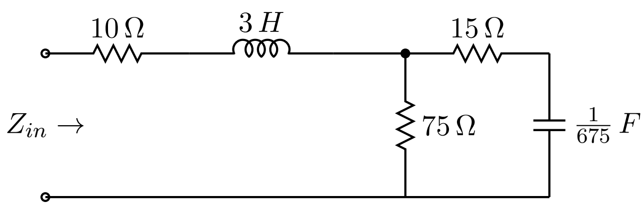
Problem 1[1]

In the figure shown below, (a) find the exact resonant frequency of the network, ω_o, and (b) find $Z_{in}(\omega_o)$.



Hint: $\frac{a+jb}{c+jd} = \frac{N\angle\theta_n}{D\angle\theta_d}$ gives a real value only when $\theta_n = \theta_d$ (*i.e.*, when $\tan^{-1}\frac{b}{a} = \tan^{-1}\frac{d}{c}$).

Problem 2[2]

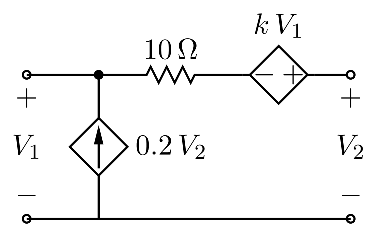
Design a parallel resonant circuit so that a variable capacitor can adjust the resonant frequency over the AM broadcast band, 550 to 1680 kHz, with $Q_o \leq 50$ at any frequency in the band. Let $R = 10\,\text{k}\Omega$ and give values for L, C_{min}, and C_{max}. Hint: before solving for L, try to solve for C_{min} or C_{max} first.

Problem 3[3]

A parallel resonant circuit has $Q_o = 20$ and is resonant at $\omega_o = 10\,\text{krad/s}$. If $Z_{in} = 5\,\text{k}\Omega$ at $\omega = \omega_o$, what is the width of the frequency band about resonance for which $|Z_{in}| \geq 3\,\text{k}\Omega$?

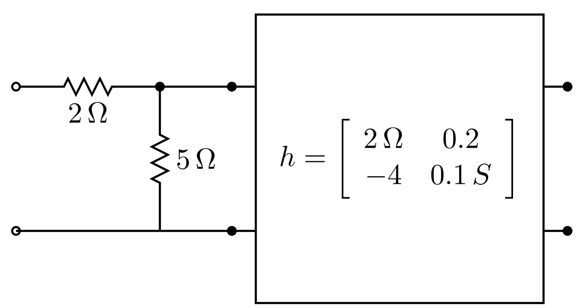
Problem 4[4]

Using the figure shown below, find the impedance parameters of the circuit. What is the value of k that will produce a reciprocal network (i.e., $z_{12} = z_{21}$)? What is the value of k that will produce a symmetric network (i.e., $z_{11} = z_{22}$)?



Problem 5[5]

In the figure below, a $2\,\Omega$ and a $5\,\Omega$ resistor are connected as shown at the input of the two port whose h parameters are given. Find the hybrid parameters for the composite network.



[1] Taken from Hayt and Kemmerly, Problem 14.5
[2] Adapted from Hayt and Kemmerly, Problem 14.6
[3] Taken from Hayt and Kemmerly, Problem 14.12
[4] Adapted from Hayt and Kemmerly, Problem 16.11
[5] Taken from Hayt and Kemmerly, Problem 16.33