ECE 2210 Exam 3

Useful Information

Bode Plots

Look for places in |H(s)| where a real number and a jω or jf term are added.
Set real = |imaginary| to find poles and zeroes.
Poles come from denominator of transfer function, zeroes from numerator.
Divide frequencies into regions & find approx |H(s)| in each region by simplifying each (real + imaginary) to just the largest part.

Slopes: -20, 0, or +20 dB/decade

dB is $20\cdot\log_{10}(|H(\omega)|)$

cut corners by $3\cdot dB$

2nd order tran.

Overdamped $b^2 - 4\cdot k > 0$ s_1 and s_2 are real and negative

$$X(t) = X(\infty) + B\cdot e^{s_1\cdot t} + D\cdot e^{s_2\cdot t} \qquad X(0) = X(\infty) + B + D \qquad \frac{d}{dt}X(0) = B\cdot s_1 + D\cdot s_2$$

Critically damped $b^2 - 4\cdot k = 0$ $s_1 = s_2 = -\frac{b}{2} = s$ s_1 and s_2 are real, equal and negative

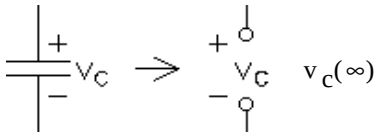
$$X(t) = X(\infty) + B\cdot e^{s\cdot t} + D\cdot t\cdot e^{s\cdot t} \qquad B = X(0) - X(\infty) \qquad D = \frac{d}{dt}X(0) - B\cdot s$$

Underdamped $b^2 - 4\cdot k < 0$ $s = \alpha \pm j\omega$ complex s_1 and s_2

$$X(t) = X(\infty) + e^{\alpha\cdot t}\cdot(B\cdot\cos(\omega\cdot t) + D\cdot\sin(\omega\cdot t)) \qquad B = X(0) - X(\infty) \qquad D = \frac{\frac{d}{dt}X(0) - B\cdot\alpha}{\omega}$$

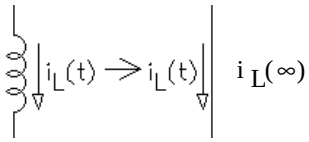
$$\frac{d}{dt}i_L(0) = \frac{v_L(0)}{L} \qquad \frac{d}{dt}v_C(0) = \frac{i_C(0)}{C}$$

Final Conditions, or "after a long time"



Replace capacitors with opens

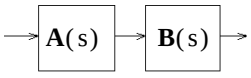
Capacitor voltage **cannot** change instantaneously



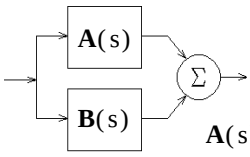
Replace inductors with wires

Inductor current **cannot** change instantaneously

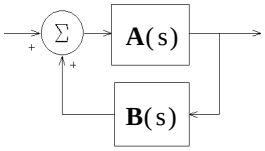
System Block Diagrams



$\mathbf{A}(s)\cdot\mathbf{B}(s)$



$\mathbf{A}(s) + \mathbf{B}(s)$

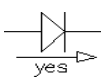


Standard feedback loop transfer function

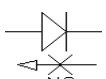
$$\frac{\mathbf{A}(s)}{1 - \mathbf{A}(s)\cdot\mathbf{B}(s)}$$

Diodes

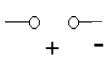
conducting not conducting



or



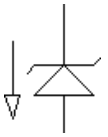
Use these models for the diodes and LEDs on this exam.



current

$V_d < 0.7V$ Check

LEDs: 2V



V_Z = zener voltage