OKAWA Electric Design

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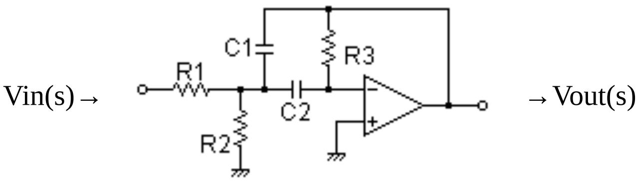
disclaimer blog

Multiple Feedback Band-pass Filter Design Tool

This page is a web application that design a multiple feedback band-pass filter. Use this utility to simulate the Transfer Function for filters at a given frequency, damping ratio ζ, Q or values of R and C. The response of the filter is displayed on graphs, showing Bode diagram, Nyquist diagram, Impulse response and Step response.

[Sample calculation](#)

Calculate the transfer function for multiple feedback band-pass filter with R and C values



Transfer function:

$$\frac{vo}{vi} = \frac{-\dfrac{1}{R1C1}s}{s^2 + s\left(\dfrac{1}{R3C2} + \dfrac{1}{R3C1}\right) + \dfrac{1}{R3C1C2}\left(\dfrac{1}{R1} + \dfrac{1}{R2}\right)}$$

R1= Ω C1= F

Calculate the R and C values for the multiple feedback filter at a given frequency and Q factor

R2= Ω C2= F

R3= Ω

p:pico, n:nano, u:micro, k:kilo, M:mega

Frequency analysis

- [x] Bode diagram
  - (•) Phase ( ) Group delay
- [x] Nyquist diagram
- [x] Pole, zero
- [x] Phase margin
- [x] Oscillation analysis

Upper and lower frequency limits:

f1= - f2= [Hz]

(frequency limits are optional)

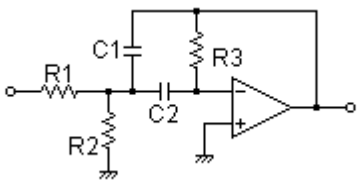
Transient analysis

- [x] Step response
- [ ] Impulse response
- [x] Overshoot
- [x] Final value of the step response

Simulation time:

0 - [sec] (optional)

Calculate

Vin(s)→  →Vout(s)

Center frequency:

$$f_0 = \frac{1}{2\pi}\sqrt{\frac{1}{R3C1C2}\left(\frac{1}{R1}+\frac{1}{R2}\right)}$$

Transfer function:

$$\frac{Vout(s)}{Vin(s)} = \frac{2\zeta(2\pi f_0)Ks}{s^2 + 2\zeta(2\pi f_0)s + (2\pi f_0)^2}$$

$$Q = \frac{1}{2\zeta}$$

$$K = \frac{R3}{R1}\frac{-C2}{C1+C2}$$

K is gain at the center frequency.

Center frequency f_0= Hz

Gain K= -1 at f_0. (K<0)

Q factor | Damping ratio ζ

Quality factor Q = 0.707

Damping ratio ζ = 1

C1 = F C2 = F

C1, C2 is optional. But when setting these capacitances, C1 and C2 of both are needed to give following the equation

$(C2/C1) > 4\zeta^2|K| - 1$

$(C2/C1) > |K|/Q^2 - 1$

Select Capacitor Sequence: E6

Select Resistor Sequence: E24

Frequency analysis

- [x] Bode diagram
  - (•) Phase ( ) Group delay
- [x] Nyquist diagram
- [x] Pole, zero
- [x] Phase margin
- [x] Oscillation analysis

Upper and lower frequency limits:

f1= - f2= [Hz]

(frequency limits are optional)

Transient analysis

- [x] Step response
- [ ] Impulse response
- [x] Overshoot
- [x] Final value of the step response

Simulation time:

0 - [sec] (optional)

Calculate

Filter tools