

Microwave Engineering

26/8/13

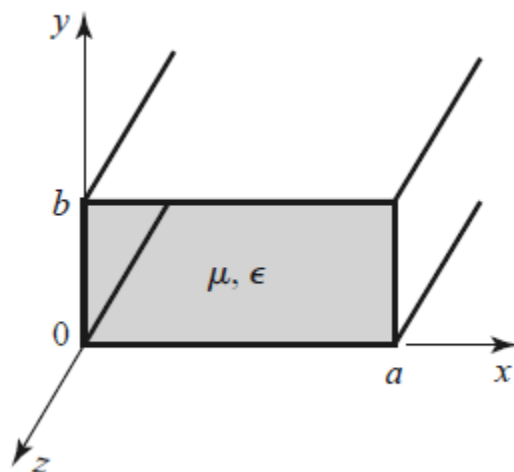
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Exercise 1

Consider a Teflon filled copper rectangular waveguide, having dimensions $a=1.07$ cm and $b=0.43$ cm.

- Find the cutoff frequency of the first three propagating modes.
- For $f=15$ GHz, determine the attenuation due to dielectric and conductor losses.

NOTE: for Teflon assume $\epsilon_r=2.08$ and $\tan\delta=0.0004$; for copper assume $\sigma=5.8 \cdot 10^7$ S/m.



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Exercise 2

- a) Define the scattering matrix of an N-port network.
- b) A two port network is defined by the following scattering elements:

$$S_{11} = 0.1 \quad S_{12} = 0.7 \quad S_{21} = 0.7 \quad S_{22} = 0.1$$

Determine if the network is reciprocal and lossless.

If port 2 is terminated in a matched load, what is the return loss at port 1?

If port 2 is terminated in a short circuit, what is the return loss at port 1?

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Exercise 3

A perfectly monochromatic plane wave ($f_1=0.9$ MHz, $|E_{0i}|=3$ V/m), impinges normally on the discontinuity schematically described in the figure; assume $\mu=\mu_0$ everywhere, $\epsilon_1=\epsilon_0$, $\epsilon_2=10\epsilon_0$, $\sigma_1=0$.

In medium 2 we have: $\sigma_2=6 \cdot 10^7 \Omega^{-1}/\text{m}$

- Compute the reflected specific power
- Compute the skin depth in medium 2

