

NANYANG TECHNOLOGICAL UNIVERSITY
SCHOOL OF ELECTRICAL & ELECTRONIC ENGINEERING
EE4341/EE6341 ADVANCED ANALOG CIRCUITS
TUTORIAL 8

1. Design an active first order low-pass filter as shown in Fig. 1 with a -3 dB cut-off frequency of 2 kHz. 10 k Ω standard resistors are preferred.

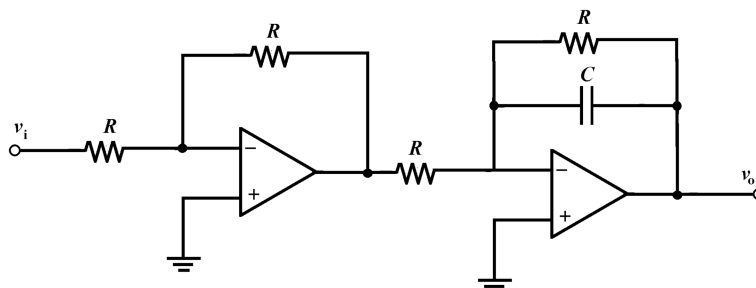


Figure 1

2. Design an active first order high-pass filter as shown in Fig. 2. It is expected to have an attenuation of 30 dB at 300 Hz. The capacitor value chosen is 2000 pF.

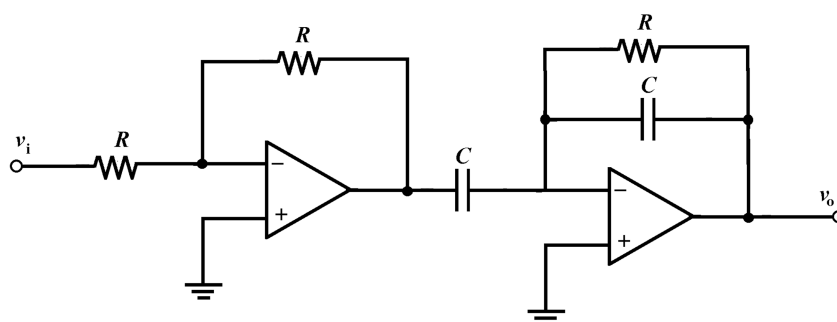


Figure 2

3. Design a second-order, low-pass Sallen-Key active filter with $Q = 1$ and -3 dB cut-off frequency = 3.8 kHz. 10 k Ω standard resistors are preferred in the design and draw the final filter circuit.
4. Prove that the active filter circuit shown in Fig. 3 describes the following low-pass transfer function.

$$T(s) = \frac{v_o}{v_i} = \frac{-1}{s^2 + 3s + 1}$$

- (a) Interchange R and C of the given filter circuit and determine its new transfer function.
- (b) Scale the new circuit in part (a) so that its reference (1 rad/s) shifted to 420 Hz. 20 k Ω resistors are preferred in the design.
- (c) Without affecting the frequency response as in part (b), rescale the value of R so that $C = 0.01$ μ F.

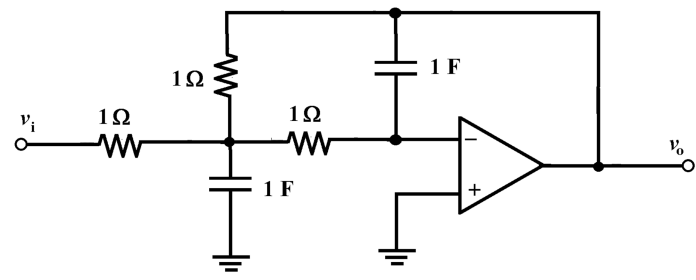


Figure 3