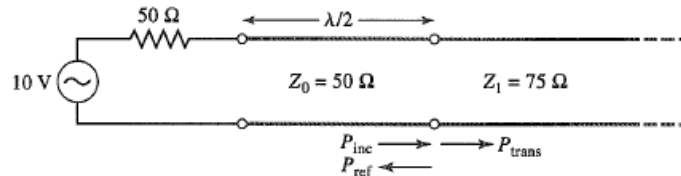


Fall 2009

EE6311 Design Project #2, Dividers and Couplers

1. For the transmission line circuit below compute the incident power, the reflected power and the power transmitted into the infinite 75 Ohm line. Show that power conservation is satisfied.



Note: for the following, design each network “on paper” first and then use Microwave Office or ADS to tune and analyze. Submit your final circuit schematic and frequency response plots for each design.

For the microstrip designs for 2 and 3:

substrate $\epsilon_r=10$

Substrate thickness, $h = 0.381$ mm

Conductor thickness, $t = 10$ μm

Conductor metal = Au

$F_0 = 15$ GHz for designs

Plot from 12-18 GHz for designs

2. Design a three-port resistive divider for an equal power split (3-dB) and a 100 Ohm system impedance. How much power is lost in each arm of the divider? Compare with the performance of a 3-dB microstrip Wilkinson power divider that is matched to 100 Ohms. Plot S_{21} and S_{31} (insertion loss), S_{11} (input return loss) and S_{32} (isolation) magnitude in dB for both designs.

3. Design a quadrature hybrid (branch-line) coupler to achieve a 3dB split at the output ports. Using one of the simulators, plot the following:

- Input return loss (S_{11} mag in dB)
- Coupling (S_{21} and S_{31} mag in dB)
- Isolation (S_{14} mag in dB)
- Directivity (S_{34} mag in dB)

4. Design a 20 dB three-section coupled line coupler with a maximally flat coupling response, centered at 3 GHz and $Z_0 = 50$ Ω . Design the coupler and find Z_{0e} and Z_{0o} for each section. Using a simulator, plot the resulting coupling (in dB) from 1 to 5 GHz. Lay out the microstrip implementation of the coupler on a substrate having $\epsilon_r=4.2$, $d=0.158$ cm, $\tan \delta=0.02$, with copper conductors 0.5mil thick.

Due: Wednesday, Nov 4, 2009