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Research perspectives in the field of ground penetrating radars in Armenia

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Armenia is a country located in a very complicated region from geophysical point of view. It is situated on a cross of several tectonic plates and a lot of dormant volcanoes. The main danger is earthquakes and the last big disaster was in 1988 in the northwest part of contemporary Armenia. As a consequence, the main direction of geophysical research is directed towards monitoring and data analysis of seismic activity. National Academy of Sciences of Armenia is conducting these activities in the Institute of Geological Sciences and in the Institute of Geophysics and Engineering Seismology.

Research in the field of ground penetrating radars is considered in Armenia as an advanced and perspective complement to the already exploiting research tools. The previous achievements of Armenia in the fields of radiophysics, antenna measurements, laser physics and existing relevant research would permit to initiate new promising area of research in the direction of theory and experiments of ground penetrating radars.

One of the key problems in the operation of ground penetrating radars is correct analysis of peculiarities of electromagnetic wave interaction with different layers of the earth. For this, the well-known methods of electromagnetic boundary problem solutions are applied. In addition to the existing methods our research group of Fiber Optics Communication Laboratory at the State Engineering University of Armenia declares its interest in exploring the possibilities of new non-traditional method of boundary problems solution for electromagnetic wave interaction with the ground. This new method for solving boundary problems of electrodynamics is called the method of single expression (MSE) [1-3]. The distinctive feature of this method is denial from the presentation of wave equation's solution in the form of counter-propagating waves, i.e. denial from the superposition principal application. This permits to solve linear and nonlinear (field intensity-dependent) problems with the same exactness, without any approximations. It is favourable also since in solution of boundary problems in the MSE there is no necessity in applying absorbing boundary conditions at the model edges by terminating the computational domain. In the MSE the computational process starts from the rear side of any multilayer structure that ensures the uniqueness of problem solution without application of any artificial absorbing boundary conditions.

Previous success of the MSE application in optical domain gives us confidence in successful extension of this method's use for solution of different problems related to electromagnetic wave interaction with the layers of the earth and buried objects in the ground.

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