IOWA STATE UNIVERSITY
Agricultural and Biosystems Engineering

Stuart J. Birrell

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Education
Ph.D. Agricultural Engineering, 1995
University of Illinois
M.S. Agricultural Engineering, 1987
University of Illinois
B.S. Agricultural Engineering, 1984
University of Natal, South Africa

Honors and Awards
Chairman, College Engineering Curriculum Committee, 2006
Chairman of ASAE PM 54 Precision Agriculture Committee, 2001-2003
Secretary of the Iowa Section of the ASAE, 2001-2002
Iowa Section of the ASAE Newcomer of the Year, 2001

Recent Publications

Hoskinson R. L., D.L. Karlen, S.J. Birrell, C.W. Radtke and W. W. Wilhelm, 2006. Engineering, soil fertility, and feedstock conversion evaluations of four corn stover harvest scenarios. Biomass and Bioenergy (In press).

*Yildirim, S., S.J. Birrell and J.W. Hummel. 2006. Laboratory evaluation of an electro-pneumatic sampling method for real-time soil sensing. Transactions of the ASAE. Vol. 49(4): 845-850.

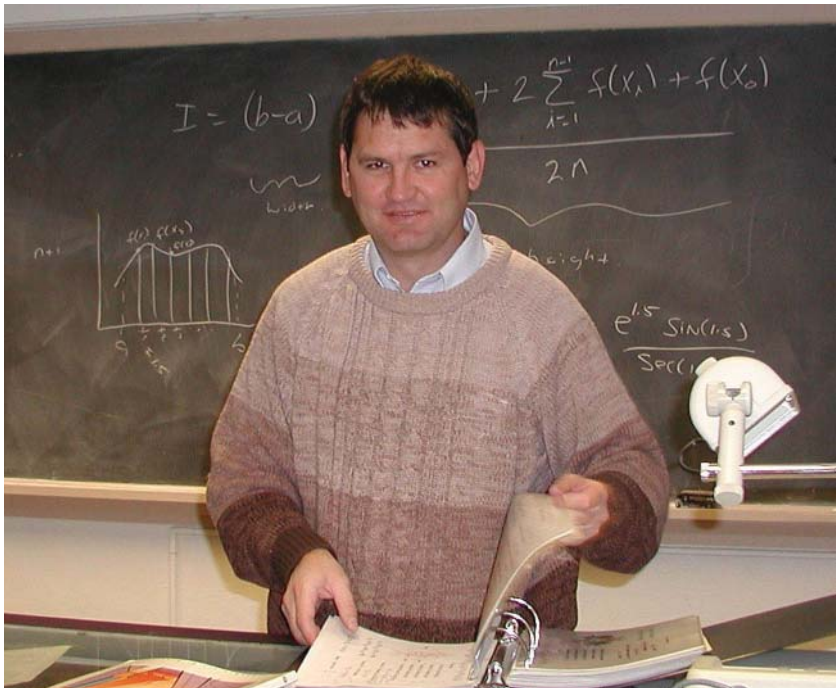
Kim, H.J., J. W. Hummel, and S. J. Birrell. 2006. Evaluation of Nitrate and Potassium Ion-Selective Membranes for Soil Macronutrient Sensing. Transactions of the ASAE. Vol. 49(3): 597-606.

*Isaac, N.E., G. R. Quick, S. J. Birrell, W. M. Edwards, B. A. Coers. 2006. Combine Harvester Econometric Model with Forward Speed Optimization. Applied Engineering in Agriculture, 22(1):25-31

Price R.R., J.W. Hummel, S.J. Birrell, and I.S Ahmad. 2003. Rapid nitrate analysis of soil cores using ISFETs. Transactions of the ASAE. Vol. 46(3): 601–610.

Birrell S.J. and J.W. Hummel 2001. Real-time multi ISFET/FIA soil analysis system with automatic sample extraction. Computers and Electronics in Agriculture, 32(1): 45 – 67.

Birrell S.J. and J.W. Hummel 2000. Membrane selection and ISFET configuration evaluation for soil nitrate sensing. Transactions of the ASAE 43(2):197-206.



Teaching

Dr. Birrell teaches two ABE engineering undergraduate courses, AE 340 Functional Analysis and Design of Agricultural Field Machinery and AE 342 Agricultural Tractor Power, and two Agricultural Systems Technology undergraduate courses, TSM 330 Agricultural Machinery & Power Management and TSM 335 Tractor Power.

Research

Dr. Birrell's research focuses 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 nitrate sensor system for precision nitrogen applications, development of sensors based on dielectric measurements, industry sponsored combine harvesting projects and development of biomass harvesting systems.

Real-time soil nitrate analysis system for precision nitrogen application
The overall objective of this research is to develop and test a real-time soil nutrient analysis system, based on ion-selective field-effect transistors (ISFETs). The proposed work concentrates on the development of nitrogen sensors, due to the economic importance of nitrogen fertilizers and the potential environmental effects of excess fertilizer applications. However, the proposed analysis system could be adapted to sense potassium, phosphate, soil pH, and many soil micronutrients as well as also used for the simultaneous analysis of multiple nutrients.

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.