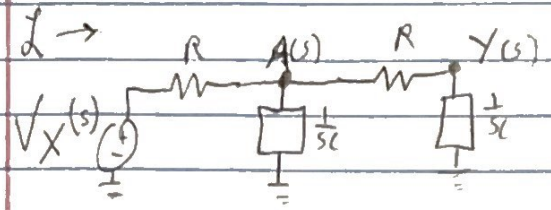
Circuit Analysis



Q1: $A = \frac{\frac{1}{sC} \| (R + \frac{1}{sC})}{R + \frac{1}{sC} \| (R + \frac{1}{sC})}$ $X(s) = \frac{\frac{1}{sC + \frac{1}{R + \frac{1}{sC}}}}{R + \frac{1}{sC + \frac{1}{R + \frac{1}{sC}}}} = \frac{1}{1 + RSC + \frac{R}{R + \frac{1}{sC}}} = \frac{R + \frac{1}{sC}}{R + \frac{1}{sC} + R^2sC + 2R}$

$\Rightarrow A = \frac{1 + RCs}{(R^2C^2)s^2 + (3RC)s + 1}$ $X \rightarrow H_a(s) = \frac{(1 + RCs)}{(R^2C^2)s^2 + (3RC)s + 1}$

$\frac{-3RC \pm \sqrt{9R^2C^2 - 4R^2C^2}}{2R^2C^2}$

Poles: $-3 \pm \sqrt{5} / 2RC$

Zero: $-1/RC$

$Y = a_0 \frac{\frac{1}{sC}}{R + \frac{1}{sC}} = \frac{1}{(1 + RCs)} \frac{(1 + RCs)}{((R^2C^2)s^2 + (3RC)s + 1)} X(s) \rightarrow H_Y(s) = \frac{1}{(R^2C^2)s^2 + (3RC)s + 1}$

Poles: $-3 \pm \sqrt{5} / 2RC$

Zero: N/A

Q2: $\mathcal{F}[Y] \Rightarrow Y(\omega) = \frac{1}{1 + j\omega(3RC) - \omega^2(R^2C^2)}$

$\rightarrow |H(\omega)| = \frac{1}{\sqrt{[1 - \omega^2R^2C^2]^2 + [\omega 3RC]^2}}$

$\rightarrow \angle H(\omega) = -\tan^{-1}\left[\frac{3\omega RC}{1 - \omega^2R^2C^2}\right]$

Q3: Passband: $\omega = 0$ rad/s $\rightarrow 38$ rad/s
-3 db point $f = 0$ Hz $\rightarrow 6$ Hz

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%Circuit Analysis Q3 for EE328
R = 10*10^3
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R = 10000
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C = 1*10^-6
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C = 1.0000e-06
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H = tf(1,[(R^2*C^2),(3*R*C),1])
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```
H =

            1
  ----------------------
  0.0001 s^2 + 0.03 s + 1

Continuous-time transfer function.
Model Properties
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```
bode(H)
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