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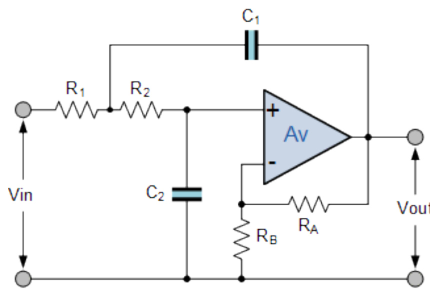
Circuit and System Analysis

Project

1. Considering the circuit given below, determine the voltage transfer function $H(s)=\dfrac{V_o(s)}{V_i(s)}$.



2. $$H(s)=\frac{K}{s^2+\frac{\omega_0}{Q}s+\omega_0{}^2}$$

   is the second-order Low-Pass function. Draw the $|H(jw)|$ and calculate the gain K value to have unit DC gain.

3. Obtain the transfer functions $H_1(s)$ and $H_2(s)$ for the frequencies $\omega_0=2\pi(159)$, $\omega_0=2\pi(79.5)$, and for the Quality factors Q=5, Q=1, respectively. Compute the gains K in order to have unit DC gains. Draw the $|H(jw)|$ and $\angle H(jw)$.

4. Download the "**data**" file from the part named **"2015-2016 Bahar Circuit and System Analysis"** from the link http://web.itu.edu.tr/~yalcinmust/dersler.html. Notice that this data file contains a signal constructed as adding the three sinusoidal signals, $\sin(2\pi 10)$, $\sin(2\pi 50)$ and $\sin(2\pi 100)$. Using the *load* and *tf* matlab functions, suggest a second-order low-pass transfer function whose response to the given signal is approximately $\sin(2\pi 10)$. Check your filter response using *lsim* matlab function.

5. Determine the capacitances and resistor values comparing the transfer function of the circuit and the obtained transfer function for two different ω_0 frequencies given in question 3.

6. Using SPICE, simulate your circuits.

Chapter 14: James W. Nilsson and Susan A. Riedel, "Electric Circuits," Pearson Prentice Hall, 2008. Chapter 4:Leon O. Chua, Charles A. Desoer, Ernest S. Kuh, "Linear and Nonlinear Circuits," McGraw-Hill, 1987. Appendix E: James W. Nilsson and Susan A. Riedel, "Electric Circuits," Pearson Prentice Hall, 2008.