

基于相位检测原理的土壤水分时域反射测量技术 Measurement of Soil Moisture Based on Phase Detecting Principle

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关键词: 土壤含水量 介电常数 时域反射 相位检测

摘要: 针对土壤水分测量的特点, 提出了用高频正弦波代替脉冲信号作为测试信号, 利用相位检测原理测量信号传播时间, 从而测量土壤含水量的方法。设计了由高频信号发生器、相位检测器、微处理器和土壤水分探头等组成的P-TDR原理样机。试验表明, 该样机测量信号传播时间的精度可达到10 ps, 在砂土、壤土和粘壤土中的土壤含水量测量结果与称重法对比差值不超过0.03。 The basic principle of time domain reflectometry used for soil moisture measurement is introduced, and the disadvantages of currently available TDR instruments are discussed as well as their advantages. A new TDR system, called P-TDR, composed of a high-frequency signal generator, a phase detector, a microprocessor and a soil moisture probe is developed. Single-frequency sinusoidal voltage signal is adopted as test signal, and the travel time of the test signal along with probe embedded in moist soil is measured by a phase detector instead of high-speed sampling oscilloscope, from which the soil water content will be estimated. It has high accuracy and resolution in travel time measurement. Calibration experiments are conducted in sand, loam soil and clayey loam soil samples with the volumetric water contents varied from zero to saturation. The experimental results show that the measuring deviation is less than 0.03 between P-TDR and gravimetric sampling method.

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