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Numerical modelling of GPR ground-matching enhancement by a chirped multilayer structure - output of cooperation within COST Action TU1208

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As is well know, Ground Penetrating Radar (GPR) is an electromagnetic technique for the detection and imaging of buried objects, with resolution ranging from centimeters to few meters [1, 2]. Though this technique is mature enough and different types of GPR devices are already in use, some problems are still waiting for their solution [3]. One of them is to achieve a better matching of transmitting GPR antenna to the ground, that will increase the signal penetration depth and the signal/noise ratio at the receiving end.
In the current work, a full-wave electromagnetic modelling of the interaction of a plane wave with a chirped multilayered structure on the ground is performed, via numerical simulation. The method of single expression is used, which is a suitable technique for multi-boundary problems solution [4, 5]. The considered multilayer consists of two different dielectric slabs of low and high permittivity, where the highest value of permittivity doesn't exceed the permittivity of the ground. The losses in the ground are suitably taken into account.
Two types of multilayers are analysed. Numerical results are obtained for the reflectance from the structure, as well as for the distributions of electric field components and power flow density in both the considered structures and the ground. The obtained results indicate that, for a better matching with the ground, the layer closer to the ground should be the high-permittivity one.

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References
[1] H. M. Jol. Ground Penetrating Radar: Theory and Applications. Elsevier, 2009. 509 pp.
[2] R. Persico. Introduction to Ground Penetrating Radar. IEEE Press, Wiley, 2014. 368 pp.
[3] A. Benedetto, L. Pajewski. Civil Engineering Applications of Ground Penetrating Radar. Springer, 2015. 371 pp.
[4] H.V. Baghdasaryan, T.M. Knyazyan, "Problem of Plane EM-Wave Self-action in Multilayer Structure: an Exact Solution", Optical and Quantum Electronics, vol. 31, 1999, pp. 1059-1072.
[5] H.V. Baghdasaryan, "Basics of the Method of Single Expression: New Approach for Solving Boundary Problems in Classical Electrodynamics", Yerevan, Chartaraget, 2013.