanol production.** *Cereal Chemistry*, 84:6, 563-566 (Nov.-Dec. 2007).

Srinivasan, R., Moreau, R. A., Rausch, K. D., Tumbleson, M. E., and Singh, V. **Phytosterol distribution in fractions obtained from processing of distillers dried grains with solubles using sieving and elutriation.** *Cereal Chemistry*, 84:6, 626-630 (Nov.-Dec. 2007).

Wang, P., Singh, V., Xue, H., Johnston, D. B., Rausch, K. D., and Tumbleson, M. E. **Comparison of raw starch hydrolyzing enzyme with conventional liquefaction and saccharification enzymes in dry-grind corn processing.** *Cereal Chemistry*, 84:1, 10-14 (Jan.-Feb. 2007).

Grain Qualities and Properties

Lee, K. M., Herrman, T. J., Rooney, L., Jackson, D. S., Lingenfelter, J., Rausch, K. D., McKinney, J., Iiams, C., Byrum, L., Hurburgh, C. R., Johnson, L. A., and Fox, S. R. **Corroborative study on maize quality, dry-milling and wet-milling properties of selected maize hybrids.** *Journal of Agricultural and Food Chemistry*, 55:26, 10751-10763 (Dec. 2007).

Martinez-Amezcuca, C., Parsons, C. M., Singh, V., Srinivasan, R., and Murthy, G. S. **Nutritional characteristics of corn distillers dried grains with solubles as affected by the amounts of grains versus solubles and different processing techniques.** *Poultry Science*, 86:12, 2624-2630 (Dec. 2007).

Rathore, S. S. S., Paulsen, M. R., Sharma, V., and Singh, V. **Use of near-infrared spectroscopy for monitoring fermentation in a corn dry grind ethanol process.** *Transactions of the American Society of Agricultural and Biological Engineers*, 50:6, 2337-2344 (Nov.-Dec. 2007).

Rausch, K. D., Raskin, L. M., Belyea, R. L., Clevenger, T. E., and Tumbleson, M. E. **Nitrogen and sulfur concentrations and flow rates of corn wet-milling streams.** *Cereal Chemistry*, 84:3, 260-264 (May-Jun. 2007).

Off-Road Equipment Engineering

Kweon, G., Grift, T. E., and Miclet, D. **A spinning-tube device for dynamic friction coefficient measurement of granular fertiliser particles.** *Biosystems Engineering*, 97:2, 145-152 (Jun. 2007) (<http://dx.doi.org/10.1016/j.biosystemseng.2007.02.013>).

McCrary, J. P., Stringer, V. L., Hansen, A. C., and Lee, C. F. **Computational analysis of biodiesel combustion in a low-temperature combustion engine using well-defined fuel properties [SAE paper no. 2007-01-0617].** *Transactions of the Society of Agricultural Engineers*, 116, 434 (Aug. 2007).

Rovira-Más, F., Zhang, Q., and Hansen, A. C. **Dynamic behavior of an electrohydraulic valve: Typology of characteristic curves.** *Mechatronics*, 17:10, 551-561 (Dec. 2007) (<http://dx.doi.org/10.1016/j.mechatronics.2007.07.003>).

Ryerson, A. E. F. and Zhang, Q. **Vehicle path planning for complete field coverage using genetic algorithms.** *Agricultural Engineering International: The CIGR Ejournal*, IX, 1-11 (Jul. 2007).

Yuan, W., Hansen, A. C., and Zhang, Q. **Computational modeling of NOx emissions from biodiesel combustion.** *International Journal of Vehicle Design*, 45:1-2, 12-32 (2007) (<http://dx.doi.org/10.1504/IJVD.2007.013668>).

Precision Agriculture

Kaleita, A. L., Hirschi, M. C., and Tian, L. F. **Field-scale surface soil moisture patterns and their relationship to topographic indices.** *Transactions of the American Society of Agricultural and Biological Engineers*, 50:2, 557-564 (Mar.-Apr. 2007).

Xiang, H. and Tian, L. F. **Artificial intelligence controller for automatic multispectral camera parameter adjustment.** *Transactions of the American Society of Agricultural and Biological Engineers*, 50:5, 1873-1881 (Sep.-Oct. 2007).

Soil and Water Resources

Algoazany, A. S., Kalita, P. K., Czapar, G. F., and Mitchell, J. K. **Phosphorus transport through subsurface drainage and surface runoff from a flat watershed in east central Illinois, USA.** *Journal of Environmental Quality*, 36:3, 681-693 (May-Jun. 2007) (<http://dx.doi.org/10.2134/jeq2006.0161>).

Qi, S. Y., Schideman, L., Mariñas, B. J., Snoeyink, V. L., and Campos, C. **Simplification of the IAST for activated carbon adsorption of trace organic compounds from natural water.** *Water Research*, 41:2, 440-448 (Jan. 2007) (<http://dx.doi.org/10.1016/j.watres.2006.10.018>).

Schideman, L. C., Mariñas, B. J., Snoeyink, V. L., Qi, S. Y., and Campos, C. **Three-component adsorption modeling to evaluate and improve integrated sorption-membrane processes.** *Environmental Science and Technology*, 41:18, 6547-6553 (Sep. 2007) (<http://dx.doi.org/10.1021/es070410o>).

Schideman, L. C., Snoeyink, V. L., Mariñas, B. J., Ding, L., and Campos, C. **Application of a three-component competitive adsorption model to evaluate and optimize granular activated carbon systems.** *Water Research*, 41:15, 3289-3298 (Aug. 2007) (<http://dx.doi.org/10.1016/j.watres.2007.05.007>).

Water Quality

Kalita, P. K., Cooke, R. A. C., Anderson, S. M., Hirschi, M. C., and Mitchell, J. K. **Subsurface drainage and water quality: The Illinois experience.** *Transactions of the American Society of Agricultural and Biological Engineers*, 50:5, 1651-1656 (Sep.-Oct. 2007).

Book Chapters

Advanced Life Support Systems

Bhalerao, K. D. **Statistical analysis design including biostatistics.** In *Systems Analysis and Modeling in Food and Agriculture*. (Ting, K. C., Fleisher, D. H., and Rodriguez, L. F., eds.) Encyclopedia of Life Support Systems, A World Wide Web publication by the United Nations Educational, Scientific and Cultural Organization (2007) (<http://www.eolss.net/e5-17-toc.aspx>).

Agricultural Infotronic Systems

Zhang, Q. and Ehsani, R. **Telecommunications for data collection and dissemination.** In *Systems Analysis and Modeling in Food and Agriculture*. (Ting, K. C., Fleisher, D. H., and Rodriguez, L. F., eds.) Encyclopedia of Life Support Systems, A World Wide Web publication by the United Nations Educational, Scientific and Cultural Organization (2007) (<http://www.eolss.net/e5-17-toc.aspx>).

Bioenvironmental Engineering

Wang, X. **Diesel engine emission control.** In *Encyclopedia of Agricultural, Food and Biological Engineering*. (Heldman, D. R., ed.) Marcel Dekker, New York (2007).

Wang, X. **Diesel exhaust gas aftertreatment technologies.** In *Encyclopedia of Agricultural, Food and Biological Engineering*. (Heldman, D. R., ed.) Marcel Dekker, New York, NY (2007).

Food and Bioprocess Engineering

Rausch, K. D., Belyea, R. L., Singh, V., and Tumbleson, M. E. **Corn processing for ethanol production.** In *Encyclopedia of Agricultural, Food, and Biological Engineering*. (Heldman, D. R., ed.) Marcel Dekker, New York, NY (2007).

Robotics

Grift, T. E. **Robotics in crop production.** In *Encyclopedia of Agricultural, Food and Biological Engineering*. (Heldman, D. R., ed.) Marcel Dekker, New York, NY (2007).

Papers Presented at Conferences and Symposia

Advanced Life Support Systems

Goss, R. P., Jiang, H., and Rodriguez, L. F. **Cluster analyses of lunar-Mars life support test project simulations.** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers, Vol. 14 BK, 10 (2007).

Jiang, H., Bhalerao, K., Bell, S., Kortenkamp, D., Soboyejo, A., and Rodriguez, L. F. **Modeling stochastic performance and random failure.** 37th International Conference on Environmental Systems (Chicago, IL, Jul. 2007). Proceedings of the 37th International Conference on Environmental Systems, Society of Agricultural Engineers Technical Paper Series (2007).

Rodriguez, L. F., Jiang, H., Bell, S., and Kortenkamp, D. **Testing heuristic tools for life support system analysis.** 37th International Conference on Environmental Systems (Chicago, IL, Jul. 2007). Proceedings of the 37th International Conference on Environmental Systems (2007).

Rodriguez, L. F., Jiang, H., Bell, S., Stark, K., and Kortenkamp, D. **Validation of heuristic techniques for design of life support systems.** 2007 Conference on Systems Engineering Research (Hoboken, NJ, Mar. 2007). Proceedings of the 2007 Conference on Systems Engineering Research (2007).

Rodriguez, L. F., Jiang, H., Stark, K., Bell, S., and Kortenkamp, D. **Validation of heuristic techniques for design of life support systems.** 2007 International Joint Conference on Artificial Intelligence (Hyderabad, India, Jan. 2007). Proceedings of the 2007 International Joint Conference on Artificial Intelligence (2007).

Automation of Biological Systems

Li, C., Zhang, Q., and Rodriguez, L. F. **Holistic management of agri-ecosystems for an organic-based animal-crop rotating production.** AgriControl 2007 (Osijek, Croatia, Sep. 2007). Proceedings of AgriControl 2007 (2007).

Menezes, G. K. and Rodriguez, L. F. **Determination of constants of a two-leaf multi-scale photosynthesis model using a genetic algorithm.** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers, Vol. 4 BK, 11 (2007).

Bioenvironmental Engineering

Lenkaitis, A. C., Wang, X., Funk, T. L., and Ellis, M. **A micro-environment measurement system during swine transport.** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers, Vol. 9 BK, 13 (2007).

Wang, X., Jiang, J., and Zhang, Y. **Numerical investigation of airflows in a full scale room at low Reynolds numbers [paper no. 074122].** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers (2007).

Biomass and Renewable Energy

Li, C., Rodriguez, L. F., Eckhoff, S. R., Khanna, M., and Spaulding, A. D. **Engineering-economic system models for rural ethanol production facilities [paper no. 077025].** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers (2007).

Li, C., Rodriguez, L. F., Khanna, M., Spaulding, A. D., and Eckhoff, S. R. **An engineering-economic evaluation of quick germ/quick fiber process for dry-grind ethanol facilities.** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers, Vol. 14 BK, 18 (2007).

Food and Bioprocess Engineering

Arora, A., Wang, P., Belyea, R. L., Tumbleson, M. E., Singh, V., and Rausch, K. D. **Thin stillage fractionation using ultrafiltration.** 2007 American Association of Cereal Chemists International Meeting (San Antonio, TX, Sep. 2007). Proceedings of the 2007 American Association of Cereal Chemists International Meeting (2007).

Arora, A., Wang, P., Belyea, R. L., Tumbleson, M. E., Singh, V., and Rausch, K. D. **Thin stillage fractionation using ultrafiltration: Resistance in series model.** 2007 North American Membrane Society Conference (Orlando, FL, May 2007). Proceedings of the 2007 North American Membrane Society Conference (2007).

Belyea, R. L., Horner, J. L., Rausch, K. D., and Tumbleson, M. E. **Oil, corn and ethanol: Mo more cheap food.** International Starch Technology Conference (Urbana, IL, Jun. 2007). Proceedings of the International Starch Technology Conference (2007).

Belyea, R. L., Rausch, K. D., Tumbleson, M. E., and Murthy, G. S. **Sources of variation in dry grind processing streams.** International Starch Technology Conference (Urbana, IL, Jun. 2007). Proceedings of the International Starch Technology Conference (2007).

Bhattarai, R., Kalita, P., and Patel, M. **Measurement and simulation of runoff and nutrient transport through vegetative filter strips [paper no. 072177].** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers (2007).

Khullar, E., Sall, E. D., Rausch, K. D., Tumbleson, M. E., and Singh, V. **Comparison of modified and conventional dry grind processes for different corn hybrids.** 2007 American Association of Cereal Chemists International Meeting (San Antonio, TX, Sep. 2007). Proceedings of the 2007 American Association of Cereal Chemists International Meeting (2007).

Lee, K., Herrman, T. J., Rooney, L., Jackson, D. S., Bean, S. R., Lingenfelser, J., Rausch, K. D., McKinney, J., Iiams, C., Hurburgh, C. R., and Johnson, L. A. **Corroborative study on maize quality, dry milling, and wet milling properties of selected maize hybrids.** 2007 American Association of Cereal Chemists International Meeting (San Antonio, TX, Sep. 2007). Proceedings of the 2007 American Association of Cereal Chemists International Meeting (2007).

Rausch, K. D., Johnston, D. B., Singh, V., Belyea, R. L., and Tumbleson, M. E. **The future of coproducts from corn processing.** 2007 American Association of Cereal Chemists International Meeting (San Antonio, TX, Sep. 2007). Proceedings of the 2007 American Association of Cereal Chemists International Meeting (2007).

Sharma, V., Singh, V., Rausch, K. D., and Tumbleson, M. E. **Effect of enzyme treatments and amylose:amylopectin ratios on dry grind processes.** 2007 American Association of Cereal Chemists International Meeting (San Antonio, TX, Sep. 2007). Proceedings of the 2007 American Association of Cereal Chemists International Meeting (2007).

Shihadeh, J. K., Rausch, K. D., Tumbleson, M. E. and Singh, V. **Vacuum fermentation for in-situ removal of ethanol during simultaneous liquefaction, saccharification, and fermentation.** 2007 American Association of Cereal Chemists International Meeting (San Antonio, TX, Sep. 2007). Proceedings of the 2007 American Association of Cereal Chemists International Meeting (2007).

Singh, V., Johnston, D. B., Rausch, K. D., Belyea, R. L., and Tumbleson, M. E. **Converting a dry grind plant into a biorefinery.** 2007 American Association of Cereal Chemists International Meeting (San Antonio, TX, Sep. 2007). Proceedings of the 2007 American Association of Cereal Chemists International Meeting (2007).

Singh, V., Parsons, C., and Pettigrew, J. **Process and engineering effect on DDGS products—Present and future.** 5th Mid-Atlantic Nutrition Conference (Timonium, MD, Mar. 2007). Proceedings of the 5th Mid-Atlantic Nutrition Conference 82-90 (2007).

Srinivasan, R. and Singh, V. **Pericarp fiber separation from corn flour using sieving and air classification.** 2007 American Association of Cereal Chemists International Meeting (San Antonio, TX, Sep. 2007). Proceedings of the 2007 American Association of Cereal Chemists International Meeting (2007).

Vidal, B. C., Rausch, K. D., Tumbleson, M. E., and Singh, V. **Sonication enhanced granular starch hydrolysis in the dry grind corn process.** 2007 American Association of Cereal Chemists International Meeting (San Antonio, TX, Sep. 2007). Proceedings of the 2007 American Association of Cereal Chemists International Meeting (2007).

Wang, P., Singh, V., Johnston, D. B., Rausch, K. D., and Tumbleson, M. E. **Use of proteases and a granule starch hydrolyzing (GSH) enzyme usages in dry grind corn process.** 2007 American Association of Cereal Chemists International Meeting (San Antonio, TX, Sep. 2007). Proceedings of the 2007 American Association of Cereal Chemists International Meeting (2007).

Grain Qualities and Properties

Rathore, S. S., Paulsen, M. R., and Singh, V. **Measuring dextrose equivalents of liquefaction slurry for dry-grind corn ethanol processing using near-infrared spectroscopy.** 2007 American Association of Cereal Chemists International Meeting (San Antonio, TX, Sep. 2007). Proceedings of the 2007 American Association of Cereal Chemists International Meeting (2007).

Mechatronics

Gao, Y., Jin, Y., and Zhang, Q. **Motion planning-based coordinated control for hydraulic excavators.** 5th International Symposium on Fluid Power Transmission and Control (Beidaihe, China, Jun. 2007). Proceedings of the 5th International Symposium on Fluid Power Transmission and Control 847-851 (2007).

Hancock, K. M. and Zhang, Q. **Fault detection of hydraulic vane pumps using multiple variables in an adaptive neuro-fuzzy inference system.** 5th International Symposium on Fluid Power Transmission and Control (Beidaihe, China, Jun. 2007). Proceedings of the 5th International Symposium on Fluid Power Transmission and Control 234-236 (2007).

Huang, R., Gao, Y., and Zhang, Q. **A comparison of three controllers for E/H steering system.** 5th International Symposium on Fluid Power Transmission and Control (Beidaihe, China, Jun. 2007). Proceedings of the 5th International Symposium on Fluid Power Transmission and Control 877-884 (2007).

Jin, Y., Gao, Y., and Zhang, Q. **Study on the track planner for automated excavation of hydraulic excavators.** 5th International Symposium on Fluid Power Transmission and Control (Beidaihe, China, Jun. 2007). Proceedings of the 5th International Symposium on Fluid Power Transmission and Control 458-463 (2007).

Kong, X., He, L., Gao, Y., Zhang, Q., and Yao, J. **The study on engine characteristic simulation based on secondary regulation.** 5th International Symposium on Fluid Power Transmission and Control (Beidaihe, China, Jun. 2007). Proceedings of the 5th International Symposium on Fluid Power Transmission and Control 926-929 (2007).

Rovira-Más, F., Zhang, Q., and Hansen, A. C. **Characterization of an electrohydraulic valve to control auto-steered off-road vehicles.** 5th International Symposium on Fluid Power Transmission and Control (Beidaihe, China, Jun. 2007). Proceedings of the 5th International Symposium on Fluid Power Transmission and Control 180-185 (2007).

Off-Road Equipment Engineering

Cheng, W. L., Stringer, V. L., McCrady, J., Hansen, A. C., and Lee, C. F. **Comparisons between a high-speed direct injection engine operating with biodiesel and petroleum based diesel.** 20th Annual Conference on Liquid Atomization and Spray Systems (Chicago, IL, May 2007). Proceedings of the 20th Annual Conference on Liquid Atomization and Spray Systems (2007).

Hansen, A. C., Zahos, S. C., and Bosworth, D. **Equipping students with an engineering toolbox in a capstone design course.** National Capstone Design Conference (Boulder, CO, Jun. 2007). Proceedings of the National Capstone Design Conference (2007).

Hansen, A. C., Zhang, Q., and Wilcox, T. A. **Modeling and analysis of row crop harvesting patterns by combines.** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers, Vol. 50, 5-12 (2007).

McCrady, J. P., Hansen, A. C., and Lee, C. F. **Computational analysis of the properties of biodiesel blended with diesel fuel.** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers, Vol. 12 BK, 12 (2007).

McCrady, J. P., Hansen, A. C., and Lee, C. F. **Modeling biodiesel combustion using GT-power.** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers, Vol. 12 BK, 18 (2007).

Rovira-Más, F., Wang, Q., and Zhang, Q. **Design of stereo perception systems for automation of off-road vehicles [paper no. 073126].** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers (2007).

Stringer, V. L., McCrady, P., Hansen, A. C., and Lee, C. F. **Modeling biodiesel spray breakup with well-defined fuel properties.** 20th Annual Conference on Liquid Atomization and Spray Systems (Chicago, IL, May 2007). Proceedings of the 20th Annual Conference on Liquid Atomization and Spray Systems (2007).

Wang, Q. and Zhang, Q. **Stereo vision-based trajectory tracking for agricultural vehicles.** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers, Vol. 1 BK, 17 (2007).

Wei, Q., Zhang, Q., and Mao, Z. **Power efficiency analysis of combine harvester in field operation [paper no. 071027].** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers (2007).

Precision Agriculture

Gingerich, N. and Tian, L. **An autonomous self sustaining field robotic system [paper no. 073112].** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers (2007).

Jeon, H. Y. and Tian, L. **A direct chemical application field robot for precise weed control [paper no. 071126].** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Paper (2007).

Xiang, H. and Tian, L. **Autonomous aerial image georeferencing for a UAV-based data collection platform using integrated navigation system.** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers, Vol. 7 BK, 28 (2007).

Xiang, H. and Tian, L. **Monitoring crop growth by seasonal multi-spectral image data.** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers, Vol. 1 BK, 14 (2007).

Xiang, H. and Tian, L. **An autonomous helicopter system for aerial image collection [paper no. 071136].** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Paper (2007).

Soil and Water Resources

Appleford, J. M., Menezes, G. K., Rodriguez, L. F., and Kent, A. D. **Development of a STELLA framework to model microbial communities in humic lakes in Wisconsin.** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers, Vol. 14 BK, 13 (2007).

Bhattarai, R., Kalita, P. K., and Patel, M. K. **Measurement and simulation of runoff and nutrient transport through vegetative filter strips [paper no. 072177].** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers (2007).

Cooke, R. A. **Drainage and the free lunch: Economics of subsurface drainage.** 2007 Indiana Certified Crop Adviser Conference (Indianapolis, IN, Dec. 2007).

Davidson, P. C., Kalita, P. K., Kuhlenschmidt, M. S., and Kuhlenschmidt, T. **Survival, fate of *Cryptosporidium parvum* rotavirus in soil-water environment [paper no. 072277].** 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun. 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers (2007).

Technology-Based Instruction

Harper, J. G. and Buriak, P. **Technical systems management curriculum modeling [paper no. 078034]**. 2007 American Society of Agricultural and Biological Engineers International Meeting (Minneapolis, MN, Jun 2007). 2007 American Society of Agricultural and Biological Engineers International Meeting, Technical Papers (2007).

Harper, J. G. and Harper, M. **Karting engineering educational opportunities in Illinois and Indiana**. 2007 American Society for Engineering Education Indiana/Illinois Section Meeting (Indianapolis, IN, Mar. 2007).

Theses

Bioenvironmental Engineering

Jerez, S. **Airborne pollutant spatial distribution, emission, and ventilation effectiveness for mechanically ventilated livestock buildings**. Ph.D. thesis, Y. Zhang, advisor (2007).

Jiang, J. **Experimental and numerical study of air flows in a full scale room**. Ph.D. thesis, X. Wang, advisor (2007).

Lenkaitis, A. **Development of a microenvironment measurement system for swine transportation**. M.S. thesis, X. Wang, advisor (2007).

Sun, Y. **Volumetric particle stream-tracking velocimetry and its application in indoor airflow measurements**. Ph.D. thesis, Y. Zhang, advisor (2007).

Food and Bioprocess Engineering

Sharma, V. **Factors affecting starch conversion to ethanol in dry grind corn process**. Ph.D. thesis, V. Singh, advisor (2007).

Off-Road Equipment Engineering

Daddupaduvari, B. **Optimization of baffle plate location in fuel tank using computational fluid dynamics and finite element analysis**. M.S. thesis, Q. Zhang, advisor (2007).

McCrary, J. **Biodiesel property definition for fuel atomization and combustion modeling**. M.S. thesis, A. C. Hansen, advisor (2007).

Viall, A. **Accelerated test method for hydraulic pump fault diagnosis research**. M.S. thesis, Q. Zhang, advisor (2007).

Soil and Water Resources

Chun, J. A. **Measurement and modeling of nitrate-N transport in subsurface bioreactors**. Ph.D. thesis, R. A. Cooke, advisor (2007).

Davidson, P. **Characterization of rotavirus survival in soil**. M.S. thesis, P. K. Kalita, advisor (2007).

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 Future Farmers of America 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

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
Fellow, American Society of Agricultural Engineers, 1992
Paul A. Funk Achievement Award, University of Illinois
College of Agriculture, 1993
President's Citation, American Society of Agricultural
Engineers, 2000, 2002
Hall of Fame Award, Illinois Extension Agricultural
Association, 2004
Honorary Knight of St. Patrick, University of Illinois
College of Engineering, 2005
Accenture Outstanding Advising Award, College of
Engineering, 2006, 2007
Ben and Georgeann Jones Excellence in Teaching Award,
University of Illinois Department of Agricultural and
Biological Engineering, 2008

Philip Buriak, Emeritus

Teaching Award of Merit, National Association of College
Teachers of Agriculture, 1986
Honorary American Farmer Degree, National Future
Farmers of America 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 of
Future Farmers of America, 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
J. Kent Mitchell Teaching Excellence Award, University
of Illinois Department of Agricultural and Biological
Engineering, 2001
Team Award for Excellence, College of Agricultural,
Consumer, and Environmental Sciences Teaching
Course Team, University of Illinois College of
Agricultural, Consumer and Environmental Sciences,
2001
E. B. Knight Journal Award, North American Colleges and
Teachers of Agriculture, 2003
Teaching Fellow Award, North American Colleges and
Teachers of Agriculture, 2003

Leslie L. Christianson, Emeritus

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
Paper Award, American Society of Heating, Refrigeration
and Air-Conditioning Engineers, 2003
Fellow, Academic for Entrepreneurship, University of
Illinois, 2005

Richard C. Coddington, Emeritus

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
J. Kent Mitchell Teaching Excellence Award, University
of Illinois Department of Agricultural and Biological
Engineering, 2005

Steven R. Eckhoff

USDA Merit Award, Aflatoxin Detoxification Award,
1979
Transactions of the ASAE Paper Award, Honorable
Mention, 1980

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

Bruce Elliott-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
Team Award for Excellence, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2001
Distinguished Teacher/Scholar Award, University of Illinois, 2003

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

Professional Staff Award for Excellence, Innovation and Creativity, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2003
Campus Award for Excellence in Public Engagement, University of Illinois, 2004

Carroll E. Goering, Emeritus

Fellow, American Society of Agricultural Engineers
Outstanding Technical Paper Awards, American Society of Agricultural Engineers; honorable mention, 1985, 1990, 1992
Outstanding Technical Paper Awards, American Society of Agricultural Engineers, 1985, 1990, 1992
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
Cyrus Hall McCormick Jerome Increase Case Gold Medal Award, American Society of Agricultural and Biological Engineers, 2005

Tony E. Grift

Superior Paper Award, American Society of Agricultural Engineers, 2002, 2003
Information and Electrical Technologies Division Outstanding Paper Award, American Society of Agricultural Engineers, 2003
Japanese Society for the Promotion of Sciences Fellowship, 2005

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

Outstanding Advisor Award, Accenture Consulting, University of Illinois College of Engineering, 2003, 2005, 2006, 2007
Outstanding Paper Award, Information and Electrical Technologies Division, American Society of Agricultural Engineers, 2003
Everitt Award for Teaching Excellence, University of Illinois College of Engineering, 2004
Faculty Award for Excellence in Teaching, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2005
Superior Paper Award, American Society of Agricultural and Biological Engineers, 2006
Teacher Fellow Award, North American Colleges and Teachers in Agriculture, 2007
Best Poster Award, National Capstone Design Course Conference, 2007

Joe G. Harper

J. Kent Mitchell Teaching Award, University of Illinois Department of Agricultural and Biological Engineering, 2007

Michael C. Hirschi

Paper Reviewers Award, American Society of Agricultural Engineers, 1988
Blue Ribbons (6), Educational Aids Competition, American Society of Agricultural Engineers, 1991 (3), 1994, 1998, 2004
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, 2006, 2007
Academy of Teaching Excellence, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2002, 2003, 2004, 2005
Karl S. Gardner Outstanding Undergraduate Advising Award, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2003
Outstanding Professional Skill Award in Writing, Association for Communication Excellence, Critique and Awards Program, 2005

Gold Award for Writing within a Specialized Publication, Association for Communication Excellence, Critique and Awards Program, 2005
Silver Award for Illustration: Single or Series, Association for Communication Excellence, Critique and Awards Program, 2005
Silver Award for Four-Color Popular Publications, Association for Communication Excellence, Critique and Awards Program, 2005
Bronze Award for Print: Four or More Colors, Association for Communication Excellence, Critique and Awards Program, 2005

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 Department of Biological and Agricultural Engineering, 1997
Outstanding Kansas State University Instructor and Advisor 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. Kent Mitchell Teaching Excellence Award, University of Illinois Department of Agricultural and Biological Engineering, 2003
Faculty Award for Excellence in Teaching, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2003
Academy of Teaching Excellence, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2003
Food and Agricultural Sciences Excellence in College and University Teaching Awards Program Nominee, U.S. Department of Agriculture, 2003
Best Paper Award, International Association of Science and Technology for Development, 2003
Outstanding Advisor Award, Accenture Consulting, University of Illinois College of Engineering, 2004
Teaching Fellow Award, North American Colleges and Teachers of Agriculture, 2004

Excellence in Teaching Award, United States Department of Agriculture Food and Agricultural Sciences, National Association of State Universities and Land-Grant Colleges, 2005

Karl E. Gardner Outstanding Undergraduate Advising Award, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2006

Accenture Outstanding Engineering Advisor, University of Illinois College of Engineering, 2006

North American Colleges and Teachers of Agriculture Regional Outstanding Teacher Award, Vancouver, Canada, 2006

Campus Award for Excellence in Undergraduate Teaching, University of Illinois, 2007

Distinguished Teacher Scholar Award, University of Illinois, 2007

ASABE President's Distinguished Service Citation Award, American Society of Agricultural and Biological Engineers, 2007

J. Kent Mitchell, Emeritus

Fellow, American Society of Agricultural Engineering Educational Aids Competition, 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

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

Paul A. Funk Achievement Award, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2005

William H. Peterson, Emeritus

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

Certificate of Appreciation, Illinois Farm Electric Council, 1981

Blue Ribbons, Educational Aids Competition, American Society of Agricultural Engineers, 1981, 1983, 1987

Certificate of Merit, Illinois Electric Council, 1996

Robert E. Petrea

President's Award, National Institute for Farm Safety, 2004

Special Recognition Award, National Institute for Farm Safety, 2004

Luis F. Rodriguez

Postdoctoral Research Fellowship, National Research Council, NASA, 2004

Lance C. Schideman

Luce Foundation Visiting Scholar, Qinghai University, 1997

Science to Achieve Results (STAR) Fellowship, U.S. Environmental Protection Agency, 2000

Abel Wolman Doctoral Fellowship, American Water Works Association, 2003

Richard and Mary Engelbrecht Award, University of Illinois Environmental Engineering, 2005

Academic Achievement Ph.D. Thesis Award, American Water Works Association, 2006

John C. Siemens, Emeritus

Blue Ribbon, Educational Aids Competition, 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

Vijay Singh

American Association of Cereal Chemists Outstanding Poster Award, 1998

Best Research Paper Award, Crop Conversion Science and Engineering Research Unit, Energy and Environmental Research Center, Agricultural Research Service, U.S. Department of Agriculture, 2003

Young Faculty Excellence Award, National Corn Refiners Association, 2003

Innovation Hall of Fame, Office of Technology Management, University of Illinois, 2004

New Holland Young Research Award, American Society of Agricultural and Biological Engineers, 2005

Archer Daniels Midland Award for Best Paper in Protein and Co-Products Published in American Oil Chemists Society Press Publications, 2006
Participant, Frontiers of Engineering Symposium, National Academy of Engineering, 2006
Excellence in Research Award, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2007
Global Scholar, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2007
Young Scientist Award, American Association of Cereal Chemists International, 2007
Research Excellence Award, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2007

Lei Tian

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

K. C. Ting

Fellow, Ralph and Mable Hunter, 1978-1979
Certificate of Appreciation, American Society of Agricultural Engineers, 1991, 1999, 2000
Certificate of Appreciation, Taiwan Agricultural Mechanization Research and Development Center, 1991
Best Paper Award, CIOSTA-CIGR (International Agricultural Engineering Society), 1993

Best Paper Award, American Society for Plastics, 1993
Team Award for Excellence in Research, Cook College/ New Jersey Agricultural Experiment Station, Rutgers University, 1996
Honorary Professor of the National Bio-Environment Engineering Laboratory of the Ministry, China Agricultural University, Beijing, China, 1996
Cook College/Alpha Zeta Professor of the Year, Rutgers University, 1997
Japanese Government Research Award for Foreign Specialists, 1999
Paper Award, American Society of Agricultural Engineers, 2000
Fellow, American Society of Agricultural Engineers, 2001
Fellow, American Society of Mechanical Engineers, 2002
Certificate of Appreciation, Mie University, Japan, 2003
Guest Chair Professor, College of Biosystems Engineering and Food Science, Zhejiang University, Hangzhou, China, 2006

Xinlei Wang

Paper Award, American Society of Heating, Refrigeration and Air-Conditioning Engineers, 2002
Honorable Mention Paper Award, American Society of Agricultural and Biological Engineers, 2006
J. Kent Mitchell Teaching Excellence Award, University of Illinois, Department of Agricultural and Biological Engineering, 2006
Scholar, ACES Global Academy, University of Illinois, 2006

Yuanhui Zhang

Outstanding Paper Award, American Society of Agricultural Engineers, 1989, 2001
Honorary Professorship, Beijing University of Agricultural Engineering, China, 1994
Honorary 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
Superior Paper Award, American Society of Agricultural Engineers, 2001
Annual Paper Award, American Society of Heating, Refrigeration and Air-Conditioning Engineers, 2002

Fellow, National Center for Supercomputing Applications,
2004
Bliss Faculty Scholar Award, University of Illinois College
of Engineering, 2005
Distinguished Service Award, American Society of
Heating, Refrigeration and Air Conditioning Engineers,
2007

Qin Zhang

Best Paper in the Decade Award, Transactions of Chinese
Society of Agricultural Engineering, 1995
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
Best Paper Award, SCI Control Systems, World Multi-
Conference on Systemics, Cybernetics and Information,
2001
Fellow, National Center for Supercomputing Applications,
2002
Adjunct Chair Professor, College of Engineering, China
Agricultural University, 2003
Adjunct Professor, College of Biological Engineering and
Food Sciences, Zhejiang University, China, 2003
Fellow, Japanese Society for the Promotion of Science,
2004
Adjunct Professor, College of Mechanical Engineering,
Department of Mechatronics, Yanshan University,
China, 2004
Select Paper Award, Information and Electrical
Technologies Division, American Society of
Agricultural and Biological Engineering, 2005
Faculty Research Award, University of Illinois College of
Agricultural, Consumer and Environmental Sciences,
2005
Honorable Mention Paper Award, American Society of
Agricultural and Biological Engineers, 2006
Superior Paper Award, American Society of Agricultural
and Biological Engineers, 2007
Academic Advisory Committee Member, Ministry of
Education Key Laboratory on Modern Agricultural
Equipment, South China Agricultural University,
China, 2007