Analysis of a Stripline by Finite Difference Method

Task

Determine properties of a shielded coplanar stripline depicted in figure designed on a suspended dielectric substrate (h = 1 mm, ε_r = 3.05) by a method of finite diferences using SOR. Find the strip width w and gap g between the strips so that the characteristic impedance is Z_0 = 50 Ω. The distance of side and top shielding walls from the stripline should be larger than 20h (not to affect the line impedance).

Evaluate and illustrate:

a) equipotencial countours and a vector electric field distribution,
b) capacity per unit length and characteristic impedance Z_0,
c) value of Z_0 as a function of number of iterations,
d) charge density on a strip.
e) Determine numerically optimal value of relaxation coefficient α for the smallest number of iterations. Compare with analytical solution that can be received as solution of quadratic equation $\alpha^2 r^2 - 16\alpha + 16 = 0$
where $r = \cos(\pi/N_x) + \cos(\pi/N_y)$ and N_x, N_y are numbers of nodes in the direction of x and y-axis. A solution is $\alpha = (8-\sqrt{(64-16r^2)})/r^2$.

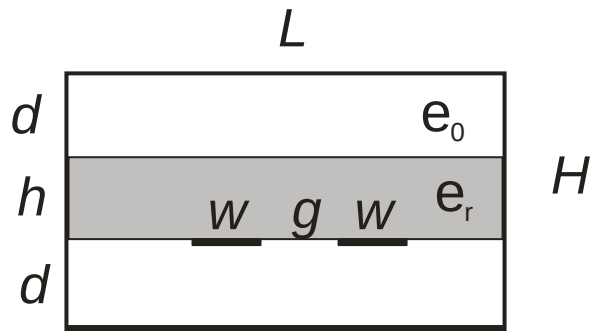

Figure. Cross section of a shielded coplanar stripline

Guidelines:

Elaborate and submit the project as an electronic *.pdf document including task, theoretical description of a method used, analysis of the problem with the evaluation of required physical quantities, and a conclusion. Enclose corresponding code files.

References

[1] Ramesh Garg, *Analytical and Computational Methods in Electromagnetics*, Artech House, 2008, chap. 7, p. 233-280.