

Abstract

Novel TDT Sensor for Soil Moisture Profile Probe [†]

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The aim of the work was to experimentally determine the sensitivity and resolution of a single sensor installed in a profile probe for moisture measurement at various soil profile depths. Its design and the principle of operation were based on a novel patent-pending implementation of the time-domain-transmissionmetry (TDT) technique using differential signals.

The sensor consisted of two stainless steel stripes wound around a plastic tube 40 mm in diameter in the form of cut loops, comprising a differential balanced line connected to a PCB placed inside the tube. Two symmetrical input and output ports were formed at the connection points. The delay of the input signal measured at the output depended on dielectric permittivity of a material surrounding the probe.

The difference in the signal delay registered for the probe, surrounded by air and water, divided by the sensor resolution, obtained from the phase loops jitter, allowed the determination of the sensor sensitivity, which was found to be under 0.1% of volumetric water content. The sensitivity can be further enhanced by elongating the length of the transmission line by increasing the probe diameter.

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