IOWA STATE UNIVERSITY
Agricultural and Biosystems Engineering

Stuart Birrell

Associate Professor and
Kinze Manufacturing Professor
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Education
Ph.D. Agricultural Engineering, 1995
University of Illinois, Urbana

M.S. Agricultural Engineering, 1987
University of Illinois, Urbana

B.S. Agricultural Engineering, 1984
University of Natal, Pietermaritzburg, RSA

Honors and Awards
Frank Wilcoxon Prize for paper "Composite Response Surface Designs for Factors with Jointly Symmetric Effects" that appeared in the May 2009, issue of Technometrics (pages 206-214).

Editorial Board Member, Biosystems Engineering (2009)

Kinze Manufacturing Professor (2007)

Recent Publications

L.D. Snell and **S.J. Birrell**. 2015. Coupled Moment Analysis of Stacked Counter-rotating Eccentric-mass Tree Shaker Energy-wheel System. Biosystems Engineering (In Review)

B. Sharma, E. Brandes, A. Khanchi, **S.J Birrell**, E. Heaton, and F. E. Miguez. 2015. Evaluation of microalgae biofuel production potential and cultivation sites using Geographic Information Systems: A review. BioEnergy Research (in review)

M. Karkee, R.P. McNaull**, S.J. Birrell** and B.L. Steward. 2011. Estimation for Optimizal Biomass Removal Rate Based on Tolerable Soil Erosion for Single Pass Crop Grain and Biomass Harvesting System. *Trans. ASABE.* 55(1): 107-115.

D.L. Karlen, **S.J. Birrell** and J.R. Hess. 2011. Corn Stover Harvest Strategies: A Five-Year Assessment in Central Iowa, USA. *Soil and Tillage* 115-116:47-55.

Patents
Air movement unit for biomass conveyance, separation, or combine performance enhancement Inventors: **Stuart Birrell**, Mark Dilts, Benjaming Schlesser Patent No: US 7,731,578 B2, issued 6-8-2010.

Combination Residue Spreader and Collector for single pass harvesting systems. Inventors: **Stuart Birrell**, Benjaming Schlesser, Mark Dilts, Patent No: US 8,177,610 B2, issued 5-15-2012.

Teaching

In the past few years, Dr. Birrell has taught the following Agricultural Engineering and Agricultural Systems Technology undergraduate courses:

- AE 340 Functional Analysis and Design of Agricultural Field Machinery
- AE 342 Agricultural Tractor Power,
- TSM 330 Agricultural Machinery & Power Management
- TSM 335 Tractor Power.

Research

Dr. Birrell's research focus is concentrated in two areas: (1) the development of sensors and controls that can be applied in advanced machinery control and in precision agriculture, and (2) Harvest technologies and biomass harvesting and logistics. Present projects include developing a real-time soil sensor systems for precision nitrogen applications, development of sensors based on dielectric measurements, industry sponsored combine harvesting projects and development of biomass harvesting systems.

Development of harvesting, handling and densification systems for biomass production

The objective of this research focus is the development of harvesting systems, and transportation system to improve biomass harvest field efficiency and reduce costs. The economic analysis has shown capital costs and material density is the primary factor influencing the transportation costs and logistics. The two major limitations to biomass harvest are harvest capacity and transport density, and are the major focus of the future work.

Multifrequency dielectric sensing for hydraulic fluid condition

The objective of this proposed research is to investigate how the dielectric properties of hydraulic fluids vary across the electromagnetic spectrum. Degradation and contamination of the working fluids is the major cause of failures in hydraulic systems. Increases in contaminant levels and changes in fluid properties can be both an indicator of deteriorating component conditions and a cause of component failure. The goal of this study is to provide basic information that would provide the foundation for studies on the development of self-calibrating, hydraulic monitoring and cylinder position sensing sensors using multiple frequency dielectric measurements.

Development of real-time soil analysis systems for precision nitrogen application

The objective of this research is to develop an underground wireless network of soil sensors to monitor soil properties like moisture content, temperature, and soil nitrogen sensors, due to the economic importance of nitrogen fertilizers and the potential environmental effects of excess fertilizer applications. The goal is the development of sensors to collect high-resolution spatial and temporal data needed for optimal management of crop inputs, including variable-rate control of irrigation and fertilization applications.