Abstracts

Exact Solutions for Rectangularly Shielded Lines by the Carleman-Vekua Method

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Exact solutions for the field of the TEM mode of rectangularly shielded round or strip conductors are obtained by solving linear, singular integral equations. There are no limitations on the dimensions or the proximity of the conductors to the shield. Here only round conductors are considered; printed microstrip conductors are analyzed in further publications. The kernel of the integral equation in such problems is the Green's function G of a line source inside the shield, possessing a logarithmic singularity near the source point. In a series of recent papers the authors have developed new expansions for G, in which the singular and certain other terms are extracted in closed form out of G and the remaining, nonsingular part is then reexpanded into series converging uniformly everywhere and very rapidly (exponentially) near the source point. These new expansions for G are particularly suited for the exact solution of the singular integral equation of round shielded conductors by the Carleman-Vekua method, otherwise known as the method of regularization by solving the dominant equation. This leads to strongly convergent solutions for the field of the mode even when the conductors are large or very near the shield. Questions of integrability of nonuniformly convergent series do not arise. Characteristic values of the shielded lines, evaluated by summing a few terms, have been checked against existing approximate results and field plots are shown in the case of close proximity. Due to the exponential convergence of the kernel expansion it is possible to provide useful, closed-form expressions for the characteristic impedance of the line. The accuracy of such formulas is shown to be amply adequate for most practical situations.

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