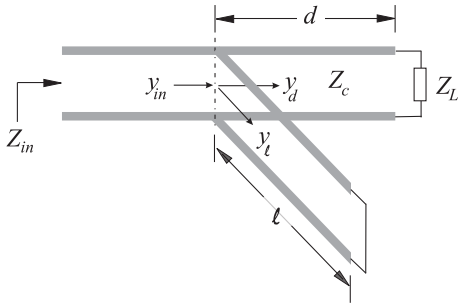
Homework set 5
EE 324/Phys 324
SPRING 2016

1. We wish to match the load $Z_L = 20 + j40\Omega$ to a $Z_c = 50\Omega$ transmission line.

   (a) Determine the shortest length d, such that the impedance attached to the quarter wave section is purely real.

   (b) What is the value of characteristic impedance is required for the quarter wave section.

2. Use a parallel single stub tuner to match the load $Z_L = 120 + j30$ to a 50Ω transmission line.



   (a) If all sections of transmission line are 50Ω determine the lengths d, and ℓ required for a match. Assume that the stub is a short circuit.

   (b) Repeat (a) if the characteristic impedance for the stub section is 100Ω, with the others sections as previously.

3. The parallel double-stub method is used to match a load impedance $Z_L = 200 + j200\ \Omega$ to a lossless transmission line of characteristic impedance 100 Ω. The spacing between stubs is 0.1λ, with one stub connected directly in parallel with the load. Determine the lengths of the stub tuners

   (a) if they are both short-circuited, and

   (b) if they are both open-circuited.

4. The parallel double stub tuner method is used to match the load impedance $Z_L = 12.5 + j25\Omega$. to a lossless transmission line of characteristic impedance $Z_c = 100\Omega$. If the spacing between stubs is given by $d = \lambda/8$, one discovers that a perfect match using the double-stub method with one stub connected directly across the load is not possible. However, a modified arrangement can be used, wherein Z_L is attached to the first stub with a length of line d_L.

   (a) Find the minimum required additional line length d_L

   (b) Find the required lengths of the short-circuited stub tuners, using the minimum d_L found in part (a).

5. As we saw in the previous problem, the double-stub method cannot be used to match certain load values to a line with a given characteristic impedance. Determine the regions of load admittances on a Smith admittance chart for which the double-stub arrangement cannot lead to a match if the distance between stubs is given by $d = \lambda/16$, $\lambda/8$ and $\lambda/4$.