ECE 6130 Power Dividers II

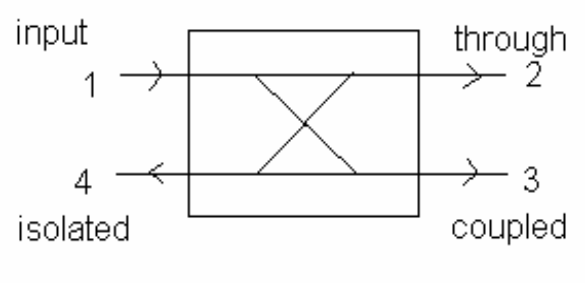
Text Section 7.1 continued and 7.2

How do you design a power divider?
See for examples Chapter 7, Problems 2,4,5

Take: Couplers, handout from other text on couplers

Example: Problem 7.3
Review Minickt sheets on couplers (parameter definitions)

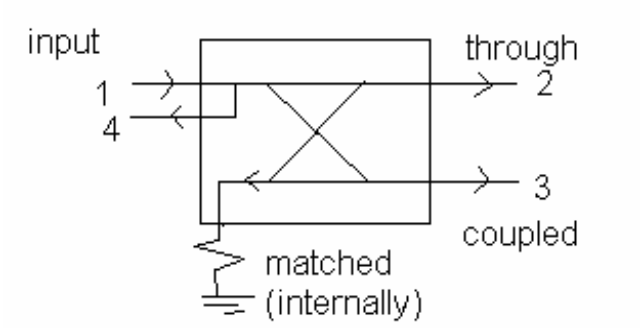
4-Port Directional Coupler



Parameter Definitions:

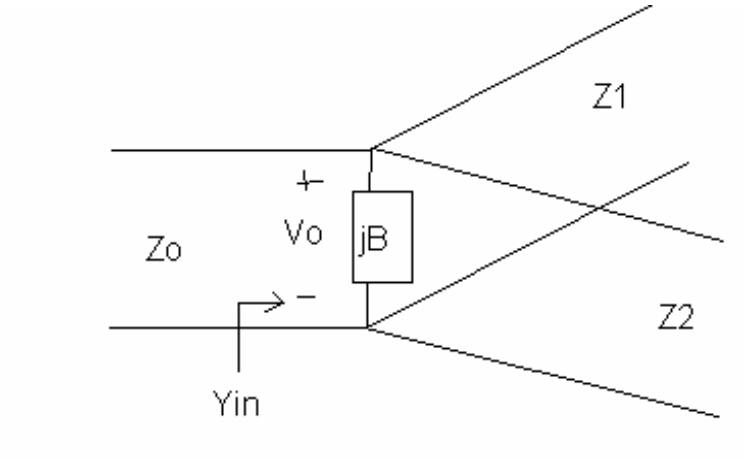
Coupling C = 10 log (P1/ P3)
Directivity D = 10 log (P3/P4)
Isolation I = 10 log(P1/P4)

Use as a 3-port device:



VSWR = Vmax / Vmin on port 1
Isolation:
Coupling (on either P2 or P3) = 10 log (P1/P2) or (P1/P3)
(This is a positive # ... 3dB coupling means that P2 = P1/2)

T-Junction Power Divider:



jB is mismatch due to reflections at junction. It is usually small (designed to be so) or is negated by adding a lumped element at junction.
Yin = jB + 1/Z1 + 1/Z2
For matched network: Zin = 1/Yin = Zo
For jB small: 1/Z1 + 1/z2 = 1/Zo

Design Power Divider:
Desire output powers to have a 3:1 ratio.

Pin = (0.5) Vo^2 / Zo
P2 = Pin / 4 = (0.5) Vo^2 / Z2
P3 = 3*Pin / 4= (0.5) Vo^2 / Z3

Z2 = 4 Zo = 200 ohms for Zo = 50 ohms
Z3 = 4 Zo/3 = 67 ohms

Input impedance Zin = Z2 || Z3 = 50 ohms
(This will be matched by definition, because we didn't allow power to go anywhere else.)

Ports 2 and 3 are not matched. There will be reflections there, that can be removed by adding matching network (single stub?).

Advantages: Lossless
Disadvantages: Mismatched at output ports AND no isolation between output ports. (Generally it is desirable for output ports to be uncoupled, in case waves are reflected at one port, they won't show up at the other port.)

RESISTIVE DIVIDER:
All three ports can be matched using a resistive power divider. But, in practice, this is not very useful, because so much power is lost, and so much heat is generated.