Current Feedback Amplifiers - 1

Exercises

TI Precision Labs: High-Speed Operational Amplifiers

Prepared and Presented by Samir Cherian

Current Feedback Amplifier – Quiz 1

(1) A CFB datasheet recommends a feedback resistance, R_F = 800Ω, when configured in a gain of 2 and R_F = 700Ω, when configured in a gain of 4. What is the inverting input impedance, R_i of the amplifier?

a) 25Ω

b) 50Ω

c) No sufficient information provided

d) None of the above

(2) A CFB datasheet recommends a feedback resistance, R_F = 800Ω, when configured in a gain of 2. What is the recommended R_F when configured in a gain of -1?

a) Value of R_i is needed in order to answer this
b) 700Ω
c) 800Ω
d) None of the above

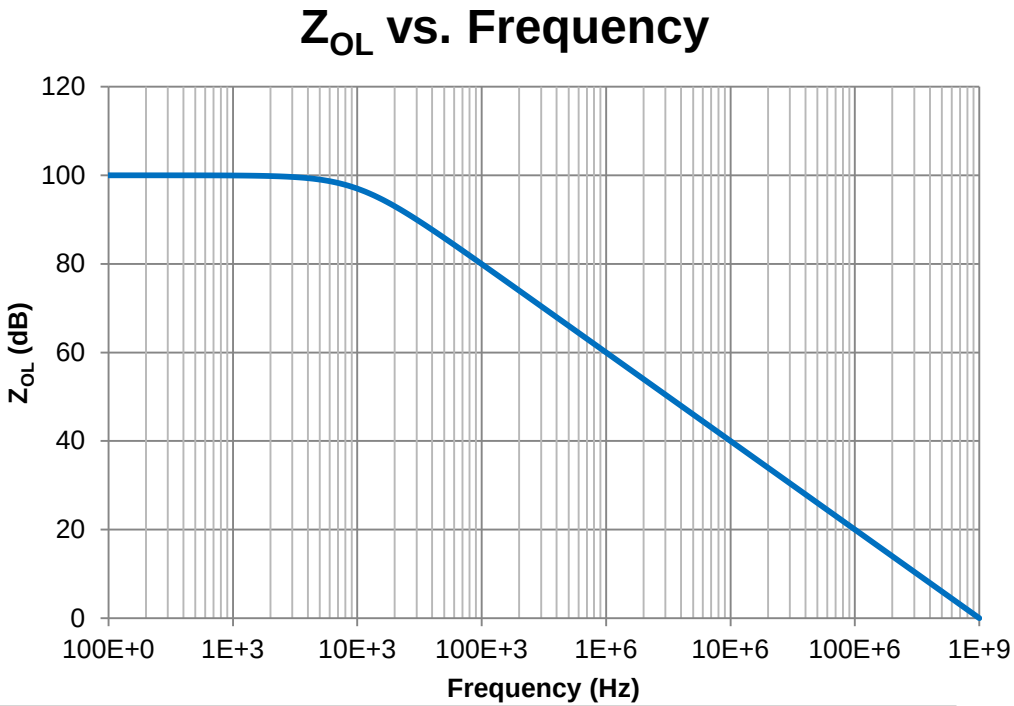
(3) The Z_{OL} curve of a CFB is shown below. If the recommended R_F= 900Ω when configured in a gain of 4 and the inverting input impedance, R_i = 25Ω, what is the closed loop bandwidth of the amplifier in a gain of 4?

a) 1 MHz

b) 3.16 MHz

c) 2 MHz

d) 10 MHz



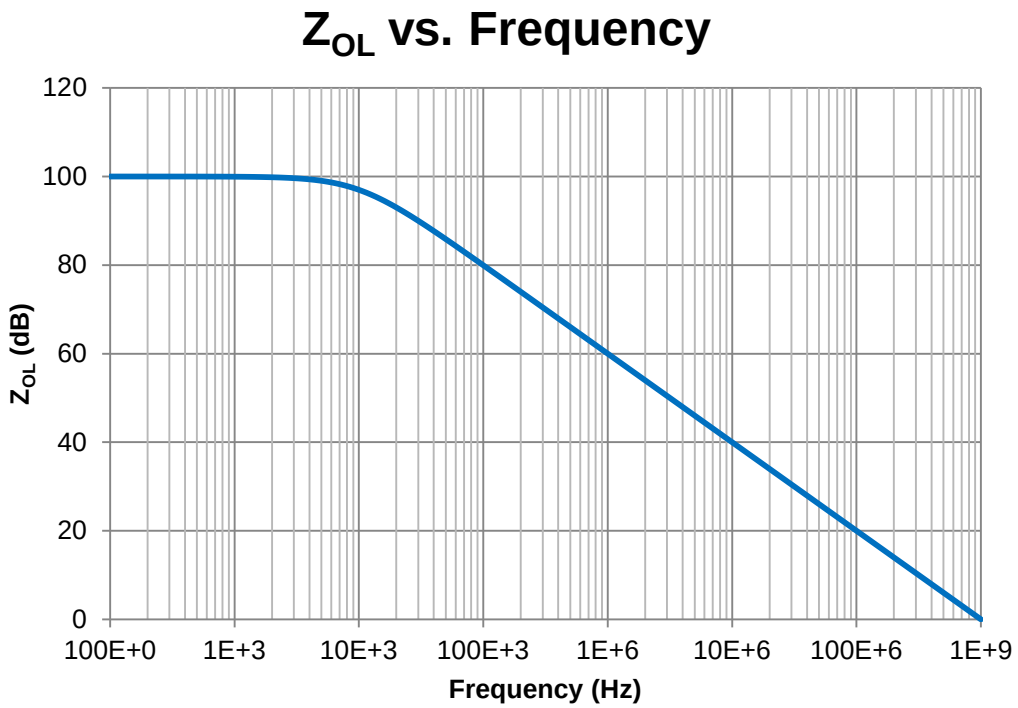
(4) In the previous example, what is the phase-margin of the amplifier when configured in a gain of 4? (R_F= 900Ω , R_i= 25Ω)

a) 45°

b) 90°

c) 135°

d) 180°



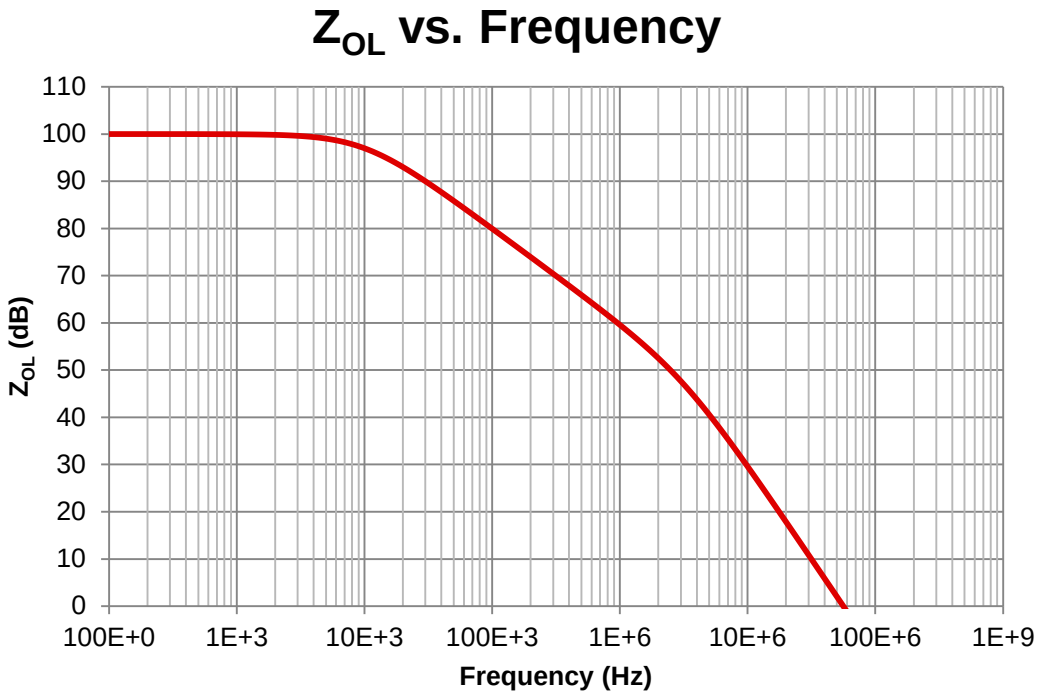
(5) The previous example was modified to have a 2nd Z_{OL} pole at 3.16MHz as shown below. What is the new phase margin?

a) 45°

b) 67.5°

c) 0°

d) 90°



Answers

(1) A CFB datasheet recommends a feedback resistance, R_F = 800Ω, when configured in a gain of 2 and R_F = 700Ω, when configured in a gain of 4. What is the inverting input impedance, R_i of the amplifier?

b) 50Ω

Answer: In order to maintain a constant feedback transimpedance, (R_F+ R_i×Noise Gain),

800Ω+R_i×2 = 700Ω+R_i×4

⇒ 2×R_i= 100Ω

⇒ R_i= 50Ω

(2) A CFB datasheet recommends a feedback resistance, R_F = 800Ω, when configured in a gain of 2. What is the recommended R_F when configured in a gain of -1?

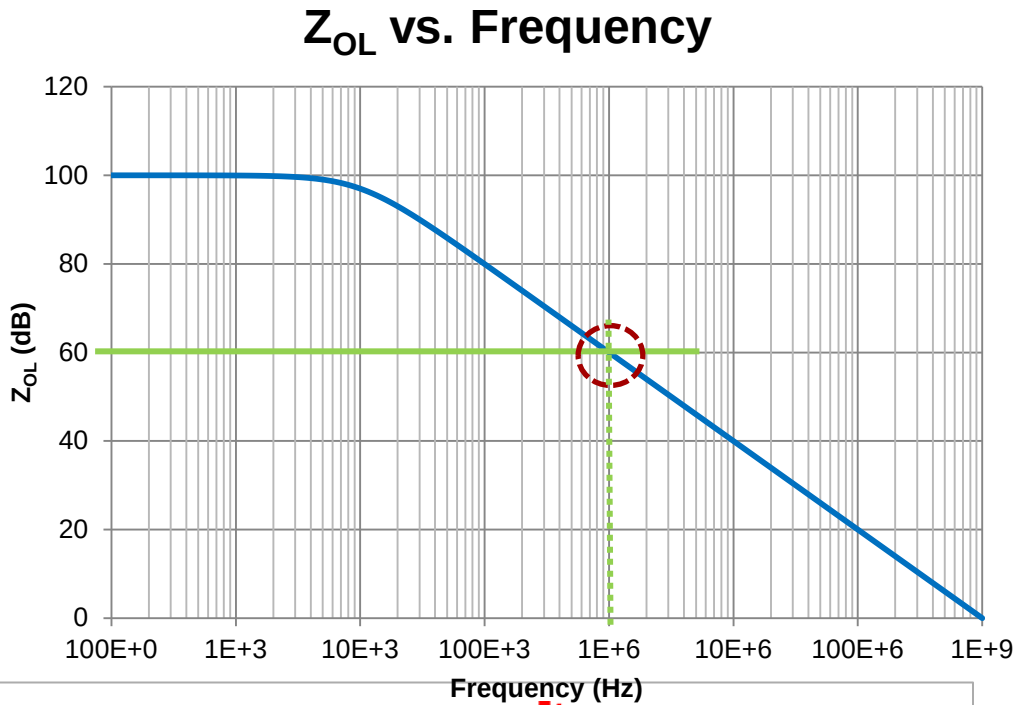
c) 800Ω

Answer: An inverting gain of -1 corresponds to noninverting gain of 2. Hence the feedback resistance RF will stay the same.

(3) The Z_{OL} curve of a CFB is shown below. If the recommended R_F= 900Ω when configured in a gain of 4 and the inverting input impedance, R_i = 25Ω, what is the closed loop bandwidth of the amplifier in a gain of 4?

a) 1 MHz

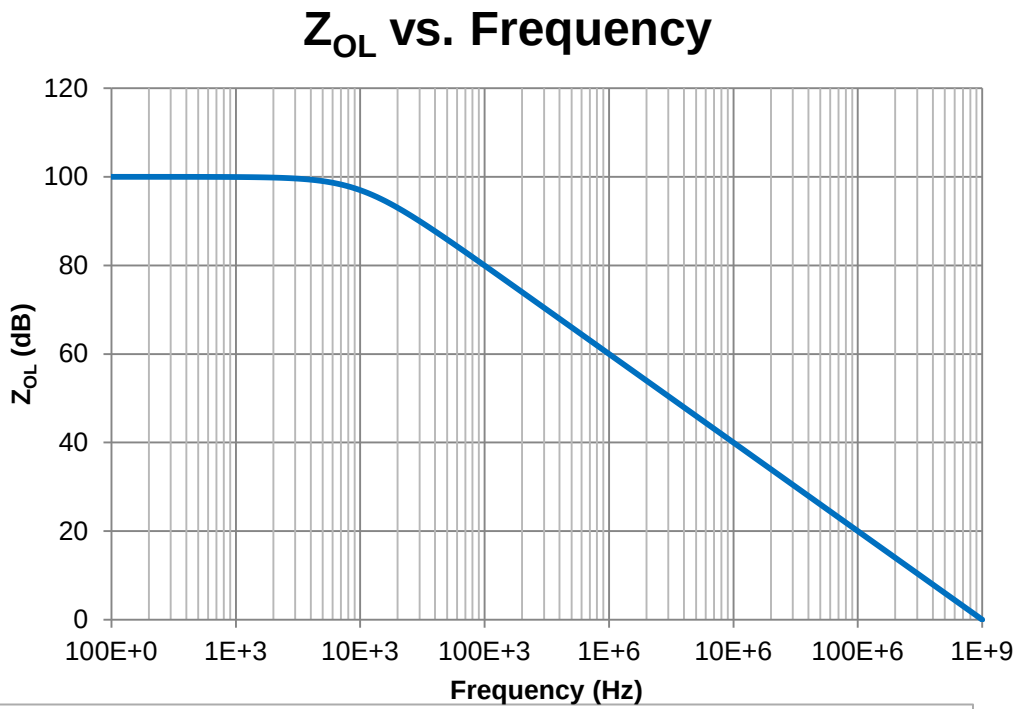
Answer: The feedback transimpedance is 900Ω+25Ω×4 = 1000Ω, which corresponds to a gain of 60dB. A straight line curve at 60dB intersect the Z_{OL} curve at 1 MHz as shown here.



(4) In the previous example, what is the phase-margin of the amplifier when configured in a gain of 4? (R_F= 900Ω , R_i= 25Ω)

b) 90°

Answer: The dominant pole of the amplifier at 10kHz contributes a total phase shift of 90° by 100KHz assuming straight line ideal Bode theory. The crossover occurs at 1MHz and since this is a 1-pole system the phase margin is 180°-90° = 90°



(5) The previous example was modified to have a 2nd Z_{OL} pole at 3.16MHz as shown below. What is the new phase margin?

b) **67.5°**

Answer: From the graph 3.16MHz corresponds to a Z_{OL} of 50dB while crossover occurs at 60dB. We know the phase changes at 45°/decade starting one decade before the pole frequency or 316kHz. The phase margin is thus 180° - 90°(dom. Pole) – 22.5°(½ decade from 2nd pole) = 67.5°