

Efficient Methods for Calculating Electromagnetic Fields in Two-Dimensional Rectangular Geometries

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Both numerical and analytical methods are employed in the modeling of modern electromagnetic problems. In electromagnetic compatibility (EMC) studies, numerical approaches are widely used due to their universality; however, they often require high computational costs. Analytical methods, in contrast, are characterized by high computational efficiency but are typically limited to simple geometries and a relatively narrow class of problems. Nevertheless, the fundamental principles of analytical approaches can be generalized for addressing relevant EMC problems.

Within the scope of the seminar, a two-dimensional rectangular waveguide with perfectly conducting boundaries is considered, in which the electromagnetic field distribution excited by a point source is computed using different approaches. Numerical modeling is performed using the two-dimensional Method of Moments (MoM) [1][2], while analytical solutions are based on the modal expansion of the structure [3][4]. In addition, an approach for accelerating analytical computations based on transformation into the spectral domain and the use of inverse Fourier-type transforms is discussed [5]. The obtained results are compared in terms of both field distributions and computational performance. It is shown that analytical approaches based on spectral representations significantly reduce computational costs and can be applied to a broader class of problems.

References

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