Application

Thus the eighth-wave line is used to transform any resistance to an impedance with a magnitude equal to R_o of the line.

(or)

To obtain a magnitude match between a resistance of any value and a source of R_o internal resistance.

The quarter wave line

The expression for input impedance of a dissipation less line is rearranged as

$$Z_s = R_o \left[\frac{\frac{Z_R}{\tan(2\pi s/\lambda)} + jR_o}{\frac{R_o}{\tan(2\pi s/\lambda)} + jZ_R} \right]$$

Subs $s = \lambda/4$ for quarter wave line

$$Z_s = R_o \left[\frac{\frac{Z_R}{\tan \frac{2\pi}{\lambda} \times \frac{\lambda}{4}} + jR_o}{\frac{R_o}{\tan \frac{2\pi}{\lambda} \times \lambda/4} + jZ_R} \right]$$

$$Z_s = R_o \left[\frac{\frac{Z_R}{\tan \pi/2} + jR_o}{\frac{R_o}{\tan \pi/2} + jZ_R} \right]$$

$(\because \tan \pi/2 = \infty)$

$$Z_s = R_o \left[\frac{jR_o}{jZ_R} \right]$$

$$\boxed{Z_s = \frac{R_o^2}{Z_R}}$$

(or) $\boxed{R_o = \sqrt{Z_s Z_R}}$

Quarter wave line - Applications

1) Used as a transformer to match a load of Z_R ohms to a source of Z_s ohms.

Such a match can be obtained if the characteristic impedance R_o' of the matching quarter wave section of the line is chosen so that,

$$R_o' = |\sqrt{Z_s Z_R}|$$

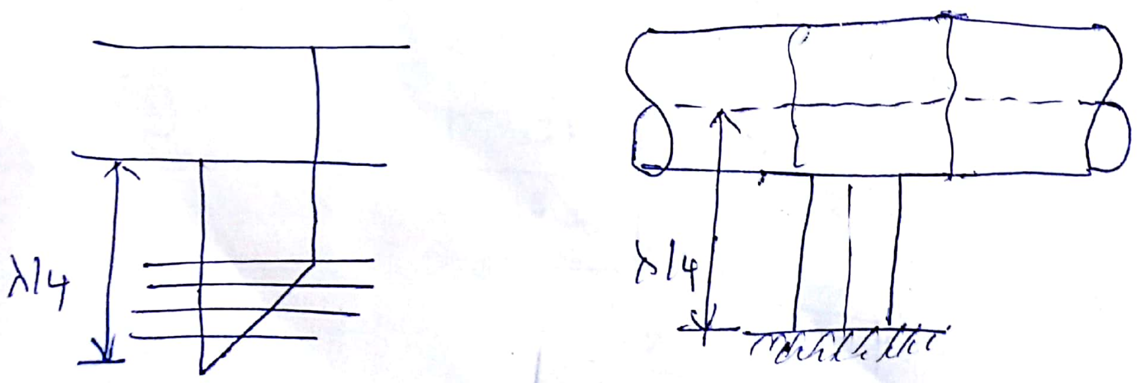
2) Used as an impedance inverter to transform a low impedance into a high impedance and vice versa.

3) Used to couple a transmission line to a resistive load such as antenna.

4) Used if the load is not pure resistance. It should be connected between points corresponding to Imax (or) Emin at which places the transmission line has resistive impedances given by R_o/S (or) SR_o.

5) Short circuited quarter wave line is used as an insulator to support an open-wire line or the center conductor of a coaxial line.

Such lines are referred to as copper insulators.



Quarter-wave lines as insulators