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ANALYSIS OF GEOMETRY OF BOUNGARY-VALUE PROBLEMS IN THE GENERALIZED METHOD OF PARTIAL DOMAINS

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The authors consider the processing of geometric information in the algorithms realizing the method of partial domains for treatment of internal boundary problems of electrodynamics. This procedure (preprocessor) generates a description of the cross-section of an intricate waveguide line with a priori unknown piecewise linear coordinate boundaries, which permits the use of unified matrix operators to calculate its basis.

An accurate electro-dynamic calculation is an important part of any design of high-frequency devices. Application of proper procedures makes it possible to reduce substantially the time spent on creating the final product and, hence, to obtain the required characteristics at minimum cost. A great number of algorithms permit calculating the waveguide assemblies with enough accuracy, but they demand large resources, which complicates their usage for optimization of the device structure. In this connection, one of the main requirements imposed on the calculation algorithm is its high efficiency.

Despite the wide use of net-type methods for treatment of internal boundary problems of electrodynamics, the competitive method of partial domains (MPD) [1–3] heretofore has no equal — in terms of the "efficiency-versatility" criterion. On the other hand, its substantial drawback is that the method requires adaptation to every new problem. All this leads to large labor input of the researcher — both for the algorithm development and for its testing. In turn it leads to delays in resolving the design problems and creates difficulties in MPD practical applications.

The current view is to generalize MPD in such a way as to unify the process of construction of the computational algorithm for any specific problem. Then, while retaining its computational effectiveness, MPD would be able to compete with net-type methods from the standpoint of ease of application and versatility. The generalization in this context means creating an algorithm, which could generate the MPD matrix equations for treatment of specific problems without preliminary analytical preparation. Below is presented a part of the algorithm (called here "preprocessor") responsible for preparation of initial data for calculation of waveguide lines with a priori unknown cross-section of arbitrary complexity, when the cross-section is formed by piecewise-linear coordinate boundaries.

Let the cross-section of the line under consideration lie in the $0XY$-plane. Point 0 (the origin of the coordinate system) coincides with the left lower angle of the rectangle described around the cross-section. Figure 1 depicts a transmission line representing a coaxial waveguide. The cross-section of this line is broken into a number of rectangular domains, which are uniform along the $0Y$-axis. These partial domains are bounded at their sides by conducting surfaces while being open from above and below. The open apertures of different domains may either be linked to one another or sandwiched with conducting walls.

In essence, the number and coordinates of the rectangular domains comprising the whole cross-section of a complex waveguide line represent a sufficient stock of geometric information, which is required for electro-dynamic calculation of the full wave basis. It should be noted that situations may occur when an insignificant change in geometric parameters

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