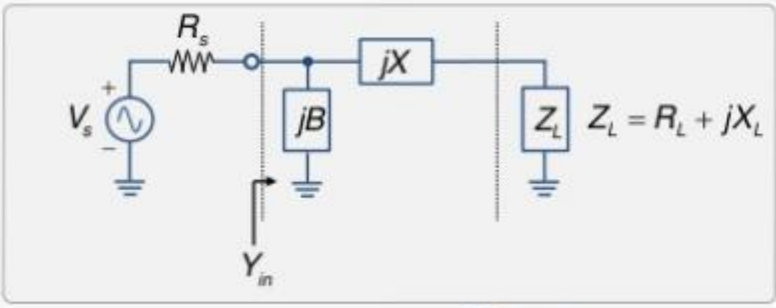
➢ **Case (b)** $R_s > R_L$



Goal:

$$Y_{in} = \frac{1}{R_s} \qquad \Gamma = \frac{\frac{1}{R_s} - Y_{in}}{\frac{1}{R_s} + Y_{in}} = 0$$

X : matching reactance
B : matching susceptance

Again, we want to find X and B

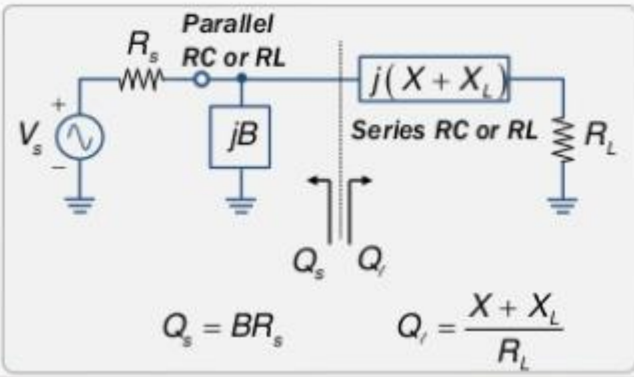
$$Y_{in} = jB + \frac{1}{(R_L + jX_L) + jX} = \frac{1}{R_s}$$

Real part: $BR_s(X + X_L) = R_s - R_L$

Imaginary part: $(X + X_L) - BR_sR_L = 0$

When the impedances are matched, the imaginary part of the input admittance looking into the matching network is equal to zero.

Use resonator concept:



Imaginary part: $(X+X_L)-BR_sR_L=0$ $\qquad \dfrac{X+X_L}{R_L}=Q_l=BR_s=Q_s=Q$

Real part: $BR_s(X+X_L)=R_s-R_L$

➡ $Q^2R_L=R_s-R_L \qquad Q=\pm\sqrt{\dfrac{R_s}{R_L}-1}$

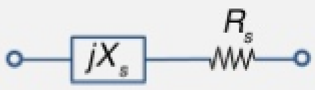
Choose $Q=Q_s=Q_l=+\sqrt{\dfrac{R_s}{R_L}-1}$

When Q is chosen, X and B are also decided.

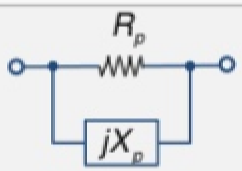
$$B=\frac{Q}{R_s}=\frac{1}{R_s}\sqrt{\frac{R_s}{R_L}-1}$$ (>0, capacitance)

$$X=R_LQ-X_L=R_L\sqrt{\frac{R_s}{R_L}-1}-X_L$$ (>0, inductance)
(<0, capacitance)

- **Series-to-Parallel transformation**



$Q_s=\dfrac{X_s}{R_s} \qquad Z_s=R_s+jX_s$



$Q_p=\dfrac{R_p}{X_p} \qquad Z_p=\dfrac{R_p\cdot jX_p}{R_p+jX_p}$

$$Q_s=Q_p=Q=\frac{X_s}{R_s}=\frac{R_p}{X_p}$$

$$Z_s=Z_p=R_s+jX_s=\frac{R_p\cdot jX_p}{R_p+jX_p}$$

$$\Rightarrow R_s\left(1+Q^2\right)=R_p$$