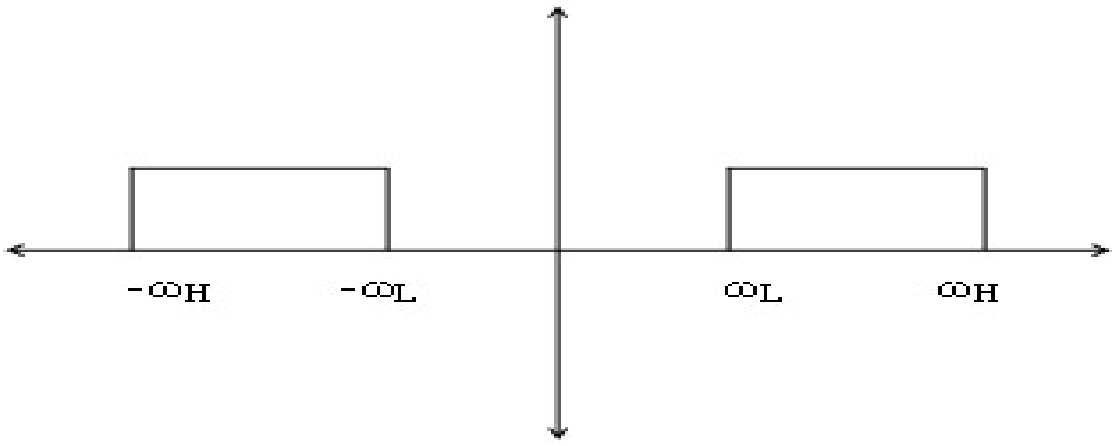
INTRODUCTION

The band reject filter is formed by the combination of low pass and high pass filters with a parallel connection instead of cascading connection. The name itself indicates that it will stop a particular band of frequencies. Since it eliminates frequencies, it is also called as band elimination filter or band reject filter or notch filter. We know that unlike high pass and low pass filters, band pass and band stop filters have two cut-off frequencies. It will pass above and below a particular range of frequencies whose cut off frequencies are predetermined depending upon the value of the components used in the circuit design. Any frequencies in between these two cut-off frequencies are attenuated. It has two pass bands and one stop band.

Def. – In signal processing, a band-stop filter or band-rejection filter is a filter that passes most frequencies unaltered, but attenuates those in a specific range to very low levels. It is the opposite of a band-pass filter. A notch filter is a band-stop filter with a narrow stopband (high Q factor).



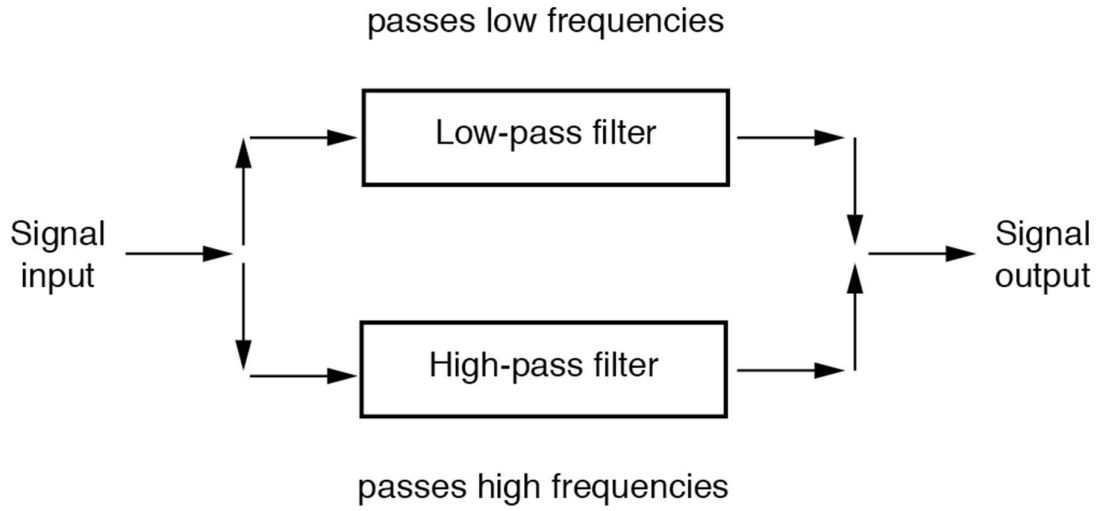
Response of Band Reject Filter / Band Stop Filter

Where w_L indicates the cut off frequency of the low pass filter
w_H is the cut off frequency of the high pass filter.

The centre frequencies $fc = \sqrt{(w_L \, x \, w_H)}$

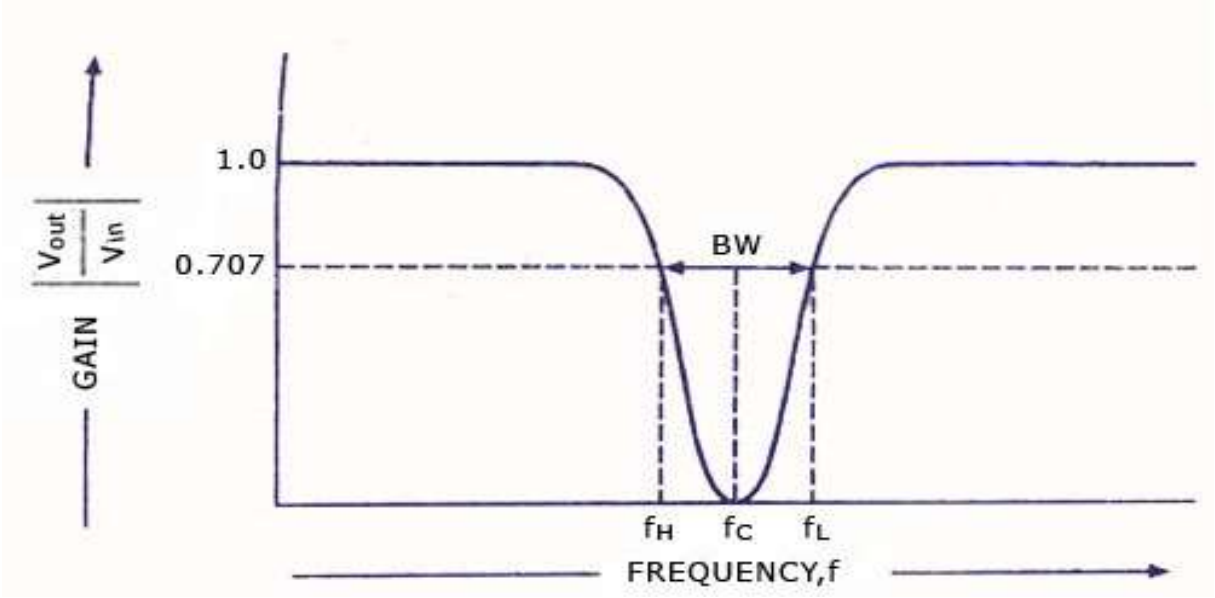
The characteristics of a band stop filter are exactly opposite of the band pass filter characteristics.

When the input signal is given, the low frequencies are passed through the low pass filter in the band stop circuit and the high frequencies are passed through the high pass filter in the circuit. This is shown in below block diagram:



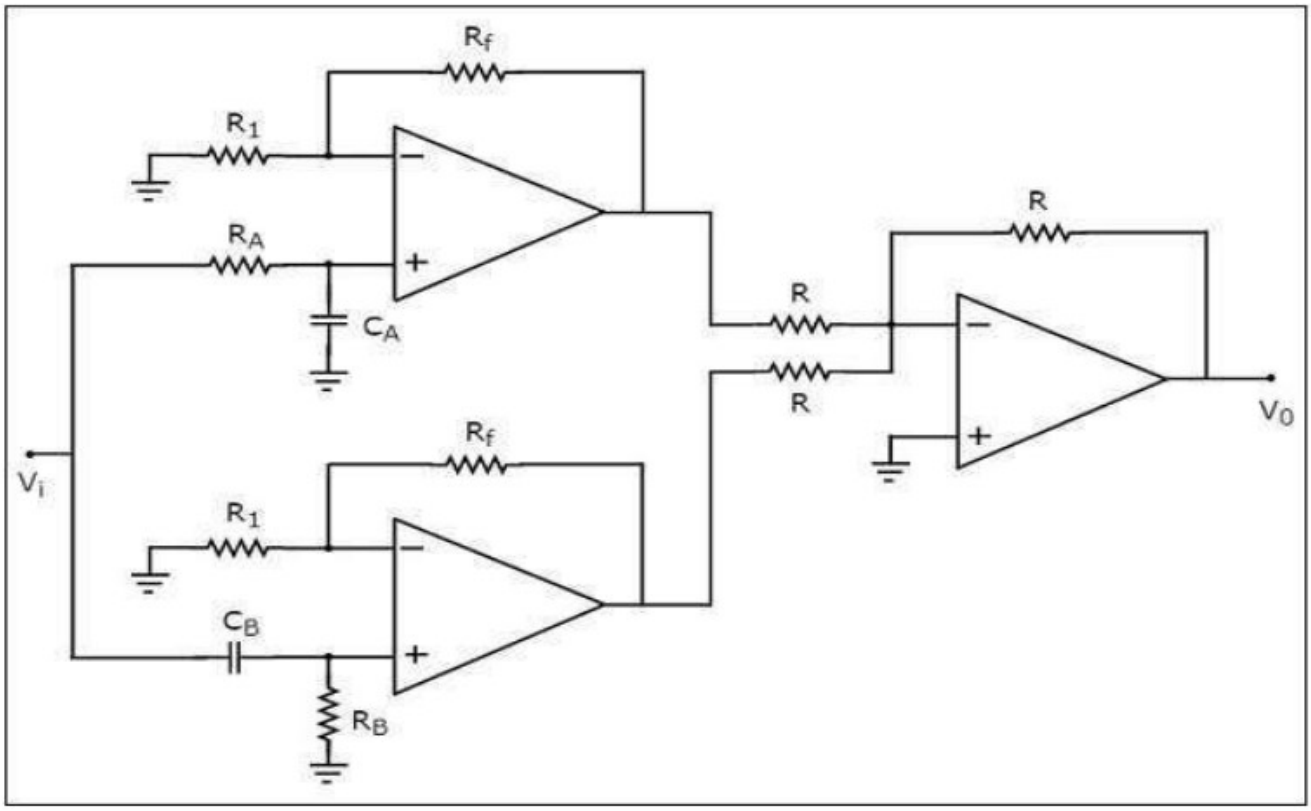
Block Diagram of Band Stop Filter/ Band Reject Filter

In practical, due to the capacitor switching mechanism in the high pass and low pass filter the output characteristics are not same as that of in the ideal filter. The pass band gain must be equal to low pass filter and high pass filter. The frequency response of band stop filter is shown below:



The frequency response of band stop filter/ band reject filter

CIRCUIT DIAGRAM



Here,

Vi – Input Voltage

R_1, R_A, R_f, R_B, R – Resistors

C_A, C_B – Capacitors

3 Op-Amps

V_0 – Output Voltage.

CIRCUIT SPECIFICATIONS

Circuit Specifications:

S. No.	Components	Values
1.	Resistance (R)	1k ohm
2.	Resistance ($R_A = R_B$)	1k ohm
3.	Resistance ($R_1 = R_f$)	1k ohm
4.	Capacitance (C_A)	79.6 nF
5.	Capacitance (C_B)	39.8 nF
6.	Input Voltage (Vi)	5V (10.0 kHz)

CALCULATIONS

1. For Low Pass Filter cut off frequency = 2 kHz

fc = 2000 Hz;

R = 1000 ohm;

Then, fc = 1/ (2*3.14*R* C_A)

C_A = 1/(2*3.14*R*fc);

C_A = 79.6 nF

2. For High Pass Filter cut off frequency = 4 kHz

fc = 4000 Hz;

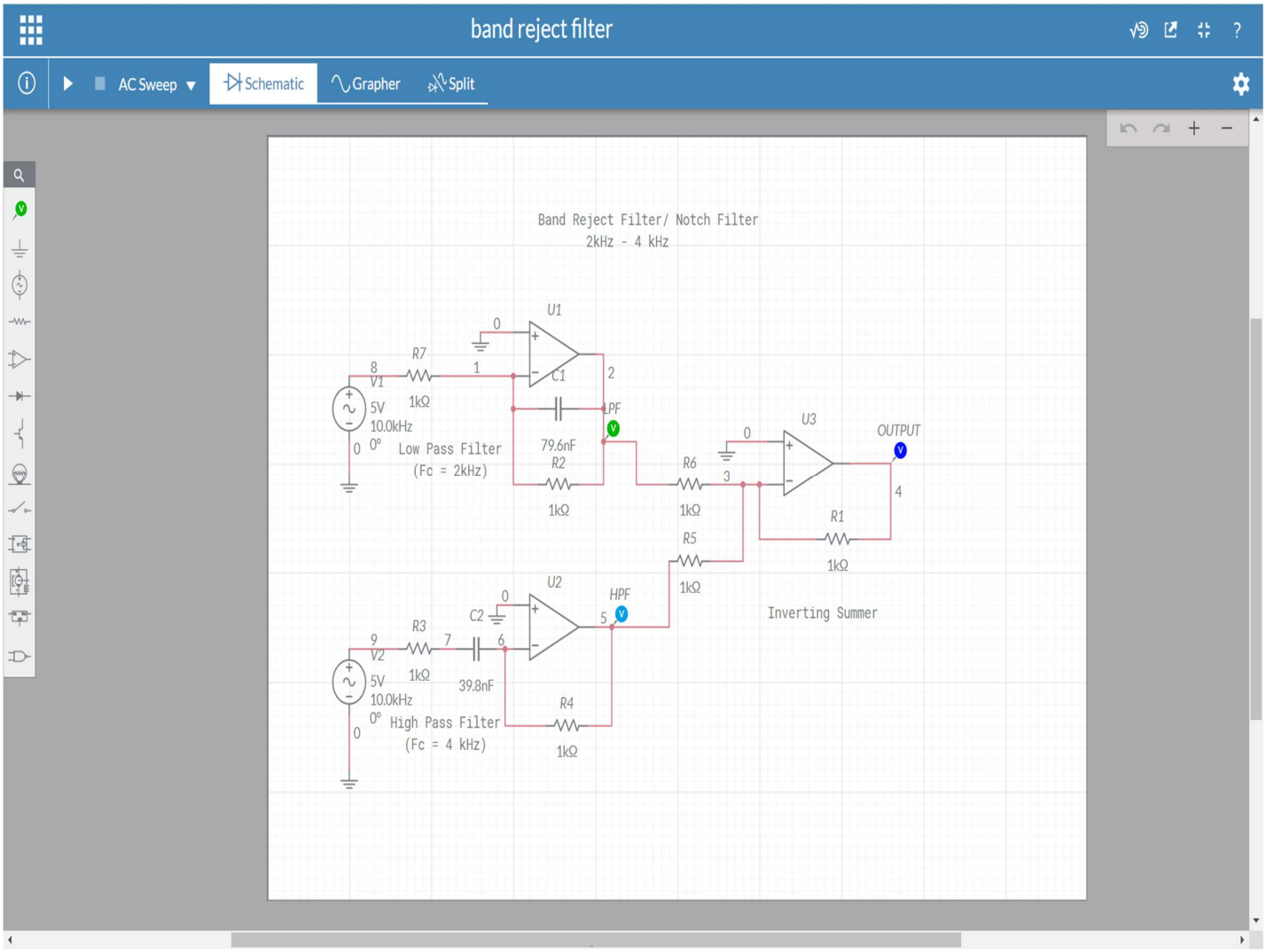
R = 1000 ohm;

Then, fc = 1/ (2*3.14*R* C_B)

C_B = 1/(2*3.14*R*fc);

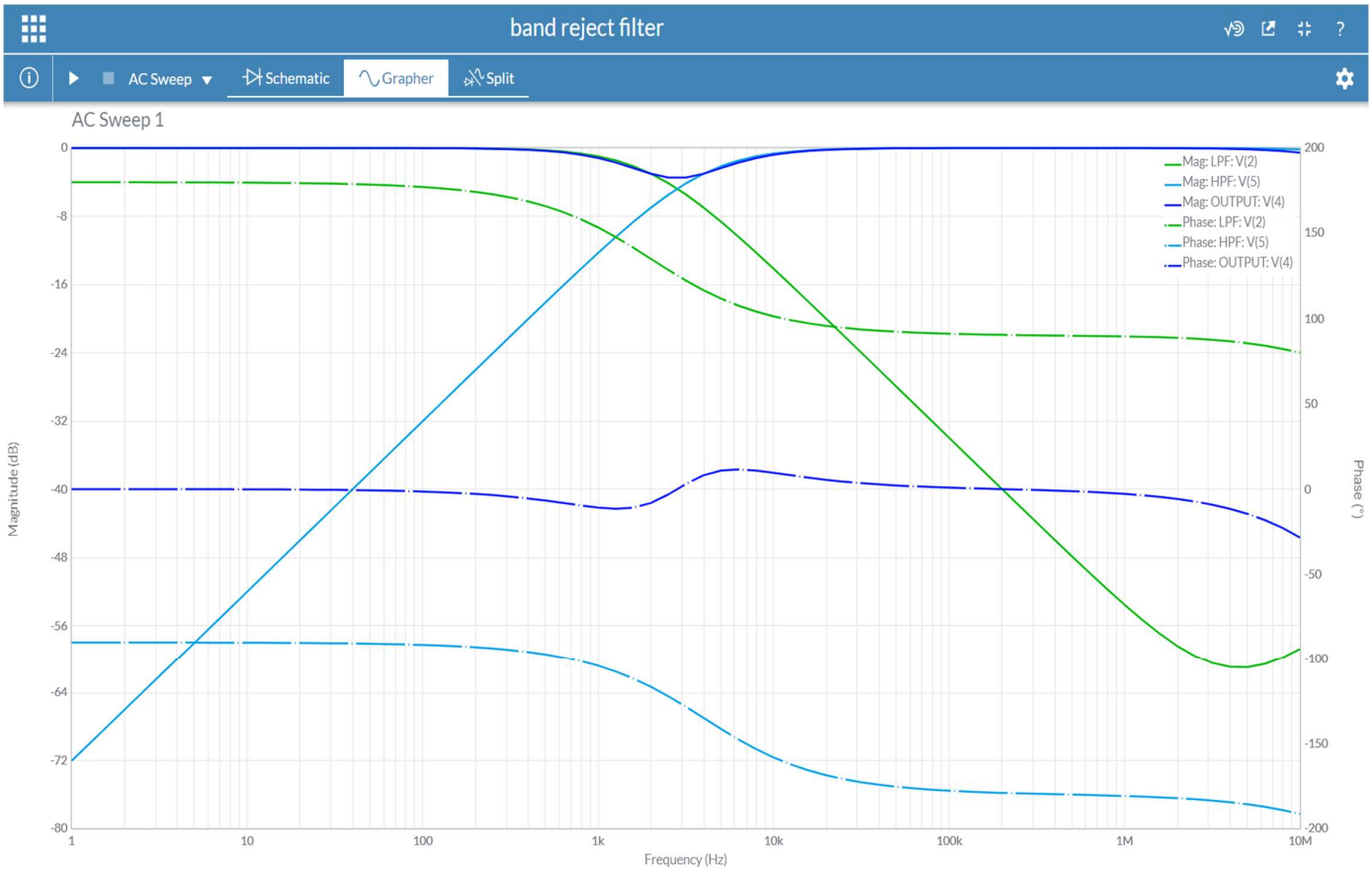
C_B = 39.8 nF

SIMULATION



Stimulation Circuit

SIMULATION RESULT



Stimulation Output Waveform

OUTPUT

After stimulation, the waveform obtained reflects a notch in the frequency range of **2000-4000 Hz,** as the cut-off frequencies of **Low Pass Filter** and **High Pass Filter** are **2000 Hz** and **4000Hz** respectively.

CONCLUSION

The relationship among the centre frequency fc, the lower frequency f_L and the upper frequency f_H were formulated. These parameters can be used to design a band-stop filter/ band reject filter or Notch filter. The steps of the design demonstrated in the project are simple and easy for calculation and stimulation.

APPLICATIONS

- In image and signal processing these filters are highly preferred to reject noise.
- These are used in high quality audio applications like PA systems (Public address systems).
- These are also used in medical field applications, i.e., in biomedical instruments like EGC for removing line noise.

REFERENCES

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- https://www.electronics-tutorials.ws/filter/band-stop-filter.html
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