Geophysical Research Abstracts
Vol. 20, EGU2018-6542, 2018
EGU General Assembly 2018

Progress in TDR probing

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Measurement of the electromagnetic characteristics of materials is of interest for several applications, ranging from geophysics [1] and quality control of alimentary products [2] to medical applications [3].
Recent studies have shown the possibility, at least theoretical, to measure both the equivalent relative dielectric permittivity and the equivalent magnetic permeability of the materials by means of time-domain reflectometer (TDR) probes [4]. It is well known that microwave circuital set-ups based on waveguides can be exploited in order to discriminate both the dielectric permittivity and the magnetic permeability of a material under test [5], however the use of TDR probes is an innovative method which isessentially based on the same concept in the framework of transmission lines.
In [4], this has been shown using an open transmission line with respect to a lossless medium. In this paper, it will be shown that a short circuited line can also be exploited. An open ended line is suitable to describe a bifilar or trifilar probe driven into the soil, whereas a short-circuited line is suitable to describe a coaxial cable partially filled with the material under test and closed with a metallic termination. Additionally, when making use of an open ended termination the radiation losses are neglected, whereas a shorted coaxial cable does not require any approximation in this sense. This contribution describes work in progress that will be suplemented with numerical and experimental work scheduled in the near future. The research is funded by the project "TDRpro: Design of Time Domain Reflectometer (TDR) Probes" funded by Ministry for the Economy, Industry and Small Business (Malta)

Reference

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