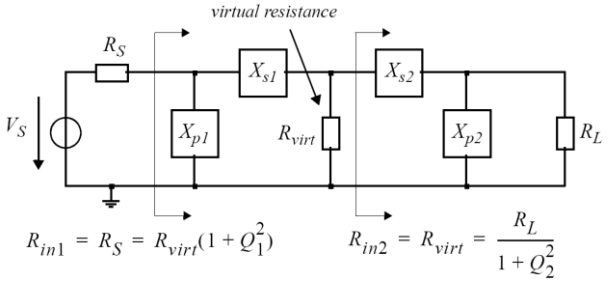
Serie 5: Π-Impedance Matching Circuit - Chapter 3

The Π-Impedance Matching Circuit is represented on Fig. 3.15 of Chap. 3 of the course book:



The Q_1 factor and the Q_2 factor are defined by the following relations:

$$Q_1 = \frac{R_S}{|Xp1|} \text{ and } Q_2 = \frac{R_L}{|Xp2|}$$

For remembrance, the quality factor of the Π-Impedance Matching Circuit is equal to :

$$Q_\Pi = \text{Max } (Q_1 , Q_2).$$

By definition, R_{virt} corresponds to the resistance seen from the middle point as represented above.

Question 1:
Explain why the nature of the impedance X_{s2} and X_{p2} are opposite; that means that (X_{s2} is an inductor if X_{p2} is a capacitor) or (X_{s2} is a capacitor if X_{p2} is an inductor) if a resistance R_{virt} is seen from the middle point.

Question 2:
Explain why the nature of the impedance X_{s1} and X_{p1} are opposite; that means that (X_{s1} is an inductor if X_{p1} is a capacitor) or (X_{s1} is a capacitor if X_{p1} is an inductor) if a resistance R_{virt} is seen from the middle point.

Question 3:
Prove that R_{virt} can be expressed by :$R_{virt} = \frac{R_S}{1+Q_1^2}$ and $R_{virt} = \frac{R_L}{1+Q_2^2}$

Question 4:
Prove that Q_1 and Q_2 can be expressed by : $Q_1 = \frac{|X_{s1}|}{R_{virt}}$and $Q_2 = \frac{|X_{s2}|}{R_{virt}}$

Question 5:
Express the relations which allow to determine the expressions of $|X_{p1}|$,$|X_{s1}|$,$|X_{s2}|$ and $|X_{p2}|$ as a function of Q_Π , R_S and R_L.