

Universität Stuttgart



## Calibration Methodology of TDR Signals Under Non-Isothermal and Varying Soil Moisture Conditions

Master Thesis

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## Abstract

Time Domain Reflectometry (TDR) has been well accepted for the estimation of soil moisture since Topp et al. in 1980, proposed using the TDR technique to obtain a correlation between bulk permittivity and soil moisture content [Topp et al., 1980a]. The evaluation and monitoring of soil moisture from TDR is an essential factor in various applications such as subsurface heat storage and thermal soil in-situ remediation. However, the effects of temperature for the interpretation of TDR signals in different types of soils, especially in clay-silt, are so far unknown. Therefore, the main objective of this thesis is to calibrate TDR sensors for various soil moisture contents, temperatures and soil types. Two methods were proposed to achieve the aim of this thesis. The first method referred through this document as the "Pressure Cooker", turned out to be quite difficult to apply due to the numerous constraints that were identified during its testing. Hence, the second method was applied; which was based on the "Rapid Calibration Method" proposed by Young et al. in 1997. The outcomes obtained for this second methodology are reasonable results for experiments carried out with Geba soil, in contrast to the results obtained for silty-clay experiments, in which difficulties were found in the interpretation of the TDR signals.