

Olin College of Engineering
ENGR2410 – Signals and Systems

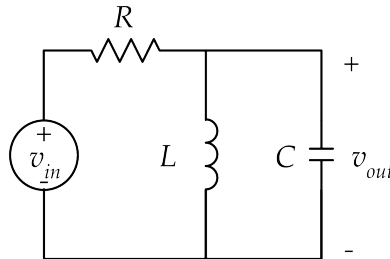
Assignment 3

Problem 1: (4 points)

- A. Find the equivalent impedance of a series RLC combination.
- B. Find an expression for the quality factor Q of the series RLC in terms of the characteristic impedance $Z_0 = \sqrt{L/C}$. Recall that Q is defined as $\frac{\omega_0}{2\alpha}$.
- C. Find a condition for R such that $Q \gg 1$. In the limit, is R acting more like a short or an open circuit?
- D. Repeat the previous three parts for the parallel RLC combination.

Problem 2: (6 points)

- A. Find the transfer function for the circuit from last week's problem 2 using impedances.



- B. Show that at low frequencies a capacitor may be replaced with an open circuit and an inductor may be replaced with a short circuit. Show that the inverse is true at high frequencies.
- C. Draw equivalent circuits for low frequencies and high frequencies. Use them to verify the extremes of the Bode plot from last week.
- D. What is the equivalent impedance of the parallel LC combination at resonance? What can you replace it with?
- E. Draw an equivalent circuit at resonance. Does it correspond to your Bode plot?