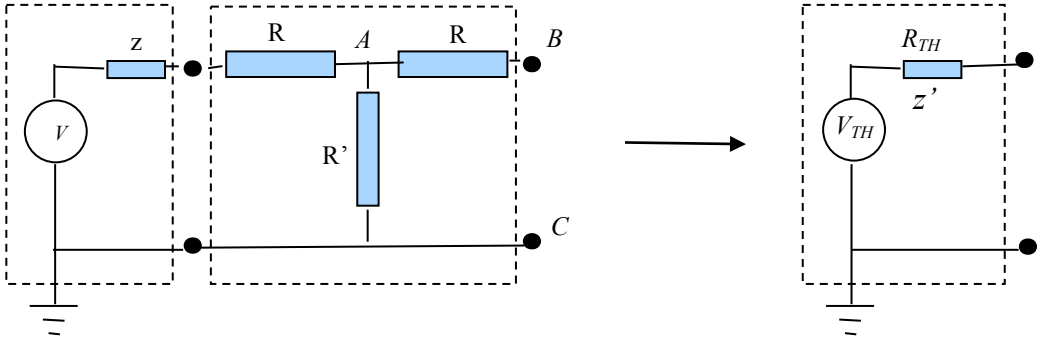
Tee Attenuators

When using a simple voltage divider we can attenuate the input signal strength but will have difficulty in keeping the input(source impedance) and output impedance the same (z=z'). A tee or pi attenuator will allow us to do this.

I. Tee Attenuator



Use Thevenin's Approach

$$V_{TH} = V_{BC} = V_A + \overbrace{V_{AB}}^{=0\,no\,current} = V_{AC} = \overbrace{\frac{R'}{z+R+R'}}^{Voltage\,Divider} V$$

$$R_{TH} = \left(\frac{1}{z+R} + \frac{1}{R'}\right)^{-1} + R = \frac{(z+R)R'}{(z+R)+R'} + R$$

$$= (z+R)\left(\frac{V_{BC}}{V}\right) + R = z'$$

Given α and z' we have two equations aand two unknowns R, R' to solve:

1) *Attenuation of the Tee Attenuator* $\alpha = \frac{V_{BC}}{V} = \frac{R'}{z+R+R'}$

2)*Output* Im *pedance of the Tee Attenuator* $z' = R_{TH} = (z+R)\left(\frac{V_{BC}}{V}\right) + R$

Example:

Let $\alpha = V_{BC}/V = 0.1$ *attenuation level*,

$z' = z = 50\Omega$ *output impedance matching input impedance*

$$R = \frac{1-\alpha}{1+\alpha} z = \frac{0.9}{1.1} 50\Omega = 41\Omega$$

$$R' = \frac{\alpha(z+R)}{1-\alpha} = 10.1\Omega$$