TYPES OF FEEDBACK CIRCUITS IN AMPLIFIERS

M.O. Sultonova

Tashkent university of information technologies

Named after Muhammad al-Khwarizmi

The transfer of amplified oscillations from the output circuit of the amplifier to the input circuit is called feedback.

The circuit in which energy is transferred from the output to the input is called a feedback circuit. It is usually done in the following way:

A) linear passive quadrupole characterized by the transmission coefficient b, which serves to give the amplifier the required properties;

B) active four-pole, as a result of which new classes of circuits are created (stabilizers of compensatory type, multivibrator).

Feedback can occur in an amplifier for three reasons:

1) due to the physical properties and structure of the amplification elements (internal feedback);

2) due to parasitic capacitance, inductive and other connections that create paths for reverse signal transmission (parasitic feedback);

3) due to the inclusion of special circuits in the circuit (external feedback).

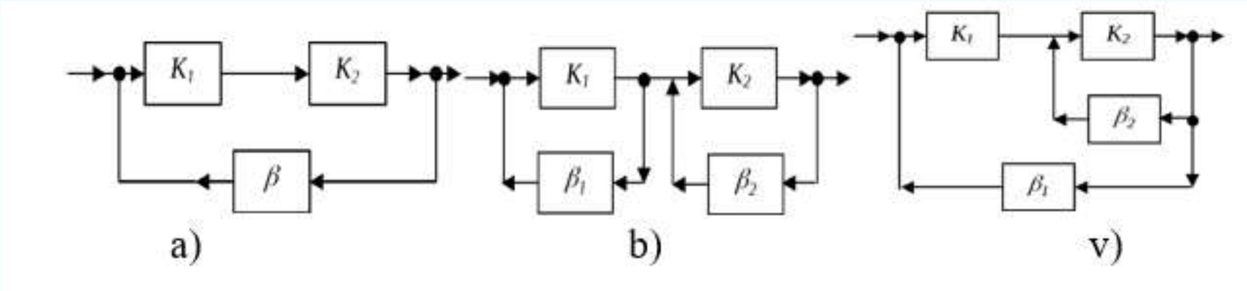
All types of feedback can strongly change the characteristics of an amplifier. Both internal and parasitic connections cannot be controlled, they often change the characteristics of the amplifier in a negative direction. External feedback is controllable and is introduced to improve the following properties of the amplifier:

- increasing the stability of the amplification factor;
- reduction of all types of violations;
- reduce noise, etc.

The closed loop formed by the feedback circuit and the connected part of the amplifier circuit is called a feedback loop. If the amplifier has only one feedback loop. Communication is single-ring (picture 1, a), if there are several rings, the feedback is called multi-ring communication (pictures 1, b, v). B2, which covers one cascade of the amplifier, is called local feedback (fig. 1,v-).

If the oscillations from the source of the input signal are combined with a feedback signal that increases the amplitude of the oscillations, then such feedback is called positive feedback.

If the source of the input signal and the feedback signal arrive at the input of the amplifier in opposite phase, which causes the amplitude of the oscillations at the input and output of the amplifier to decrease, then such feedback is called negative feedback. Negative feedback changes all the parameters of the amplifier and serves to give it the necessary properties.

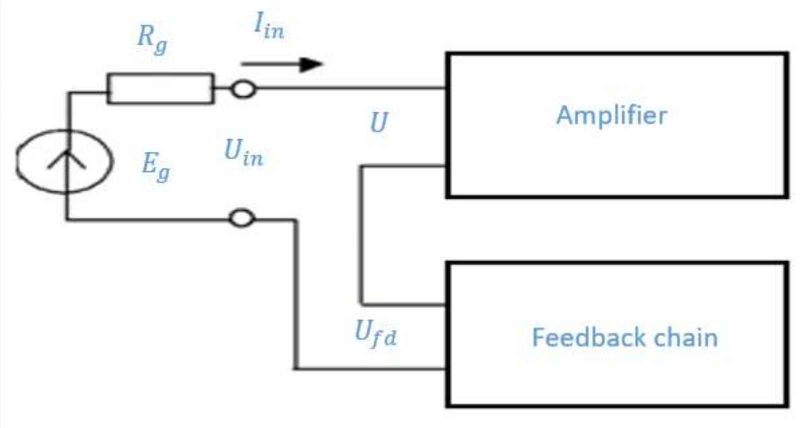


Picture 1. Types of feedback loops

If the ratio of the voltage at the output of the feedback circuit to the voltage at its input does not depend on frequency (the feedback circuit does not have inductances and capacitances), the feedback is called a frequency-independent feedback. If the ratio of the indicated voltages depends on the frequency, then the feedback is called frequency-dependent feedback.

Depending on the method of providing the feedback signal to the input of the amplifier, it is divided into series and parallel feedback.

If the source of the input signal is connected in series with the input of the amplifier and the output of the feedback circuit, then such feedback is called series feedback. In this case, the U_{fd} feedback signal is fed to the input of the amplifier in series with the U_e input signal (fig. 2).



Picture 2. Continuous feedback

If the feedback circuit is connected in parallel to the source of the input signal, then such feedback is called parallel feedback (fig. 3). In parallel feedback, an algebraic addition of currents rather than voltages in series feedback takes place at the input of the amplifier. For this, it is necessary that $R_G \neq 0$, $R \neq 0$.

According to the method of connecting the feedback circuit to the output of the amplifier: it is divided into voltage and current feedback.

In voltage feedback, the output of the amplifier, the load and the feedback circuit are connected in parallel to each other (fig. 4). In this case, the feedback signal is proportional to the input voltage of the amplifier.

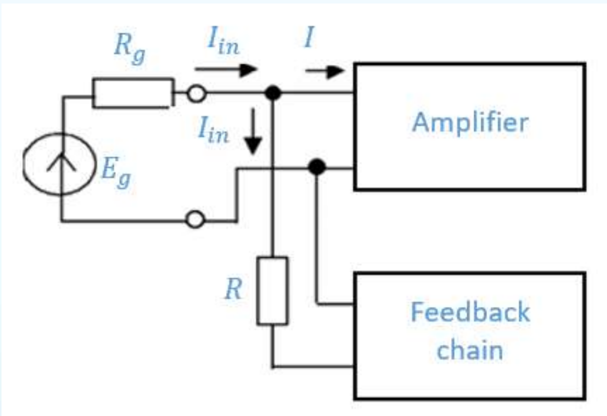


Figure 3. Parallel feedback

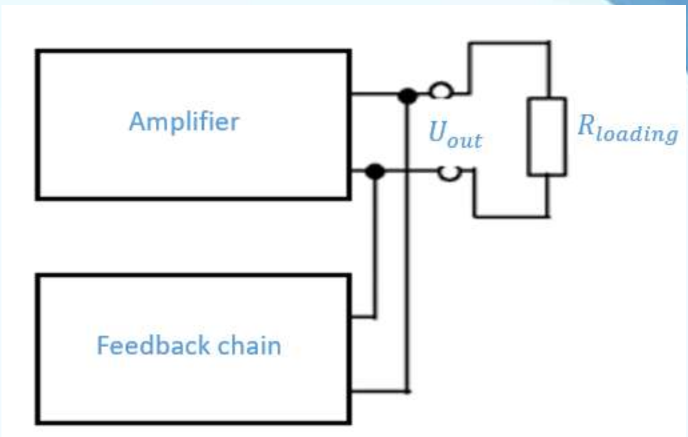


Figure 4. Voltage feedback

If the output of the amplifier, the load and the feedback loop are connected in series (figure 5), this is current feedback, where the feedback signal is proportional to the current flowing through the load.

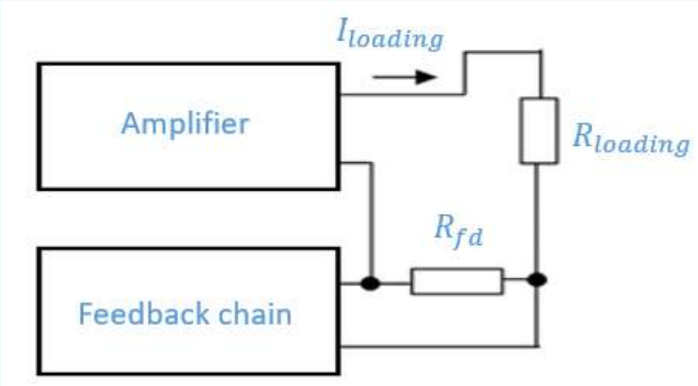


Figure 5. Current feedback

As can be seen from figures 4 and 5, in the short-circuit mode of the load, the voltage feedback is lost, and the current feedback is preserved. In the passive operation mode ($R_{upload} \rightarrow \infty$), voltage feedback is maintained, current feedback is lost.

Thus, amplifier circuits can have four types of negative or positive feedback:

- series by voltage;
- in series according to current;
- parallel in voltage;
- parallel current.

As well as affecting the gain of the device, feedback also affects the variation of the gain which is always present in the operation of the amplifier. The variation of the amplification factor depends on the following various factors, called destabilizing factors:

- changes in the power of supply sources;
- wear and replacement of reinforcement elements and details;
- environmental temperature changes, etc.

References

1.Опадчий Ю.Ф., Глудкин О.П., Гуров А.И. Учебник для вузов. Аналоговая и цифровая электроника. М., радиосвязь, 2001 г.

2.Радиоприемные устройства. Учебник для студ. вузов, обуч. по спец. "радиосвязь, радиовещание и телевидение" / под ред. проф. Н. Н. Фомина. - 2-е изд., перераб. и доп. - М. : Радио и связь, 2007.

3. A.Abduazizov, D.Davronbekov. Radiouzatish va qabul qilish qurilmalari. O‘quv qo‘llanma. – T.: “Fan va texnologiya”, 2011, 272 bet.

4. D.A.Davronbekov, U.T.Aliyev. Teleradioeshittirishda uzatish va qabul qilish qurilmalari. Darslik. –T.: “Aloqachi”, 2019, 256 bet.

5. D.A.Davronbekov, M.O.Sultonova. «Yangi avlod kuchaytirgichlarining texnika va texnologiyalari». O‘quv qo‘llanma – T.: TATU, 2019. - 161 bet.