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Evaluation of wood structure using GPR with FO method – Effect of moisture, fibers direction and density

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Abstract

This work deals with the potential of GPR method in the evaluation of wood structure in relation with density of wood (different wood species), the orientation of fibers and water content (Maï et al., 2015; Reci et al., 2016). The system of measurements is the georadar type (GPR-ground penetrating radar) composed of an electromagnetic signal generator (SIR 3000 of GSSI), and one couple of antennas, one Transmitter (T) and a Receiver (R) of 1.5GHz center frequency, located in the same box in a fixed distance of 6cm. Six wood samples are tested, three samples of Epicea and three samples of Pine. To compare and analyze the results of dielectric constants, we have used the data on three principal directions (Transvesal, Longitudinal and Radial).
We note that the dielectric constant of wood increases with the moisture by mass as a consequence of increasing polarization and the conduction phenomena. This effect is more distinguished when the electric field is polarized parallel to the fibers than in perpendicular direction. The smallest contrasts are observed in the radial direction. We conclude that is more appropriate to evaluate the water content along the parallel direction of fibers. In this case we observe the maximum of contrasts of dielectric contrasts between dry and humidity states. Differences on dielectric constant, spectras and amplitudes are taken between different wood samples. Knowing that the dielectric constant is related to the capacity of polarizing (dependent on the water quantity), the increasing of water content could explain the difference of values obtained for the dielectric constants between two kinds of wood.

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