

Extraction of the Signature of a Buried Object

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The objective of Ground Penetration is the close-in sensing of underground and urban-embedded targets using a network of sensors. Buried targets are usually associated with a difficult clutter environment because of the presence of a ground, which is a lossy medium. The range is primarily governed by the material loss, the spreading loss and the scattering loss. In order to detect the buried object the electromagnetic wave should not have very high frequency components. The physical model of the system is shown in Fig 1. One of the challenges of GPR is antenna design as most antennas show dispersive characteristics due to the reflections from the ends. For target detection the spiral antenna is more appropriate because it exhibits circular polarization. The antenna coupling and ground bounce effects are removed from the receiver response, yielding a late-time response due to the target only. But this response is convolved with the transmitter and receiver antenna characteristics which have to be removed by deconvolution. For ill-posed problems of this type the conjugate gradient gives better extraction results. For the purpose of target identification we have compared the deconvolved sphere response with the simulated response of the target in Fig 2. Natural frequency extraction is done for the full-time data as well as for the late time target signature only. A very close match is obtained between the natural frequencies of the simulated and the extracted target responses in case of the target buried deep in the ground as shown in Fig 3.

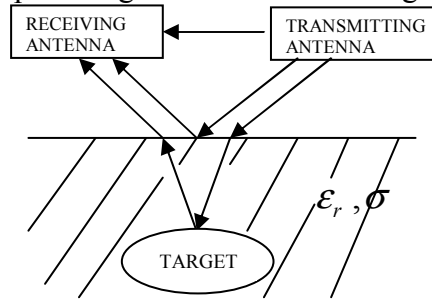


Fig. 1. Block Diagram of Setup

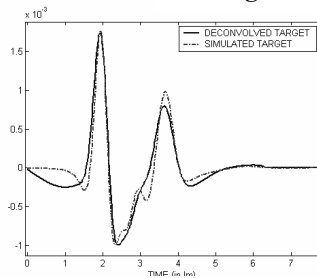


Fig. 2. Target Response Using Spiral Antennas

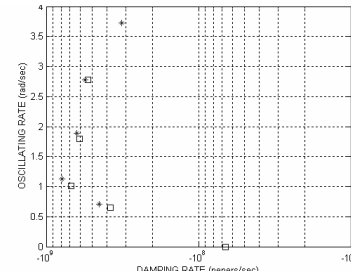


Fig. 3. Natural Resonance Frequencies of Late-time Response of Target