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Dual Amplifier Band-Pass (DABP) Filter

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IN THIS MINI TUTORIAL

The dual amplifier band-pass filter is used in high Q and high frequency designs. This filter is one of a set of discrete circuits incorporating op amps described in a series of mini tutorials.

The dual amplifier band-pass filter structure is useful in designs requiring high Qs and high frequencies. Its component sensitivity is small, and the element spread is low. A useful feature of this circuit is that the Q and resonant frequency can be adjusted more or less independently.

Referring to Figure 1, the resonant frequency can be adjusted by R2. R1 can then be adjusted for Q. In this topology, it is useful to use dual op amps. The match of the two op amps lowers the sensitivity of Q to the amplifier parameters.

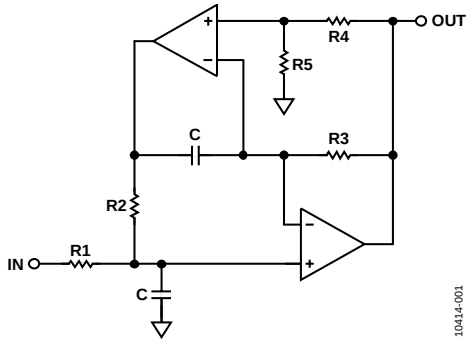


Figure 1. Dual Amplifier Band-Pass Filter

Note that the DABP has a gain of 2 at resonance. If lower gain is required, Resistor R1 may be split to form a voltage divider. This is reflected in the addendum to the design equations of the DABP (see Figure 2).

$$\frac{+H\omega_0 S}{s^2+\alpha\omega_0 s+\omega_0^2}$$

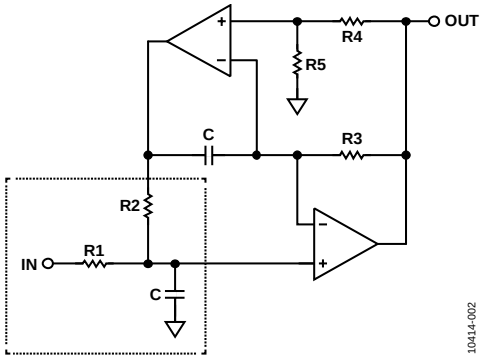


Figure 2. Dual Amplifier Band-Pass Filter Design Equations

$$\frac{V_O}{V_{IN}}=\frac{s\left(\frac{2}{R1C}\right)}{s^2+s\left(\frac{1}{R1C}\right)+\frac{1}{R2\ R3\ C^2}}$$

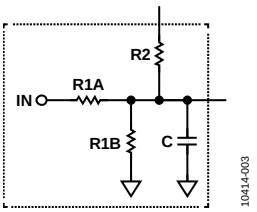
Choose C, R4.
Then, R5 = R4.

$$R=\frac{1}{2\pi F_0 C}$$

$$R1=Q\,R$$

$$R2=R3=R$$

For gains <2 (gain = A_V):



$$R1A=\frac{2R1}{A_V}$$

$$R1B=\frac{R1A\ A_V}{2-A_V}$$

REFERENCE

Zumbahlen, Hank. *Linear Circuit Design Handbook*. Elsevier. 2008. ISBN: 978-7506-8703-4.

REVISION HISTORY

3/12—Revision 0: Initial Version