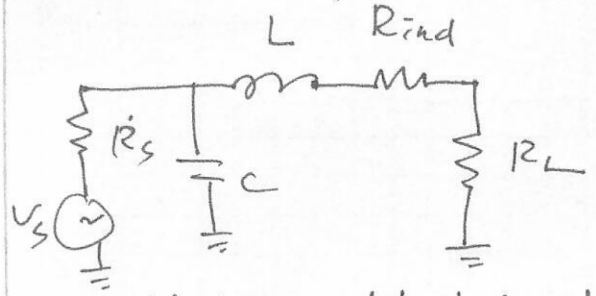
HW #1. solution problem-2



Under matched conditions

1) $V_L = \frac{1}{2} V_s \frac{R_L}{sL + R_{ind} + R_L}$

$i_L = \frac{1}{2} V_s \frac{1}{sL + R_{ind} + R_L}$

$\therefore P_L = Re(V_L \cdot I_L^*) = \frac{V_s^2}{4R_L} \frac{1}{\left(1+\frac{R_{ind}}{R_L}\right)^2 + \left(\frac{\omega_0 L}{R_L}\right)^2}$

$= \frac{V_s^2}{4R_s} \cdot \frac{R_s}{R_L} \frac{1}{\left(1+\frac{R_{ind}}{R_L}\right)^2 + \left(\frac{\omega_0 L}{R_L}\right)^2}$

$\frac{R_s}{R_L} = Q_T^2 + 1$

$\frac{R_{ind}}{R_L} = \frac{Q_T}{Q_{ind}}$

$\frac{\omega_0 L}{R_L} = Q_T$

→ apply

$= \frac{V_s^2}{4R_s}\left(Q_T^2+1\right) \frac{1}{\left(1+\frac{Q_T}{Q_{ind}}\right)^2 + Q_T^2}$

2) $V_{ind} = \frac{1}{2} V_s \frac{R_{ind}}{sL + R_{ind} + R_L}$, $i_{ind} = i_L = \frac{1}{2} V_s \frac{1}{sL + R_{ind} + R_L}$

$\therefore P_{ind} = Re(V_{ind} \cdot I_{ind}^*) = \frac{V_s^2}{4R_L} \frac{R_{ind}/R_L}{\left(1+\frac{R_{ind}}{R_L}\right)^2 + \left(\frac{\omega_0 L}{R_L}\right)^2}$

$= \frac{V_s^2}{4R_s} \cdot \frac{R_s}{R_L} \cdot \frac{R_{ind}}{R_L} \cdot \frac{1}{\left(1+\frac{R_{ind}}{R_L}\right)^2 + \left(\frac{\omega_0 L}{R_L}\right)^2}$

$= \frac{V_s^2}{4R_s}\left(Q_T^2+1\right) \frac{Q_T}{Q_{ind}} \frac{1}{\left(1+\frac{Q_T}{Q_{ind}}\right)^2 + Q_T^2}$