基于相位检测原理的TDR土壤电导率测量研究Research of Soil Conductivity Measuring Technique with TDR Based on Phase Detecting Principle

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关键词： 土壤 电导率 盐分 时域反射 相位检测

摘 要： 介绍了基于相位检测的时域反射（P-TDR）技术的工作原理。对8种不同盐分含量的砂壤土土样在5个含水量水平下进行实验，结果显示，信号的反射系数随电导率增加单调减小。分别采用线性和二次多项式对测量结果进行建模实验，并选择二次多项式为P-TDR电导率测量模型，模型的决定系数达0.812以上。土壤含水量对电导率测量有较大影响，在分析了土壤含水量与多项式系数关系的基础上，最终建立了以土壤含水量和反射系数为变量的土壤电导率预测模型。土壤质地等因素对P-TDR电导率测量的影响还需通过田间现场测量实验进行研究。 P-TDR is a new time-domain reflectometry based on the phase detection principle. It measures the travel time of testing signal by detecting phase difference of the incident and reflected waves, and thereby calculates the soil moisture content. The P TDR measurement accuracy of soil moisture content reaches the level of the traditional TDR. But if it is used to measure soil conductivity (σ) by detecting the testing signal reflectivity (ρ), verification is necessary. The measurement method of soil conductivity and the principle of P-TDR were introduced firstly. Then an experiment was arranged. The testing signal reflectivity of P-TDR was measured in 8 sandy loam soil samples, which had different salt contents under five levels of soil moisture content (θ). The relationship between ρ and σ was modeled respectively by using linear and quadratic polynomial model, and the quadratic polynomial was chose for P TDR electrical conductivity measurement model, whose determination coefficient was above 0.812. The experiment results also showed that soil moisture content had greater influence on the electrical conductivity measurement. After the analysis of the relationship between soil moisture and the quadratic polynomial coefficients, the predictive model of soil electrical conductivity, which is the function of ρ and θ , was established. The experiments of in-situ measurements are needed to research the influence of factors such as soil texture on the P-TDR soil conductivity measurement.

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