ANALOG CIRCUIT DESIGN

WISSENAIRE

Simulation Report

And Solutions

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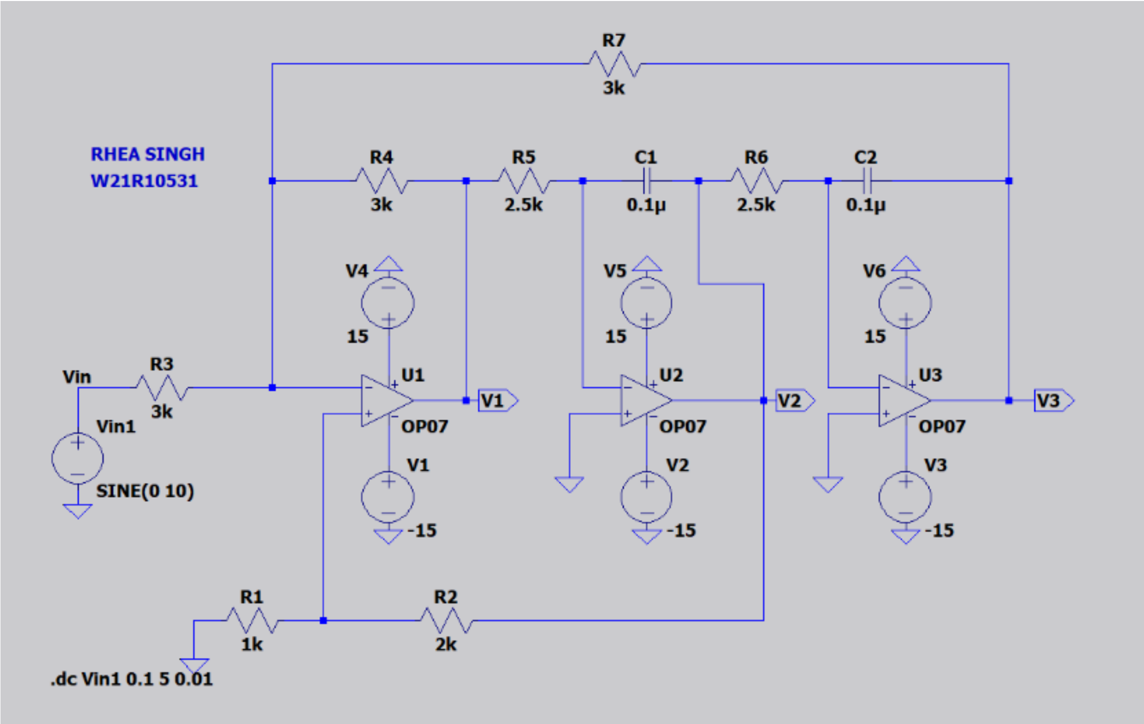
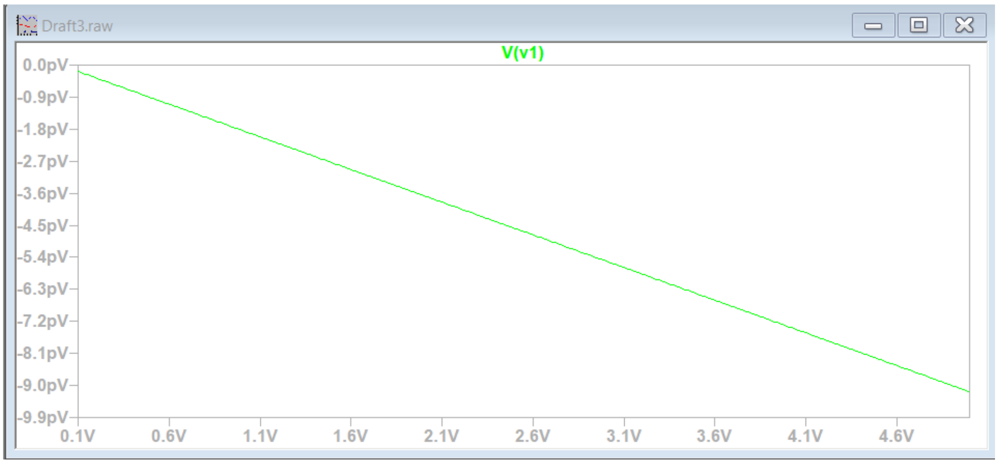
Solution No. 1

a) The screenshot of the LT-spice schematic diagram of the constructed circuit :

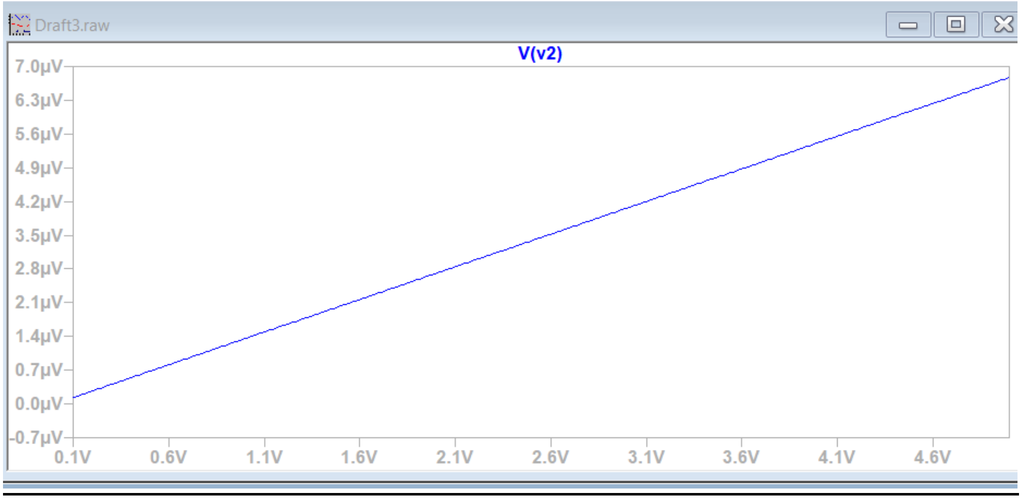


b) The screenshots of all the high pass, low pass and band pass responses by performing a DC sweep simulation :

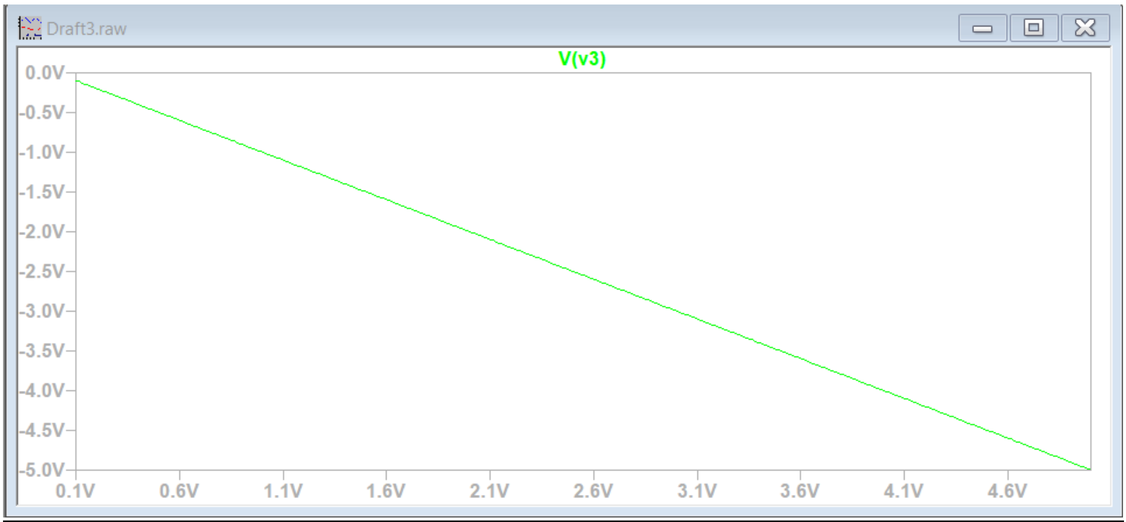
<u>High pass response of V1 –</u>



Band pass response of V2 –



Low pass response of V3 –

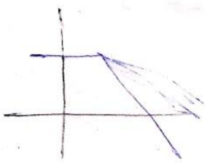


c) The above-mentioned circuit is one of the filter circuits which is the **State variable filter.**

d) The formula of second order low pass, high pass and band pass responses are as follows:

Low pass response -

$$H(j\omega) = \frac{1}{1 - \left(\frac{\omega}{\omega_0}\right)^2 + \left(j\frac{\omega}{\omega_0}\right)/Q}$$



High pass response –

$$H(j\omega_0) = \frac{-\left(\frac{\omega}{\omega_0}\right)^2}{1 - \left(\frac{\omega}{\omega_0}\right)^2 + \left(\frac{j\omega}{\omega_0}\right)/Q}$$

$H_o(HP)$

Band pass response –

BPF :

$$H(j\omega) = \frac{\left(\frac{j\omega}{\omega_0}\right)/Q}{1 - \left(\frac{\omega}{\omega_0}\right)^2 + \left(\frac{j\omega}{\omega_0}\right)/Q}$$

e) The 3dB cut-off frequencies of low-pass response and high-pass response that you obtain from simulation are same because at the cut off frequency both the responses of high pass and low pass becomes the same which is Q.