3. Operational amplifier - inverting amplifier, non-inverting amplifier, combiner, differential circuit

1) Task

In the amplifier circuit fromFig.1 (inverting amplifier) assuming ideal OA parameters should be:

a) Determine the voltage transmittance of the system;

b) Estimate the voltage gain of the circuit when $R_1 = 10$ kΩ, $R_2 = 20$ kΩ.

2) Task

Determine A_V, R_{in}, R_{out}, f_g of the amplifier circuit from Fig.1 considering the finite voltage gain of OA. For calculations, assume $R_1 = 15$ kΩ, $R_{(2)} = 15$ kΩ and OA with parameters: $A_{VOL} = 10^5$ V/V, $f_{(p1)} = 10$ Hz, $f_T = 1$ MHz, $R_{ins} = 10^9$, $R_{(inr)} = 10^{(6)}$, $R_{(outWO)} = 75$ Ω.

3) Task

In the amplifier circuit from Fig.2 assuming ideal OA parameters and $R_g = 500$ Ω, $R_{(L)} = 10$ kΩ should:

a) Select R_1, R_2 so that $A_V = -6$ V/V;

b) Select R_d to compensate for the input polarization current.

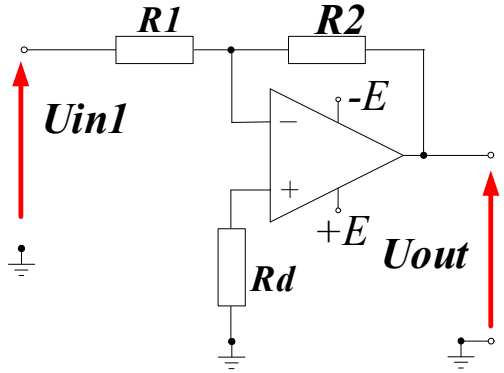

Fig.1 . Inverting amplifier

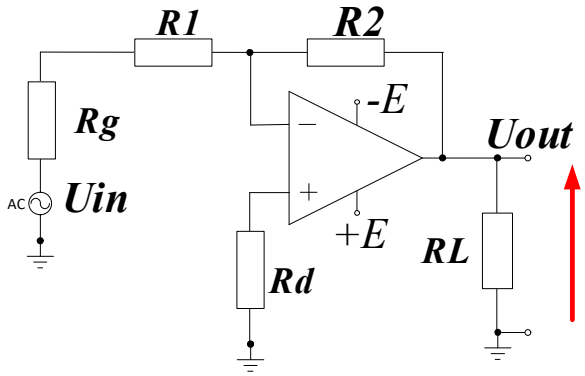

Fig.2 . Inverting amplifier

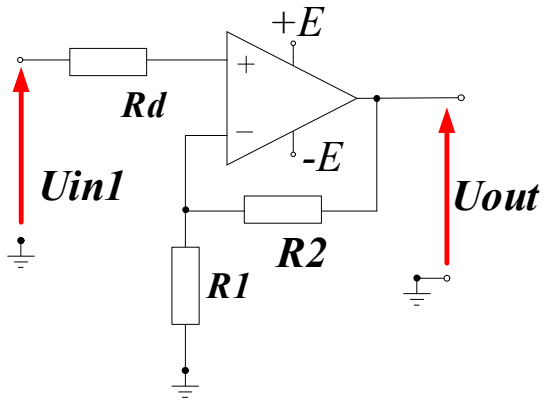

Fig.3 . Non-inverting amplifier

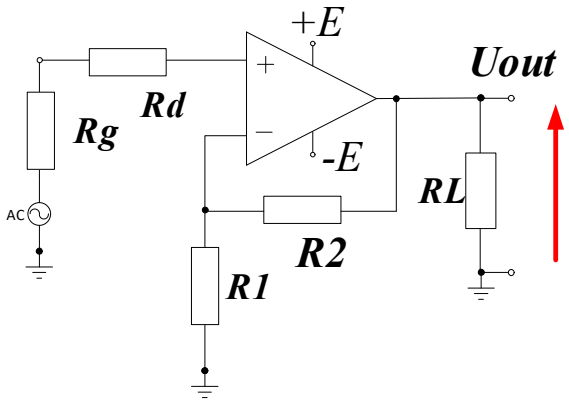

Fig.4 . Non-inverting amplifier

4) Task

In the amplifier circuit from Fig.3 (non-inverting amplifier) assuming ideal OA parameters should be:

a) Determine the voltage transmittance of the system;

b) Estimate the voltage gain of the system when $R_1 = 10$ kΩ, $R_{(2)} = 20$ kΩ;

c) Analyze the possibility of obtaining voltage gain $A_V = 1$.

5) Task

Determine A_V, R_{in}, R_{out}, f_g of the amplifier circuit from Fig.3 considering the finite voltage gain of WO. For calculations, assume $R_1 = 15$ kΩ, $R_{(2)} = 15$ kΩ and OA with parameters: $K_{UR} = 10^5$ V/V, $f_{(p1)} = 10$ Hz, $f_T = 1$ MHz, $R_{ins} = 10^9$, $R_{(inr)} = 10^{(6)}$, $R_{(outWO)} = 75$ Ω.

6) Task

In the amplifier circuit from Fig.4 assuming ideal OA parameters and $R_G = 500$ Ω, $R_{(L)} = 10$ kΩ should:

a) Select R_1, R_2 so that $A_V = 4$ V/V

b) Select R_d to compensate for the input polarization current

7) Task

In the amplifier circuit from Fig.5 (differential amplifier) assuming ideal WO parameters should be:

a) Determine the relationship for the output voltage U_{OUT} as a function of the input voltages U_{IN1}, U_{IN2}, and $U_{(IN3)}$,
b) Determine the relationship on U_{OUT} when $R_3 = R_{(1)}$ and $R_4 = R_{(2)}$.

8) Task

In the circuit of the amplifier in Fig.5 (differential amplifier) assuming ideal OA parameters should be:

a) Estimate the output voltage U_{OUT} when $U_{IN1} = 1$ V, $U_{IN2} = 5$ V, $U_{IN3} = 5$ V, $R_1 = 10$ kΩ, $R_{(2)} = 50$ kΩ, $R_{(3)} = 20$ kΩ, $R_{(4)} = 10$ kΩ;
b) Select the resistance values in the circuit so that it realizes the function $U_{OUT} = -5\ U_{IN1} + 6\ U_{IN2}$ (U_{IN3}=0V)
c)

9) Task

In the amplifier circuit from Fig.5 (differential amplifier) assuming ideal WO parameters should be:

a) Determine the condition for minimizing the effect of input polarization current;
b) Determine the injunction resistance of the individual injunctions of the system.
c)

10) Task (exam task - example)

In the amplifier circuit from Fig.5 (r ożnic amplifier) assuming ideal OA parameters and UIN1 = 2 V, UIN2 = 2 V, UIN3 = 2 V, R1 = 10 kΩ, R3 = 20 kΩ, R2 = 40 kΩ, R4 = 10 kΩ, estimate the value of the output voltage U_{OUT};

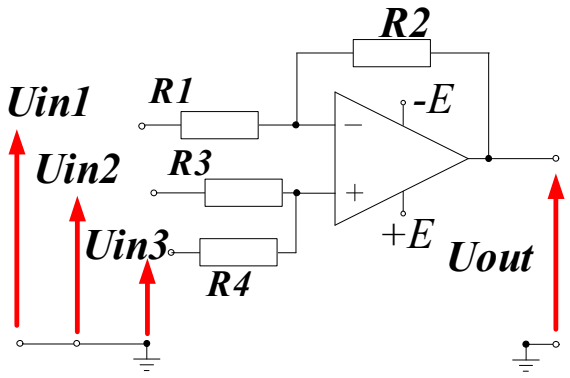

Fig.5 . Differential amplifier

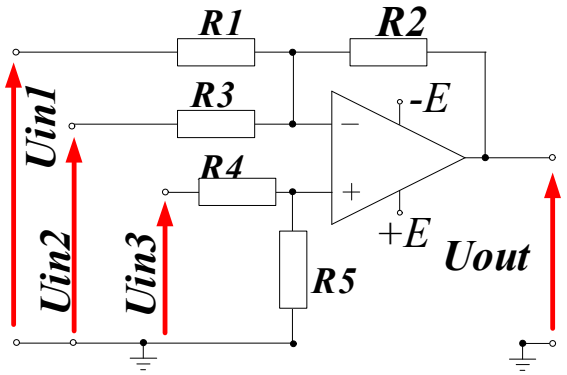

Fig.6 . Level shifting summing amplifier

11) Task

In the amplifier circuit from Fig.6 (combiner) assuming ideal OA parameters, determine the dependence on the output voltage U_{OUT} as a function of the input voltages U_{IN1}, U_{IN2} and U_{IN3}.

12) Task (exam task - example)

In the amplifier circuit from Fig.6 (combiner) assuming ideal OA parameters and $U_{IN1} = 2$ V $U_{IN2} = 2$ V, $U_{IN3} = 2$ V, $R_1 = 10$ kΩ, $R_{(3)} = 20$ kΩ, $R_{(2)} = 40$ kΩ, $R_{(4)} = 10$ kΩ, $R_{(5)} = 10$ kΩ should: Estimate the value of the output voltage U_{OUT};

13) Task (exam task - example)

In the amplifier circuit from Fig.6 (combiner) assuming ideal OA parameters, select circuit elements to realize the function:

a) $U_{OUT} = -(2\,U_{IN1} + U_{(IN2)})$;

b) $U_{OUT} = -(5\,U_{IN1} + 6\,U_{(IN2)})$.