Answer on question # 85831 Physics / Electric Circuits

On the basis of their biasing, with the help of appropriate diagrams, justify the uses of Class A, AB and C amplifiers for various applications.

Answer

Class A mode of operation. In Class A mode of operation, the operating point is set at the linear portion of the dynamic characteristic. To do this, between the base and the emitter of the transistor using one of the power circuits of the base circuit, you must create a constant component of the voltage, which is called the magnitude of the bias voltage. In the absence of a variable component of the amplified signal, the operating point is called the operating point of rest. Consider Figure 1. Up to time point t_1, the variable component of the input signal is absent, and the DC component of the collector current, called the quiescent current, will flow in the collector circuit of the transistor under the action of the value E_{shift}. Class A mode of operation is characterized by minimal non-linear distortions, since the amplifying element works on the linear portion of the characteristic. The disadvantage of class A mode is low efficiency. η = (25 - 30%). This is explained by the fact that the energy from the power source is spent not only on the amplification of the variable component, but also on the creation of the constant component I_0, which is useless and is subsequently eliminated by the separation capacitor. Class A mode is used mainly in preliminary amplification cascades

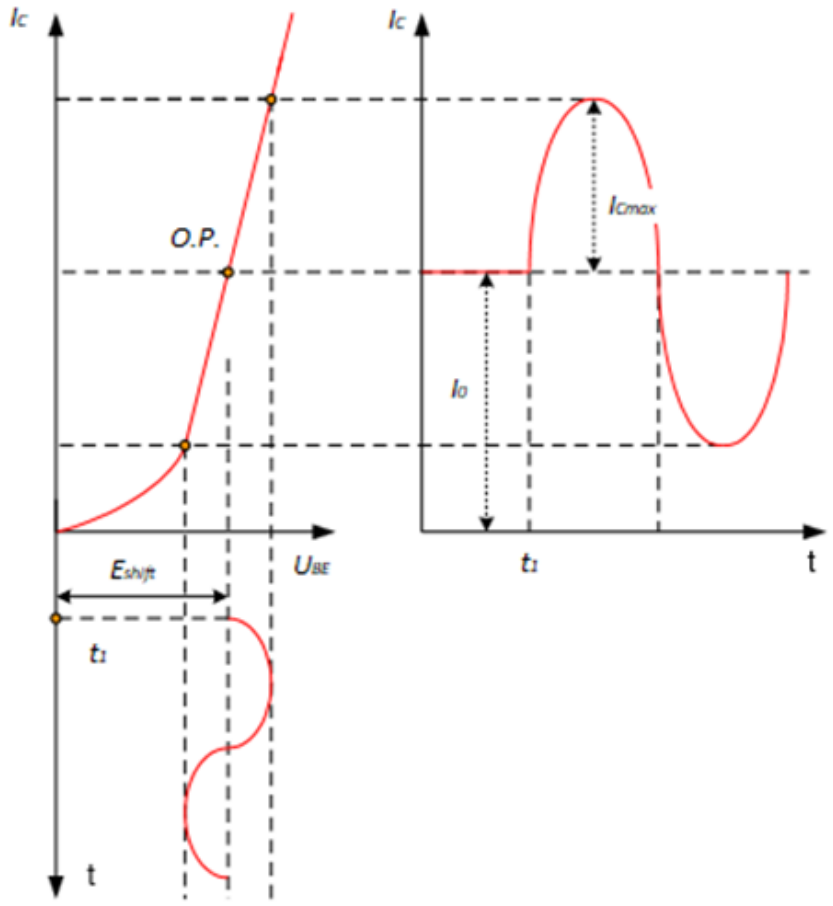

Figure 1

Mode class AB. Sometimes the position of the point of rest in class AB mode is selected on the lower bend of the dynamic characteristic (see Figure 2).

In this case, the quiescent current will take place, but its magnitude will be much less than in class A. The cut-off angle in class AB mode will be less than 90 °. The class AB mode has a slightly lower efficiency than the class B mode (η = 50 ÷ 60%) and slightly less non-linear distortion. It is used in the same way as class B mode in push-pull power amplifiers.

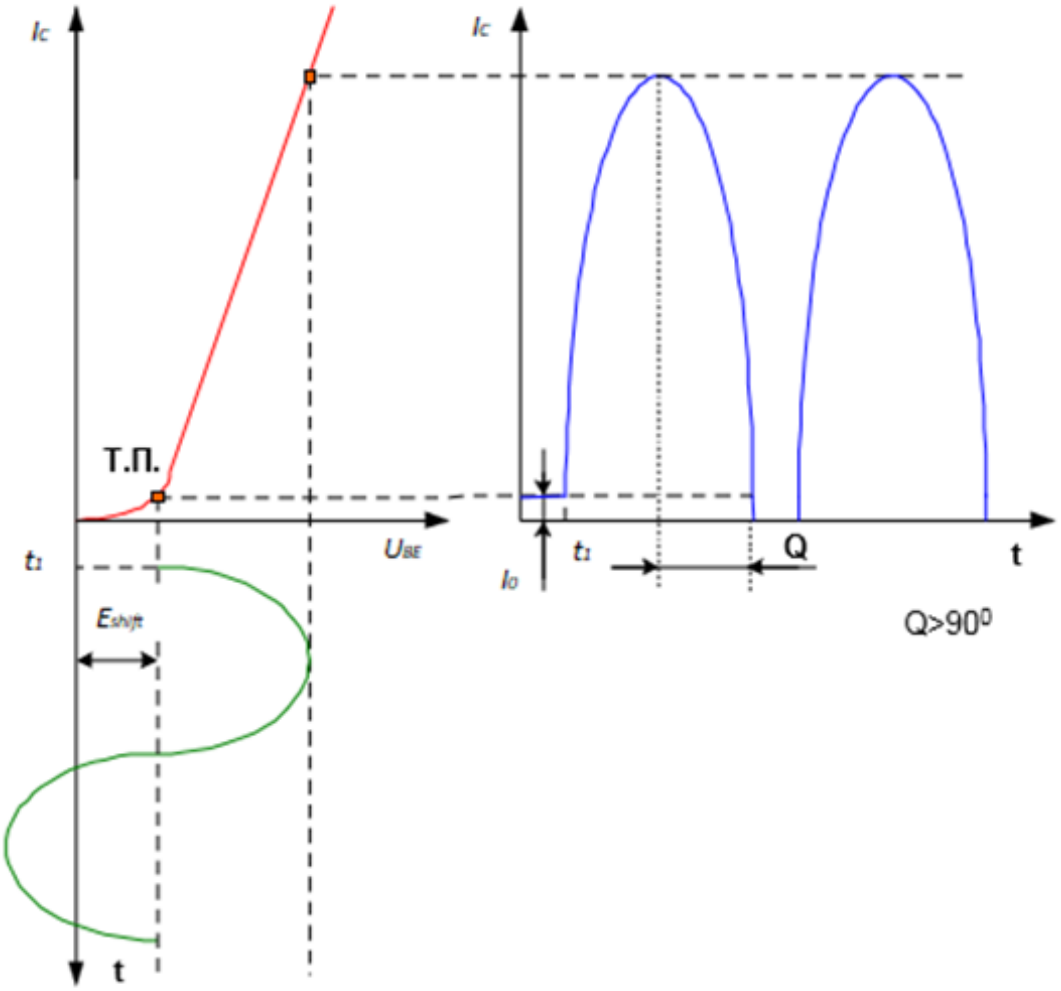

Figure 2

Class C operation mode. This is the mode in which the value of E_{shift} is negative (see Figure 3).

Class C mode is characterized by maximum efficiency η = 80%, but also by the greatest nonlinear distortions. Mode C in amplifiers is used in the output stages of high-power transmitters.

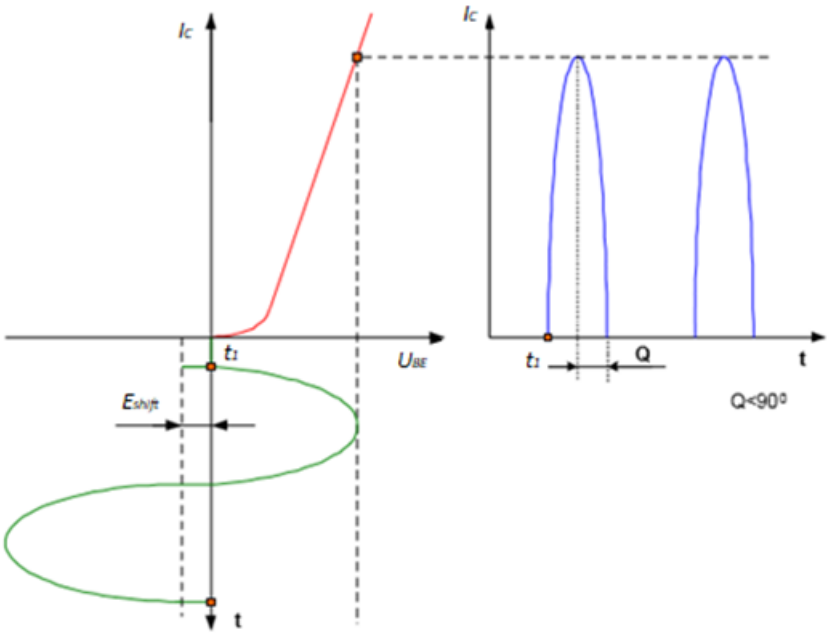

Figure 3