

Thread: Why resistor is used @ feedback?

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11-07-11, 11:30

#1

Oby1

Junior Member level 2



Join Date: May 2011
Posts: 22
Helped: 0 / 0
Points: 429
Level: 4

Why resistor is used @ feedback?

In case of voltage follower, why resistor is used @ feedback??
Is it for current limiting???

[untitled.JPG](#)

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11-07-11, 12:11

#2

dv_sa559

Full Member level 1



Join Date: Dec 2009
Location: Iran
Posts: 107
Helped: 28 / 28
Points: 1,126
Level: 7

Re: Why resistor is used @ feedback?

I think at voltage follower you no need to use resistance.2.png
on the other hand $V_{out} = V_{in}$
[Operational amplifier applications - Wikipedia, the free encyclopedia](#)

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11-07-11, 12:20

#3

FvM

Advanced Member level 5



Achievements:



Awards:



Join Date: Jan 2008
Location: Bochum, Germany
Posts: 20,176
Helped: 5908 / 5908
Points: 131,546
Level: 87

Re: Why resistor is used @ feedback?

I think at voltage follower you no need to use resistance.

Basically, yes. In some some cases it may be recommended or even required. It's e.g. necessary for current-feedback (CFB) mode operational amplifiers.

Where did you see it?

1 members found this post helpful.

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11-07-11, 12:27

#4

sjukrishnan ◊

Member level 1



Join Date: Jul 2011
 Location: India
 Posts: 33
 Helped: 4 / 4
 Points: 409
 Level: 4

Re: Why resistor is used @ feedback?

Voltage follower is a positive feedback amplifier, the gain of 1.
 Gain of non-inverting closed loop OP-AMP configuration can be approximated as $A = 1 + (R_f/R_{in})$ where R_f is the feedback resistor and R_{in} is the input resistor.
 Since you need unity gain for a voltage follower, you just make $R_{in} = \infty$. Whatever be the value of R_f , you will get the second term zero, hence the gain would be 1.
 As far as I understand, there is no role of external resistor current limiter since OP-AMP itself having very high input impedance by birth.
 However, I would like to hear comments from experts...

1 members found this post helpful.

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11-07-11, 12:41

#5

Oby1 ◊

Junior Member level 2



Join Date: May 2011
 Posts: 22
 Helped: 0 / 0
 Points: 429
 Level: 4

Re: Why resistor is used @ feedback?

I saw this in some analog circuits... can you explain me little about **current-feedback (CFB) mode operational amplifiers**. As amplifiers have very high R_{in} , how feedback current is going to effect gain??

=====
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11-07-11, 13:05

#6

dv_sa559 ◊

Full Member level 1



Join Date: Dec 2009
 Location: Iran
 Posts: 107
 Helped: 28 / 28
 Points: 1,126
 Level: 7

**Re: Why resistor is used @ feedback?**

Originally Posted by **FvM**

Basically, yes. In some some cases it may be recommended or even required. It's e.g. necessary for current-feedback (CFB) mode operational amplifiers.

Where did you see it?

Dear FVM
 Thank you very much for your suggestion.
 But i see that case in many buffer without resistance.
 would you explain that how calculate R in "CFB" and amount of it's resistance

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11-07-11, 13:12

#7

FvM ◊

Advanced Member level 5



Achievements:



Awards:



Join Date: Jan 2008

Re: Why resistor is used @ feedback?

CFB is a special case, I just wanted to mention it, because resistors are needed there. You'll find recommendations for feedback R values in the CFB datasheets. CFB OPs have low impedance -ve inputs, so the resistor is effectively setting the loop gain.

2 members found this post helpful.

Location: Bochum, Germany
 Posts: 20,176
 Helped: 5908 / 5908
 Points: 131,546
 Level: 87

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11-07-11, 14:34

#8

LvW 

Advanced Member level 5



Join Date: May 2008
 Location: Germany
 Posts: 4,336
 Helped: 1209 / 1209
 Points: 32,624
 Level: 44

Re: Why resistor is used @ feedback?

 Originally Posted by **Oby1** 

I saw this in some analog circuits... can you explain me little about **current-feedback (CFB) mode operational amplifiers**. As amplifiers have very high Rin, how feedback current is going to effect gain??

As long as the opamp can be considered as ideal, the feedback resistor is not necessary for unity gain applications because there is absolutely no current flowing into the idealized input (input impedance infinity).

However, in real applications it can be beneficial to have such a resistor to compensate for a (rather small) voltage drop across the source resistance (not shown in the simple diagram) in front of the non-inv. input that sometimes cannot be neglected. This method is known as "offset current compensation".

Regarding the current-feedback amp (CFA): It has a low-resistance inverting input (current input) and the current flowing into this input is mirrored and transferred into a voltage (internally). That means, the input circuitry of a CFA is completely different if compared with the conventional opamp. In this context, it is to be noted that the open loop "gain" of the CFA is given in "ohms" and, therefore is called "transfer impedance" (because the input current is transferred to an output voltage).

The information as given by FvM (regarding the feedback resistor) becomes clear if you compare the closed loop gain of both amplifier types. For comparing purposes the gain is written as a product consisting of (a) the idealized and frequency-independent gain factor G_o and (b) a real frequency-dependent error factor $E(j\omega)$:

Closed-loop Gain $G=G_o \cdot E(\omega)$ with $G_o=1+R_2/R_1$ for both amplifiers.

* voltage opamp: $1/E(j\omega)=1+1/(G_o/A(j\omega))$ with $A(j\omega)$: opamp open loop gain
 * CFA: $1/E(j\omega)=1+1/(R_2/Z(j\omega))$ with $Z(j\omega)$: CFA open loop transfer impedance.

Advantage of CFA: $Z(j\omega)$ must not be frequency compensated because R_2 always can be chosen - independent on the desired closed-loop gain - in such a way that no stability problems arise. For this purpose, the manufacturers specify a suitable (minimum) value for this feedback resistor.

----- Post added at 14:34 ----- Previous post was at 13:12 -----

Remark 1: perhaps I should mention that the CFA calculation assumes that $R_1 \gg r_{in}$ (r_{in} : inv. input resistance, in reality app. 50 ohms or less).

Remark 2: Of course, one also can compare the loop gain of both opamp types with feedback:

* opamp: $LG=-k \cdot A(j\omega)$ with $k=r_1/(R_1+R_2)$

*CFA: $LG=-R_2 \cdot Z(j\omega)$

2 members found this post helpful.

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12-07-11, 06:59

#9

Oby1 

Junior Member level 2



Join Date: May 2011
 Posts: 22

Re: Why resistor is used @ feedback?

Thank you FvM and LvW for your wonderful explanation:)

Dear LvW, from your answer I have come to conclusion that FB resistor in voltage follower is used for "offset current compensation".

Helped: 0 / 0
Points: 429
Level: 4

untitled.JPG

In above figure to compensate offset current from/to +terminal and -terminal, I should have

$R_{in} \approx R_f$

so that very small voltage drop will be there across both resistors, which cancels each to nullify "offset voltage" @ o/p.
am I right?

=====

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12-07-11, 07:13

#10

keith1200rs 

Super Moderator



Join Date: Oct 2009
Location: Yorkshire, UK
Posts: 8,817
Helped: 1773 / 1773
Points: 45,554
Level: 52

Re: Why resistor is used @ feedback?

I think you will sometimes see it with very high speed voltage feedback opamps where the feedback resistor interacts with the input capacitance and affects the frequency response.

Keith

I started life with nothing and I've still got most of it left. (Seasick Steve)

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12-07-11, 08:16

#11

FvM 

Advanced Member level 5



Achievements:



Awards:



Join Date: Jan 2008
Location: Bochum, Germany
Posts: 20,176
Helped: 5908 / 5908
Points: 131,546
Level: 87

Re: Why resistor is used @ feedback?

Offset compensation is another possible purpose of a feedback resistor with buffer amplifiers. But it's only reasonable for bipolar OPs without input current compensation. Many modern OPs have input current compensation and don't get any advantage from compensation resistors. Nevertheless are some designer still placing these resistors because the read it in a text book.

For low noise and/or high speed designs, an offset compensation resistor should be bypassed with a capacitor. Besides adding noise, the resistor creates a pole with the OP's input capacitance and reduces the feedback phase margin.

2 members found this post helpful.

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