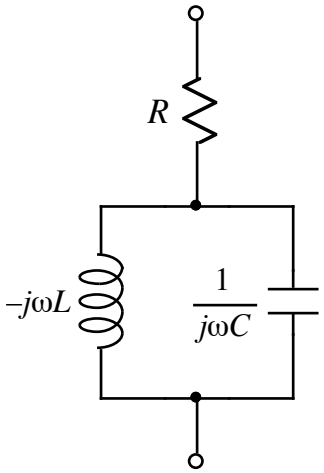
HOMEWORK #14 solution prob 3

Ex: Derive a symbolic expression for the impedance of an R in series with an L and C in parallel at frequency ω. Express the answer as a ratio of polynomials with complex coefficients.

Sol'n: The circuit is shown below.



When working with parallel impedances, it is typically easier to use the summation of conductance form of parallel impedance.

$$z_{||} = \frac{1}{\frac{1}{j\omega L} + \frac{1}{\frac{1}{j\omega C}}} = \frac{1}{\frac{1}{j\omega L} + j\omega C} = \frac{1}{-j\left(\frac{1}{\omega L} - \omega C\right)} = j\frac{1}{\left(\frac{1}{\omega L} - \omega C\right)}$$

or

$$z_{||} = j\frac{\omega L}{\left(1 - \omega^2 LC\right)}$$

We add R to the above value to obtain the total impedance:

$$z = R + j\frac{\omega L}{\left(1 - \omega^2 LC\right)}$$