EXERCISE 1

The transfer function of a voltage amplifier with differential input, in open loop is:

$$A(jf) = \frac{16.10^3}{\left(1+jf10^{-1}\right)\left(1+jf2.10^{-4}\right)\left(1+jf2.10^{-5}\right)\left(1+jf10^{-7}\right)} \quad \text{with } f \text{ in Hz}$$

1. Represent the asymptotic Bode diagram (modulus and phase) of the amplifier.
2. Determine if this amplifier is stable when it is used as a voltage follower. Give reasons for your answer.
3. If the amplifier is feedback with a non-inverting configuration, what is the minimum value of the closed-loop gain for which the amplifier is stable with a phase margin of 45°?
4. Represent the schematic of the feedback amplifier and calculate the values of the resistors of the β network for the minimum gain value calculated in the previous section.

EXERCISE 2

The transfer function of a voltage amplifier with differential input, in open loop is:

$$A(jf) = \frac{10^3}{\left(1+j\frac{f}{100}\right)\left(1+j\frac{f}{10^3}\right)\left(1+j\frac{f}{2.10^4}\right)} \quad \text{with } f \text{ in Hz}$$

1. Draw the asymptotic Bode diagram, modulus and phase, of the amplifier, for frequencies between 10 mHz and 1 MHz. Clearly indicate the most significant points and slopes of each section.
2. Determine, from the Bode diagram above, if the amplifier is stable if it is feedback as a voltage follower. Justify your answer.
3. At what frequency would the first pole of the amplifier have to be moved so that the feedback amplifier as a voltage follower is stable with a phase margin of 45°? Justify your answer.

EXERCISE 3

The transfer function of a multistage amplifier with differential input is as follows:

$$A(jf) = \frac{10^3}{\left(1+j\frac{f}{10^5}\right)\left(1+j\frac{f}{10^3}\right)\left(1+j\frac{f}{10^4}\right)} \quad \text{with } f \text{ in Hz}$$

1. Represent the asymptotic Bode diagram of the frequency response (modulus and phase) of the amplifier. Is this amplifier stable? Give reasons for the answer.

You want to use this amplifier, in a feedback configuration, as a voltage follower. In this case:

2. Value of β to be used in the feedback network. Is this feedback amplifier stable as a follower? Give reasons for the answer.

3. In the event that the feedback amplifier as a voltage follower is unstable, proceed to compensate it by means of a dominant pole so that the compensated system has a phase margin of 45° (PM = 45°).

EXERCISE 4

Figure 1 represents the asymptotic Bode diagram of a voltage amplifier with differential input in open loop,

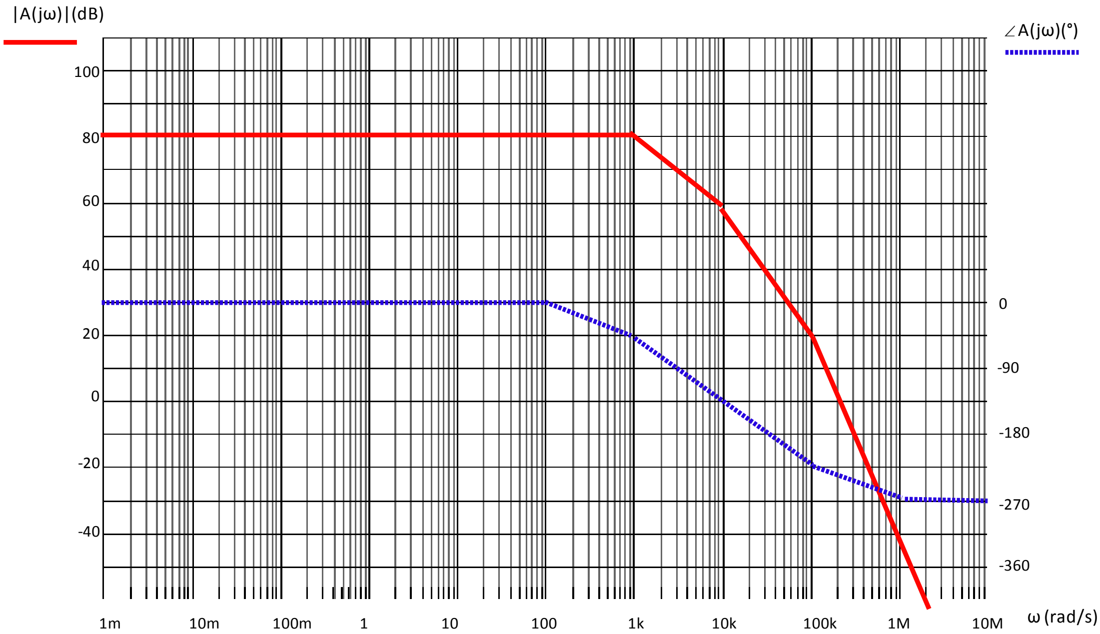

Figure 1

1. Determine the frequencies of the poles and zeros of the amplifier, and its gain at mid frequencies. Give reasons for the answer.

You want to use this amplifier in a feedback configuration as shown in figure 2

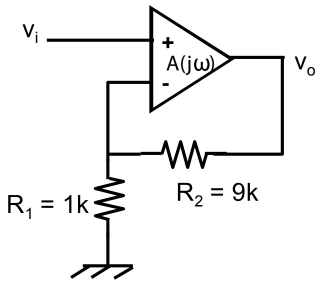

Figure 2

2. Is the feedback amplifier in Figure 2 stable? Give reasons for the answer.
3. In the assumption that the feedback amplifier in figure 2 is unstable, proceed to compensate it using the dominant pole so that the compensated system has a gain margin equal to 20dB, GM = 20dB.

EXERCISE 5

The transfer function of a voltage amplifier with differential input is:

$$A_V(jf) = \frac{500}{\left(1 + j\frac{f}{1kHz}\right)\left(1 + j\frac{f}{1kHz}\right)\left(1 + j\frac{f}{10kHz}\right)}$$

1. Represent the Asymptotic Bode Diagram (modulus and phase) of the amplifier, $A_V(jf)$. Is this amplifier stable? Justify your answer.
2. This amplifier is used in a feedback configuration as a voltage follower, as shown in Figure 3.

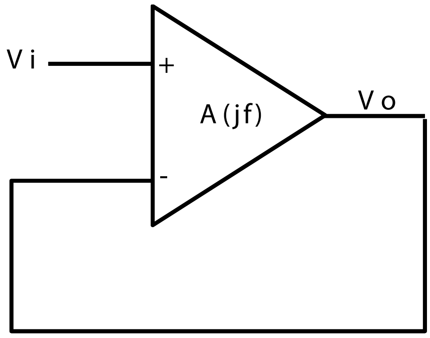

Figure 3

Is this feedback amplifier stable as a voltage follower? Justify your answer.

3. At what frequency would a dominant pole have to be inserted in the feedback amplifier so that it is stable as a voltage follower with a gain margin of 20dB? Justify your answer.