FINITE DIFFERENCE TIME DOMAIN NUMERICAL SIMULATION OF 3D GROUND PENETRATING RADAR FOR URBAN ROAD CAVITY DETECTION

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The urban road collapse is usually elusive, urgent and with great damage. It is difficult to find hidden danger of road accurately with traditional two-dimensional ground penetrating radar (GPR) detection technology due to its single profile, small amount of information and ambiguity. 3D ground penetrating radar detection technology, which obtain sectional view, plan view and cross section in 1~2m width detection range at one time and form accurate multi-angle 3D image of the underground space, can make up for the defects of two-dimensional detection. In this paper, the finite difference time domain method was used to systematically analyze the electromagnetic wave propagation characteristics in three-dimensional space, and 3D GPR detection for road subgrade, cavity and gradual enlargement process were simulated, furthermore, their electromagnetic field characteristics in 3D ground penetrating radar are comparative analyzed with three-dimensional detection examples. The results show that when a component of electromagnetic field was loaded source, the energy distribution of other components is different, showing symmetry. The spatial position and extension of cavity disease can be accurately obtained by analyzing the reflection wave field characteristics of 3D GPR combined profiles, forward modeling results and examples are in good agreement.