Geophysical Research Abstracts
Vol. 16, EGU2014-15250, 2014
EGU General Assembly 2014

Reconstruction of buried objects embedded in circular opaque structures

Raffaele Persico (1), Gianluca Gennarelli (), and Francesco Soldovieri ()
(1) (r.persico@ibam.cnr.it), (2) swoldovieri.f@irea.cnr.it

This contribution deals with the ground penetrating radar imaging of targets embedded in a visually opaque circular structure. The problem has practical relevance in civil engineering and archeological prospections, where structures of interest such as columns or pillars may have to be inspected in non-invasive way in order to detect the possible presence of anomalies (e.g. cracks, water infiltrations, and so on). In this framework, we investigate the possibility to inspect the circular region of interest thanks to a radar system composed by two antennas that are in contact with the structure and rotate simultaneously around it in order to illuminate and measure the field scattered by buried objects from multiple directions. Two different measurement strategies are examined. The first one is the multimonostatic configuration where the backscattered signal is collected by the transmitting antenna itself, as it moves along the circular observation line. The second acquisition strategy is the multibistatic one, with the transmitting and receiving antennas shifted by a constant angular offset of ninety degrees as they move around the column. From the mathematical viewpoint, the imaging problem is formulated as a linear inverse scattering one holding under Born approximation [1]. Furthermore, the Green's function of a homogeneous medium [2] is used to simplify the evaluation of the kernel of the integral equation. The inverse problem is then solved via the Truncated Singular Value Decomposition algorithm [3] in order to obtain a regularized solution. Tomographic reconstructions based on full-wave synthetic data generated by the Finite Difference Time Domain code GPRmax2D [4] are shown to assess the effectiveness of the reconstruction process.

REFERENCES

[1] W. C. Chew, Waves and fields in inhomogeneous media, IEEE Press, 1995.
[2] R. F. Harrington, Time harmonic electromagnetic waves, McGraw-Hill, New York, USA, 1961.
[3] M. Bertero and P. Boccacci, Introduction to Inverse Problems in Imaging, Bristol, U. K.: Inst. Phys., 1998.
[4] A. Giannopoulos, GprMax2D/3D, User's Guide, 2002. [Online]. Available: www.gprmax.org.