EXACT SOLUTION OF THE EQUATION FOR ELECTROMAGNETIC SCATTERING IN RANDOM MEDIA MEAN GREEN'S FUNCTION

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Volume scattering plays an important role in electromagnetic response of radar in remote sensing of much earth and other planetary surfaces terrain. Therefore the adequate description of this physical phenomenon is an important problem.

Usually the scattering process was described using the various approximate solutions of the Maxwell equations with random dielectric permittivity. For example, one of the most known approximations is the so-called nonlinear approximated equation for the mean Green's function. However, this form of the equation includes only the part multiple-scattering terms and does not provide sufficient accuracy in the some cases. In general, for these solutions are often questionable whether the contribution from the unaccounted terms could always be ignored. Therefore it seems attractive to obtain the solution of the scattering volume problem in general case of the randomness and to check the various assumptions and approaches.

The objective of this study is to develop an exact solution for mean electromagnetic field when the source is given by the delta-function. Using a technique of the variational derivations for the averaging we have obtained the equation for the mean Green's function. To describe the fluctuation part of the dielectric permittivity a characteristic functional has been used. The variational derivations allow taking into account a general case of the randomness of the arbitrary kind by introducing the corresponding terms into exponential index.

The general form of the Green's function expression has presented as an infinite sum of terms. These terms include the exponents whose indexes contain sum of operators. Using the general form we have obtained the mean Green's function for some interesting cases. One of them has been considered for the correlation function of the dielectric permittivity presented in an exponential form. For this case Green's function has been given as infinite series of partial waves. The "effective" propagation coefficients of these waves present functions that contain the sums of the wave vector and the correlation length of permittivity fluctuations. The amplitudes of these waves are also determined of the correlation length and described the electromagnetic field decaying due to multiple scattering. The interference effects for partial waves are considered and their applications for measurements of the medium parameters are discussed. The various relations between wave vector and correlation length are studied; the comparisons with various well-known approximate solutions are provided. The special attention was given to the case when the wave vector was an approximately equal to the correlation length. The strong interference effects have been observed in this case due to simultaneous interaction a number of partial waves.

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