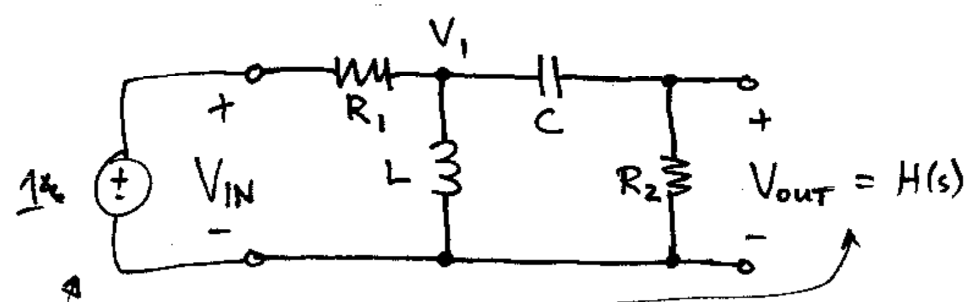
EC200 M.E. #8 NAME:

CM:

① Find the voltage transfer function $H(s) = \frac{V_{out}}{V_{IN}}$. (see below) Express your result as a ratio of two polynomials in s, with a unity coefficient on the highest order denominator term.



Nodal analysis (can use other methods, too):

$$\frac{V_1 - 1}{R_1} + \frac{V_1}{Ls} + \frac{V_1 - H}{1/cs} = 0$$

$$\frac{H - V_1}{1/cs} + \frac{H}{R_2} = 0$$

SOLVE using Maple...

$$\Rightarrow H(s) = \frac{(LCR_2)s^2}{s^2(LCR_2 + R_1CL) + s(L + R_1R_2C) + R_1}$$

(I collected terms)

$$= \frac{\left(\frac{LCR_2}{LCR_2 + LCR_1}\right)s^2}{s^2 + \frac{L + R_1R_2C}{LCR_2 + LCR_1}s + \frac{R_1}{LCR_2 + LCR_1}}$$

$$= \frac{\frac{R_2}{R_1 + R_2}s^2}{s^2 + \left[\frac{1}{(R_1+R_2)C} + \frac{R_1 \| R_2}{L}\right]s + \frac{1}{LC}\left(\frac{R_1}{R_1+R_2}\right)}$$

② Plot the pole-zero diagram for the impedance function $Z(s)$:

$$\frac{3s^3 + 15s}{s^4 + 8s^3 + 32s^2 + 80s + 100} = Z(s)$$

* Factor the numerator: $3s\,(s+j2.24)(s-j2.24)$

* Factor the denominator: $(s+3+j)(s+3-j)(s+1+j3)\cdot$
$(s+1-j3)$