ABSTRACT

GPR (Ground Penetrating Radar) is a useful tool for the detection of objects buried beneath the soil surface to a certain depth. GPR be very useful because it is not necessary to dig the ground to find objects as well as information about the situation in the ground so that it can save time and energy. In most GPR systems, the antenna is very important. Generally, each antenna only has a certain footprint. In general, the footprint area (spot) that can be scanned by the antenna sender, in a horizontal plane in the soil at certain depths. To obtain optimal performance, shape and size of the footprint should be proportional to the object. If the footprint is too large compared to the object, then the ground clutter also increases. Ground clutter is the signal that come out of the object reflecting the signal from the transmitter so as to obscure the description of the object. If this happens, the user must perform GPR advanced image processing in order to distinguish between targets with clutter. In other words, the more optimal depiction of the object if the ground clutter to a minimum. Conversely if the footprint is too small compared to the object, the object will be difficult to detect. With these considerations, the author tries to develop a GPR antenna system with multiple footprints.

The antenna in this simulation is rolled-dipole antennas with resistive loading for impulse GPR applications. Resistive loading aims to suppress late-time ringing. Late-time ringing is an oscillation that followed pulses sent. These oscillations can obscure the signal reflected by the object, making it hard to do the detection. Antenna system that will simulate numbered 9 arranged pieces shaped diamonds. Antenna rationing election will determine the resulting footprint. This allows the operation of the GPR for a variety of footprint by using only a single antenna system.

For purposes of analysis the author uses electromagnetic FDTD method (Finite-difference time-domain) with software for watching FDTD3D the transmitted waveform at the broadside antenna in time domain and observing the resulting footprint. These methods include the selection for work on domain FDTD time, so for a wide range of frequencies can be solved with a single simulation.

From the simulation results can be analyzed several important things. First, rolled-dipole antenna can be used for impulse GPR applications with Fractional bandwidth for 0:53 so that is ultra-wideband (UWB). Second, Level ringing rolled-dipole antenna is of -29.9 dB at a distance of 15 cm from the ground, and -31.3 dB at a distance of 30 cm from the ground, so that's feasible to use GPR applications impluse high resolution. Third, footprint size can be adjusted in accordance with a powered antenna, and the distance between the nearest feedpoint to produce the desired footprint is 25 cm or one-half of a wavelength. Fourth, rolled-dipole antenna is very supportive for the antenna configuration can reduce the order for the antenna dimension reduction by a factor up to 4.

Keywords: *GPR antenna, impulse GPR, pulse, rolled dipole antenna, resistive loading, footprint, FDTD, FDTD3D, Matlab.*