Indonesian Journal of Electrical Engineering and Computer Science
Vol. 8, No. 2, November 2017, pp. 546 ~ 548
DOI: 10.11591/ijeecs.v8.i2.pp546-548

Analysis and Measurement of Wave Guides Using Poisson Method

M. Sudha[1], A. Kumaravel[2]
[1]Department of Mathematics, AMET University, Chennai.
[2]Department of Soft Computing, Bharath University, Chennai.

Abstract

The Poisson equation is used to analyze and measure the waveguide in quick and exact calculation of Green's capacity. For this reason, Green's capacity is composed as far as Jacobian elliptic capacities including complex contentions. Another calculation for the quick and precise assessment of such Green's capacity is definite. The principle advantage of this calculation is effectively appeared inside the casing of the Limit Integral Resonant Mode Expansion technique, where a generous decrease of the computational exertion identified with the assessment of the referred to Green's capacity is gotten.

***Keywords**: Poisson equation, Green's capacity, Jacobian elliptic*

1. Introduction

In recent days the Poisson equation is used to calculate the green's algorithm under very high accuracy and efficiency. To acquire higher rates of meeting, a group of arrangement speeding up methods has been proposed in the specialized writing. For example, the Poisson summation equation for nothing space intermittent Green's capacities was the favored technique in the 1980s [Lampe et al., 1985], where it was connected to 2-D and 3-D Green's capacities for the Laplace and the Helmholtz conditions [1, 2].

The rectangular waveguide geometry has been generally utilized as a part of numerous viable applications. In this way, the proficient and precise assessment of Green's capacities for such a topology has been significantly researched. For example, the Ewald technique was effectively proposed to assess such capacities for both rectangular depressions and waveguides [3, 4]. All the more as of late, in the work of Quesada-Pereira et al. [2007], Green's capacities for the parallel-plate waveguide have been additionally quickened utilizing Kummer's change: this has been profitable for the productive investigation of inductive hindrances in rectangular waveguides. In this paper, we concentrate on enhancing the numerical productivity identified with the exact calculation of 2-D Green's capacity for the Poisson condition in rectangular waveguides [5, 6].

2. Green's Algorithm

Green's capacity for the Poisson condition in the rectangular space was concentrated numerous years back, and showed up in numerous traditional books on electromagnetic. The simple formulation is

$$\nabla^2 G\left(x, y|x', y'\right) = -\delta\left(x - x'\right)\delta\left(y - y'\right)$$

Where (x,y)= genetic field
(x', y')= source point

The fundamental question is to decide the quantity of terms that ought to be included to accomplish the coveted precision, in light of the fact that the rate of union relies on upon the area of the source and the field focuses, and in addition on the measurements of the rectangular space. To beat this issue and to diminish the related calculation time, an alternate expression for the scalar Green's capacity (announced by Morse and Feshbach as a potential

Received July 22, 2017; Revised September 30, 2017; Accepted October 15, 2017

made by a charge q inside a rectangular space that is proportional to the line charge inside a waveguide) will be utilized rather than (4). This expression utilizes conformal mapping in the complex variable, which has been generally utilized for illuminating numerous issues in electromagnetic.

Give a waveguide a chance to be invariant along the z hub (i.e., a 2-D issue), and in this manner we can utilize the complex plane to draw its rectangular cross segment. Without misfortune of all inclusive statement, we consider a > b, where an and b are the waveguide width and stature, individually. The rectangle is assigned in the main quadrant, with one vertex at the starting point of the z plane. The representing the problem in geometry is shown in Figure 1.

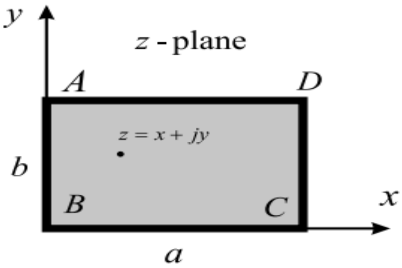

Figure 1. Representation of problem in geometry

3. Scalar representation of Green’s function

In green function is easily obtained by using the Poisson equation in free space.

$$\nabla^2 G\left(r\middle|r'\right) = -\delta\left(r-r'\right) = -\frac{1}{2}\ln\left|r-r'\right|$$

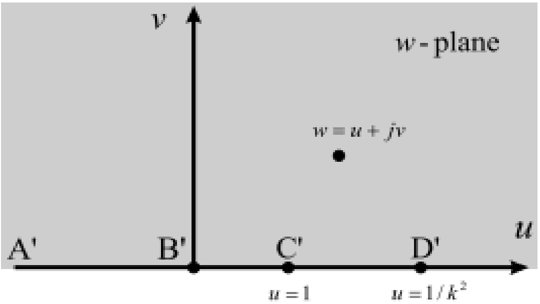

Figure 2. Rectangle is mapped in upper plane

The principle preferred standpoint of this arrangement is that Green's capacity is not given in an arrangement frame, and consequently no union issues will emerge. Be that as it may, there will be couple of downsides which are recorded underneath: The calculation of the Jacobian elliptic capacity with complex contention is required. Figure 2 mapped in upper plane.

4. Performance of green’s function

This peculiarity has an indistinguishable conduct from the one identified with the free-space Green's capacity, as it can be seen from (8) and as of now clarified by Haber man. Amid the calculation of a portion of the network components identified with the numerical arrangement of essential conditions, the referred to singularities commonly show up. For example, when the corner to corner components Lii of the BI-RME strategy are assessed taking after the integrand has a peculiarity at whatever point the source and field focuses concur. Such a peculiarity can be incorporated, yet not numerically since the integrand moves toward becoming unendingness

5. Conclusion

Another calculation for the speedier calculation of the scalar Green's capacity in a rectangular waveguide area has been proposed. Computationally advantageous expressions have been produced from the hypothesis of elliptic capacities, demonstrating a decent adaption for numerical procedures utilized as a part of connected electromagnetic. The solitary conduct of the new expression for Green's capacity has been considered, bringing about the run of the mill. In R frame identified with the arrangement of 2-D issues. This calculation has been uncovered to be to a great degree effective when a high number of assessments of Green's capacity is for all intents and purposes required.

References

[1] Poisson, Antonin, Angel Fernandez, Dario G Perez, Regis Barille, Jean-Charles Dupont. Thin laser beam wandering and intensity fluctuations method for evapotranspiration measurement. *Optics & Laser Technology* 80 2016: 33-40.

[2] Brillard, A, J-F Brilhac, P Gilot. A second-order finite difference method for the resolution of a boundary value problem associated to a modified Poisson equation in spherical coordinates. *Applied Mathematical Modelling*. 2017.

[3] da Silva, João Rogério, José Geraldo Peixoto de Faria, Márcio Matias Afonso, Giancarlo Pellegrino. Effect of local support configuration on the precision of numerical solutions of Poisson equation obtained with differential quadrature method. *IEEE Transactions on Magnetics*. 2017.

[4] Treyssede, Fabien. Spectral element computation of high-frequency leaky modes in three-dimensional solid waveguides. *Journal of Computational Physics* 2016; 314: 341-354.

[5] Fan, Li, Peter Monk, Virginia Selgas. Time Dependent Scattering in an Acoustic Waveguide Via Convolution Quadrature and the Dirichlet-to-Neumann Map. In *Trends in Differential Equations and Applications*. Springer International Publishing. 2016: 321-337.

[6] Kato, Hatsuhiro, Yoshimasa Naito, Takaaki Ishii, Hatsuyoshi Kato. *The control of resonance curve using the shape modulation of the scattering region in elastic waveguide*. In Proceedings of Meetings on Acoustics 172ASA, 2016; 29(1): 065002. ASA.