

## 基于信号波形幅度检测放大技术的电容式土壤水分传感器研究

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摘要:

土壤水分量测对于农田系统的评估和选择、水资源的合理利用是十分重要的。本文根据土壤水分与土壤相对介电常数的关系, 基于信号波形幅度检测放大技术设计了一种电容式土壤水分传感器。在标准溶液样品、粘壤土、砂壤土、粘土土样中对本文提出的传感器进行测试。实验结果显示, 传感器输出电压与被测介质含水量有良好的线性关系 ( $R^2=0.81\sim 0.99$ ), 传感器灵敏度受土质影响明显, 实际应用时需要根据土质进行校准, 传感器功耗低, 在2.5V供电电压下功耗低于8mW。本文设计的传感器可推广至精准农业系统应用中。

关键词: 土壤水分传感器; 电容法; 信号波形幅度检测放大技术; 低功耗设计

## Development of a Capacitive Soil Moisture Sensor Based on Wave Amplitude Detection and Amplification

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**Abstract:**

Measurement of soil water content is essential for evaluation and selection of agro-systems, and for the reasonable use of water resources. This paper presents a new type of capacitive soil moisture sensor based on the wave amplitude detection and amplification according to the relationship between soil water content and soil relative permittivity. The sensor was tested in solution samples, clay loam, sandy loam and clay soils. Results showed that there is a very linear relationship between sensor output voltage and water content of the measured medium ( $R^2=0.81\sim 0.99$ ). The sensor should be calibrated before being put into applications because the sensitivity of the sensor varies significantly with soil texture. The power consumption of the sensor is lower than 8mW under an operating voltage of 2.5V. The sensor can be extended to real-time measurement of soil moisture in precise agricultural systems.

**Keywords:** soil moisture sensor; capacitance method; wave amplitude detection and amplification; low-power design

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