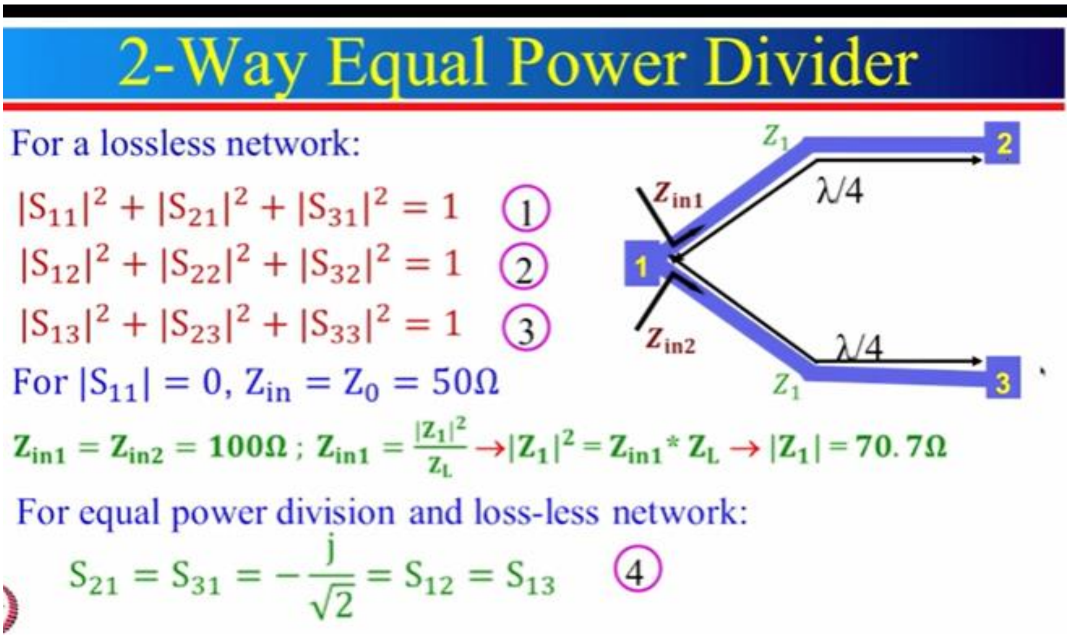
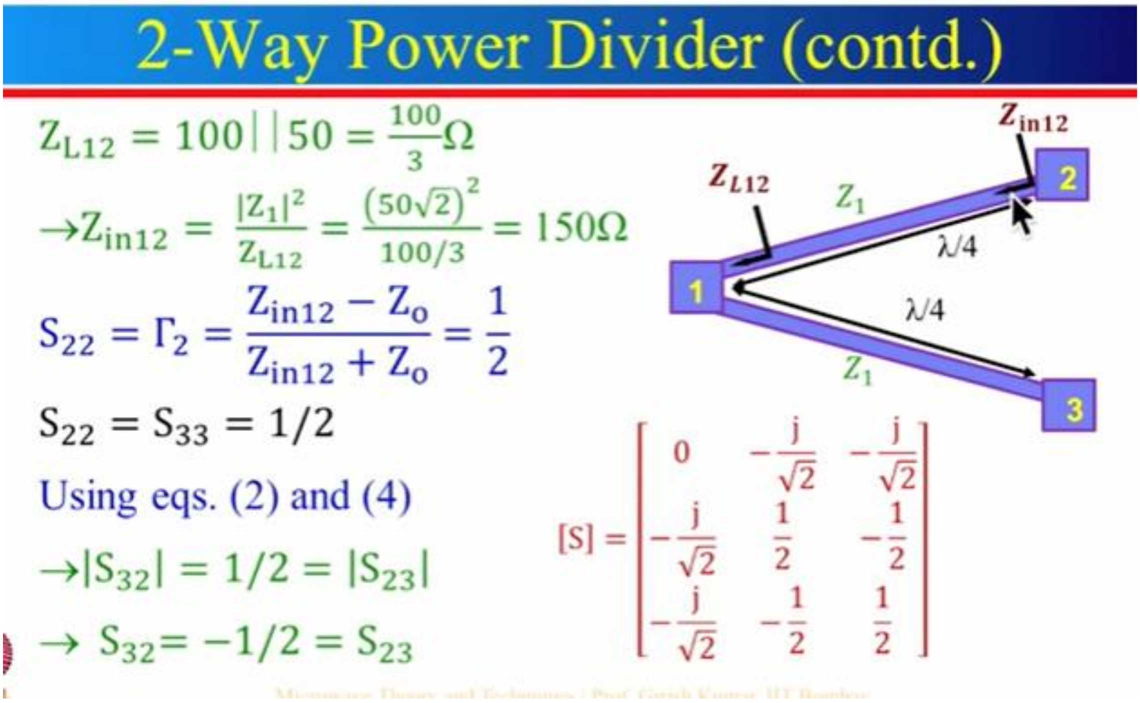


If signal transmission considered from port 1 to port 2 then path difference (λ/4) causes phase difference (ß * λ/4 = 2π/λ * λ/4 = π/2) which can be replaced by 'j' and (-) sign indicates phase delay.

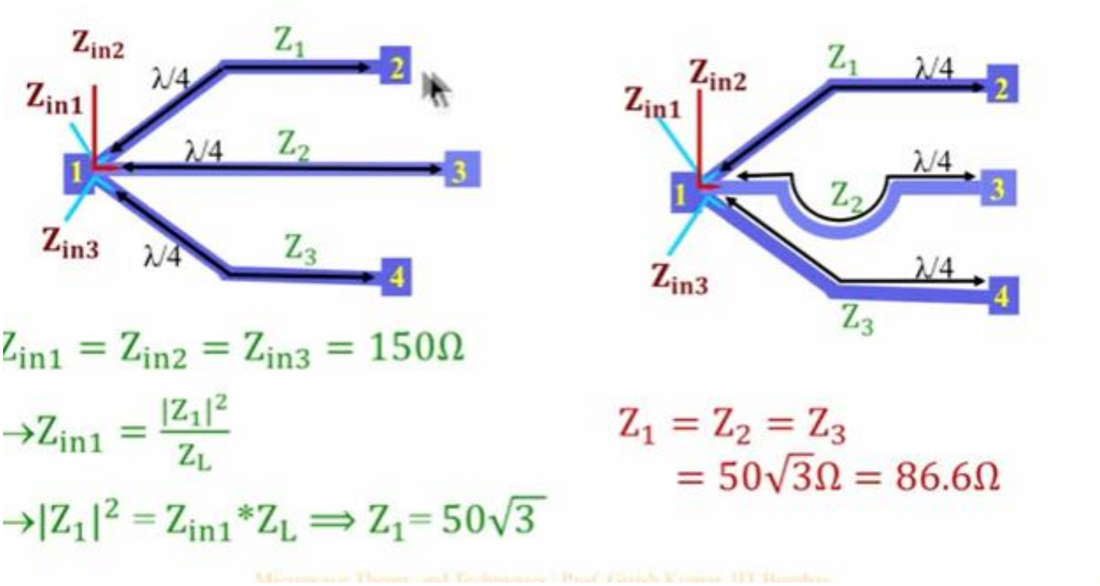
(0+ j1 …90 degree)

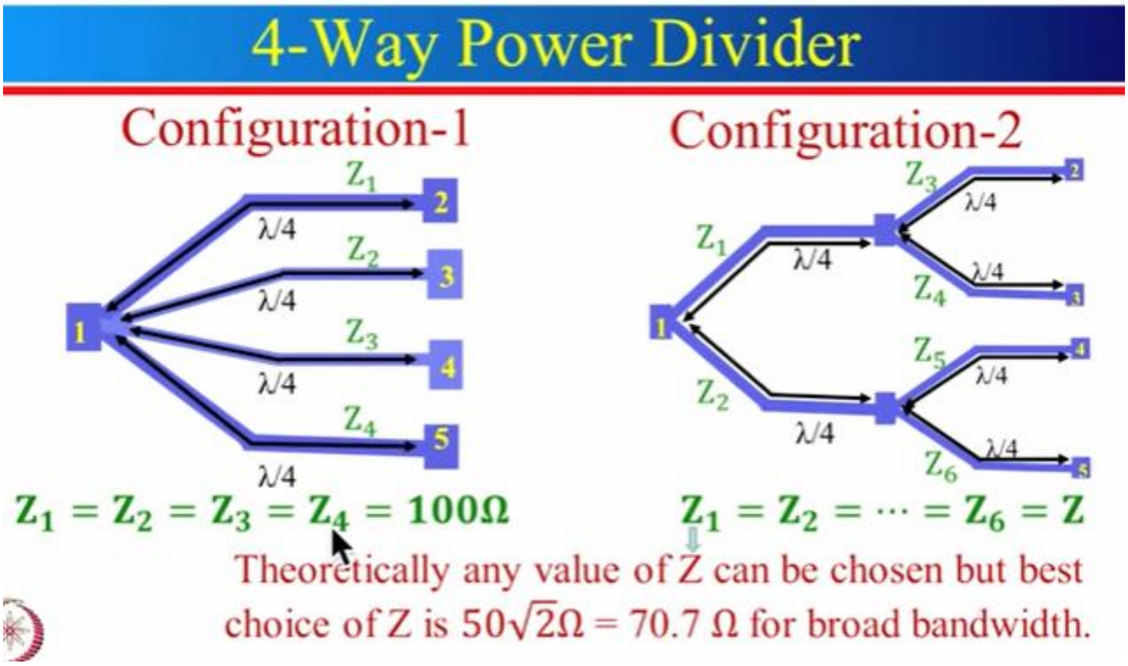


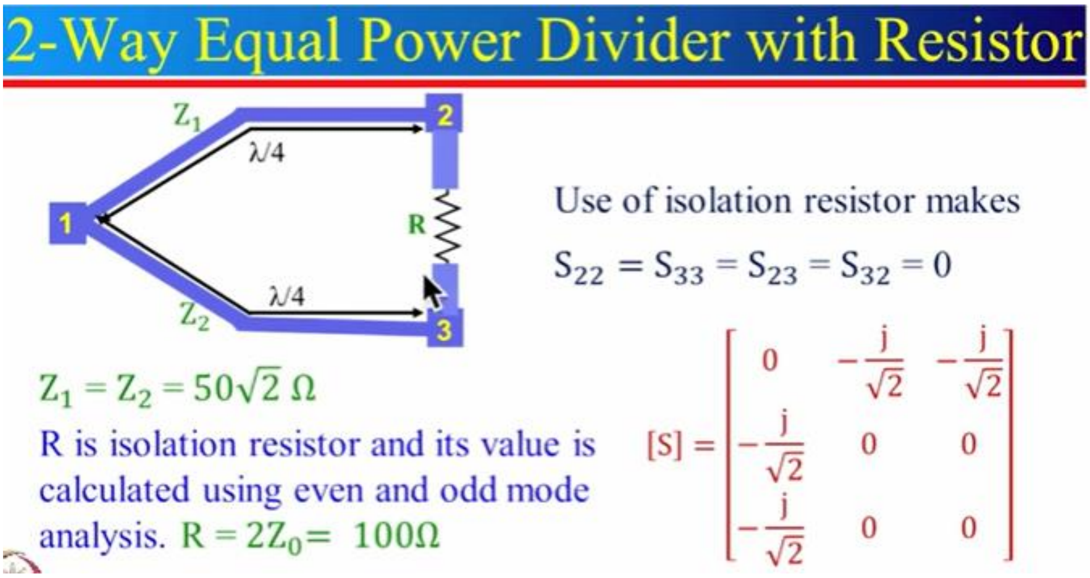
If signal transmission considered from port 2 to port 3 then path difference (λ/4 + λ/4) causes phase difference (ß *2 λ/4 = 2π/λ * 2λ/4 = π, 180 degree) which can be replaced by '-1' and (-) sign indicates phase delay.

Good power divider but a not good power combiner.

3 Way Equal Power Divider





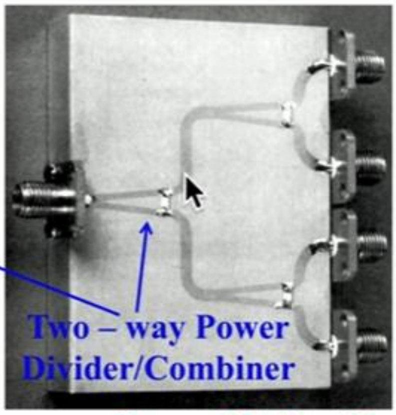


Consider input at port 2 then no output from port 3-, Reason: there are two path from port 2 and 3- one directly from 2 to 3 but practically the distance between port 2 and 3 are very loss causes 0 degree phase difference- another path 2 to 1 then 1 to 3 causes 180 degree phase difference due to 2* λ/4 path difference- so the signal mixed are out of phase causes 0 output.

While considering power combiner donot look at the terms of S matrix isolated because while considering signal transmission between two port third is considered as matched, whereas in power combiner signal applied simultaneously in two ports- signal applied in two port should be same in phase.

Power Divider/Combiner

Two – way Power Divider



Four – way Power Divider/Combiner

2-Way Unequal Power Divider

For $|S_{11}| = 0$, $Z_{in} = Z_0 = 50\Omega = Z_{in1} \parallel Z_{in2}$

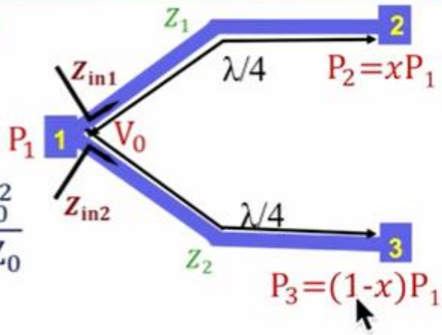
$$Z_{in1} = \frac{|Z_1|^2}{Z_0} \text{ and } Z_{in2} = \frac{|Z_2|^2}{Z_0}$$

$$\rightarrow Z_1 = \sqrt{Z_{in1} * Z_0} \text{ and } Z_2 = \sqrt{Z_{in2} * Z_0}$$

$$P_1 = \frac{V_0^2}{2Z_0};\ P_2 = \frac{V_0^2}{2Z_{in1}} = x\,P_1 = x\frac{V_0^2}{2Z_0}$$

$$\Rightarrow Z_{in1} = \frac{Z_0}{x} = \frac{Z_1^2}{Z_0} \Rightarrow \mathbf{Z_1} = \frac{\mathbf{Z_0}}{\sqrt{\boldsymbol{x}}}$$

$$P_3 = \frac{V_0^2}{2Z_{in2}} = (1-x)P_1 \Rightarrow Z_{in2} = \frac{Z_0}{1-x} = \frac{Z_2^2}{Z_0} \Rightarrow \mathbf{Z_2} = \frac{\mathbf{Z_0}}{\sqrt{\mathbf{1}-\boldsymbol{x}}}$$



Desired: $P_2 = 1/4P_1$ and $P_3 = 3/4P_1 \Rightarrow Z_1 = 100\ \Omega$ and $Z_2 = 57.7\ \Omega$