

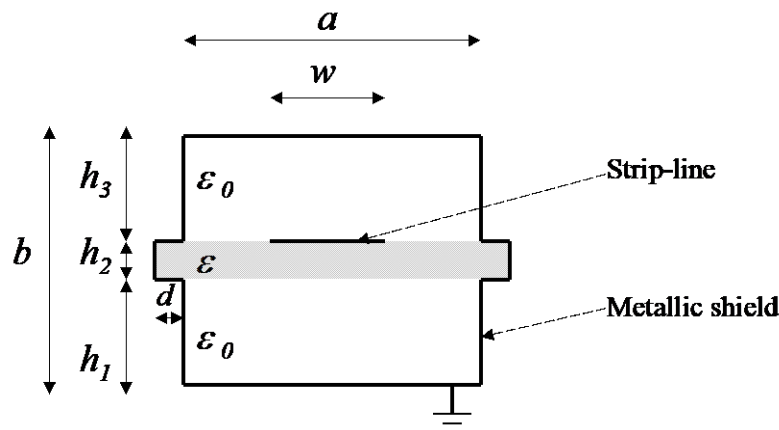
ECEN5154: Homework #2 – due 3-5-20 in class

1. Consider the shielded strip-line on a suspended substrate and supporting grooves as shown in figure below. If the dielectric constant of the substrate is 2.22, and relations between appropriate lengths (as depicted in the figure 1) are: $a / b = 1$, $h_1 / b = h_3 / b = 0.4$, do the following:
 - a) Develop all finite difference equations needed for simulating given structure with the finite difference method;
 - b) Program your finite difference solution and compute the capacitance and the characteristic impedance of the line for the combinations of w / b and d / b given in the table 1. In filling the table, use cell sizes of 0.1 and 0.05 units. Give maps for all node fields (only for case $w / b = 0.8$). You can use Matlab, fortran, C, or excel to carry out the calculations;

| w / b | d / b | |
|---------|---------|-----|
| | 0 | 0.1 |
| 0.2 | | |
| 0.6 | | |
| 0.8 | | |

Table 1.

- c) If the desired characteristic impedance is 75Ω , should h_2 be increased or decreased? Comment what will physically happen for $w / b = 0.2$ and $w / b = 0.8$.
- d) Exploit the inherent geometrical and associated physical symmetries to formulate the FD solution for this problem. Show at least the algorithm, associated equations, and results.

**Figure.** Shielded strip-line structure to be solved using finite difference method.