Labor of Fundamentals of Electronics and Power Electronics

Exercise No. 16

APPLICATION OF LOW POWER OPERATIONALS AMPLIFIERS

16.1 <u>Basic information</u>

The primary aim of this exercise is to know the capabilities to application of operational amplifier in regulation, control and measuring systems. In the exercise, selected basic circuits of the operational amplifier are analysed, covering both the range of work: linear and nonlinear. There are two general-purpose amplifiers µA741 type in the laboratory stand.

References:

Tse Chi Kong: Linear circuit analysis
Baranecki A.: Laboratorium układów elektronicznych. Cz. 2
Fabijański P. i inni: Ćwiczenia z podstaw elektroniki
Jaczewski J., Opolski A., Stolz J.: Podstawy elektroniki i energoelektroniki
Kaźmierkowski M.P., Matysik J. T.: Wprowadzenie do elektroniki i energoelektroniki
Titze U., Schenk Ch.: Układy półprzewodnikowe

16.2 <u>Exercise description</u>

View the front panel of desktop is shown in Figure 16.1.

On the desktop are located:

- Measuring and connecting sockets, which allow the implementation of an appropriate connection topology of the selected circuit,
- Two independent operational amplifiers µA741 type,

Operational amplifiers are supplied symmetrically (voltages ± 12 V) by special internal connectors from the front panel of the laboratory stand. Select the power 12 V (two buttons 12 V in the main panel). For assembling electrical circuits use: jumpers, resistors, capacitors, rectifier and Zener diodes, which are belonged to the laboratory stand. For the control system use regulated DC voltage UR supplied by potentiometers on the front panel. Potentiometers can also be used as part of a feedback in the circuits. For the control of circuits use the function generator with rectangular, triangular or sinusoidal output voltage. The circuits should be used with resistors equal to or greater than 1 kOhm.

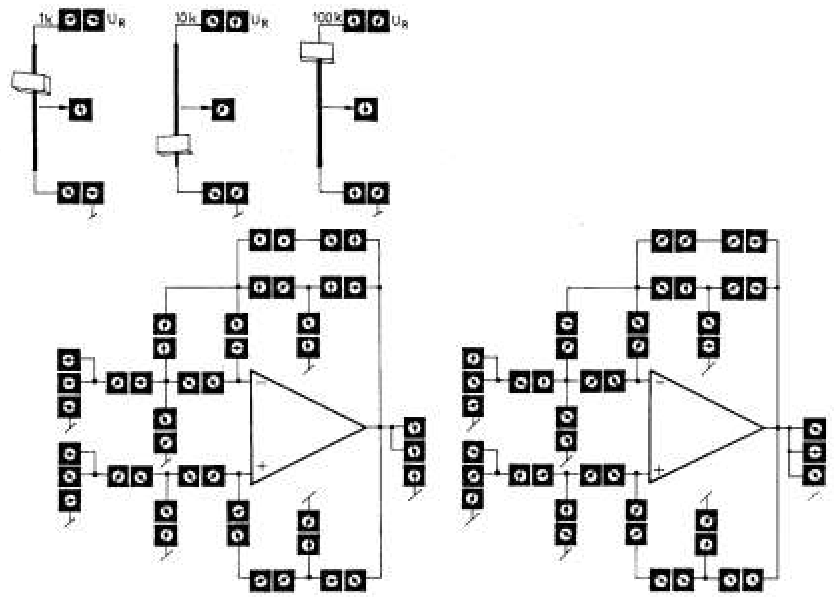

Fig. 16.1

16.3 Exercise program

16.3.1 Connect the circuit according to the scheme shown in Figure 16.2.a (inverting amplifier). Analyse the response of circuit for different input signals and different gains. Determinate the maximum steepness of the rise of output voltage by control the square wave at frequency of the order of several kHz.

16.3.2 Connect the circuit according to the scheme shown in Figure 16.2.b (voltage follower). Analyse the response of circuit for different input signals.

16.3.3 Connect the circuit according to the scheme shown in Figure 16.2.c (non-inverting amplifier). Analyse the response of circuit for different input signals and different gains. Determinate the maximum steepness of the rise of output voltage by control the square wave at frequency of the order of several kHz

16.3.4 Connect the circuit according to the scheme shown in Figure 16.2.d (voltage comparator). Analyse the response of circuit for different input signals.

16.3.4 Connect the circuit according to the scheme shown in Figure 16.2.e (Schmitt trigger). Analyse the response of circuit for input We2 connected to ground with different input signals We1 and different gains. Repeat analyse for input We2 supplied by DC voltage from regulated potentiometer located on front panel of laboratory stand (e.g. 10 kΩ). Supply potentiometer from regulated voltage UR by applicable connecting of sockets. Start analysis with initial values: $R_2 = 2{,}2$ kΩ, $R_3 = 10$ kΩ.

16.3.6 Connect the circuit according to the scheme shown in Figure 16.2.f (integrator). Analyse the response of circuit for different R_1C_1 time constant with rectangular and triangular input voltage.

16.3.7 Connect the circuit according to the scheme shown in Figure 16.2.g (multivibrator). Analyse the response of circuit for different R_1C_1 time constant and different value of relation R_2/R_3.

16.3.8 Connect the circuit according to the scheme shown in Figure 16.2.h (multivibrator with variable duration of output waveform). Analyse the response of circuit for different value of relation R_1/R_2 and R_3/R_4 and for different value of capacitor C_1.

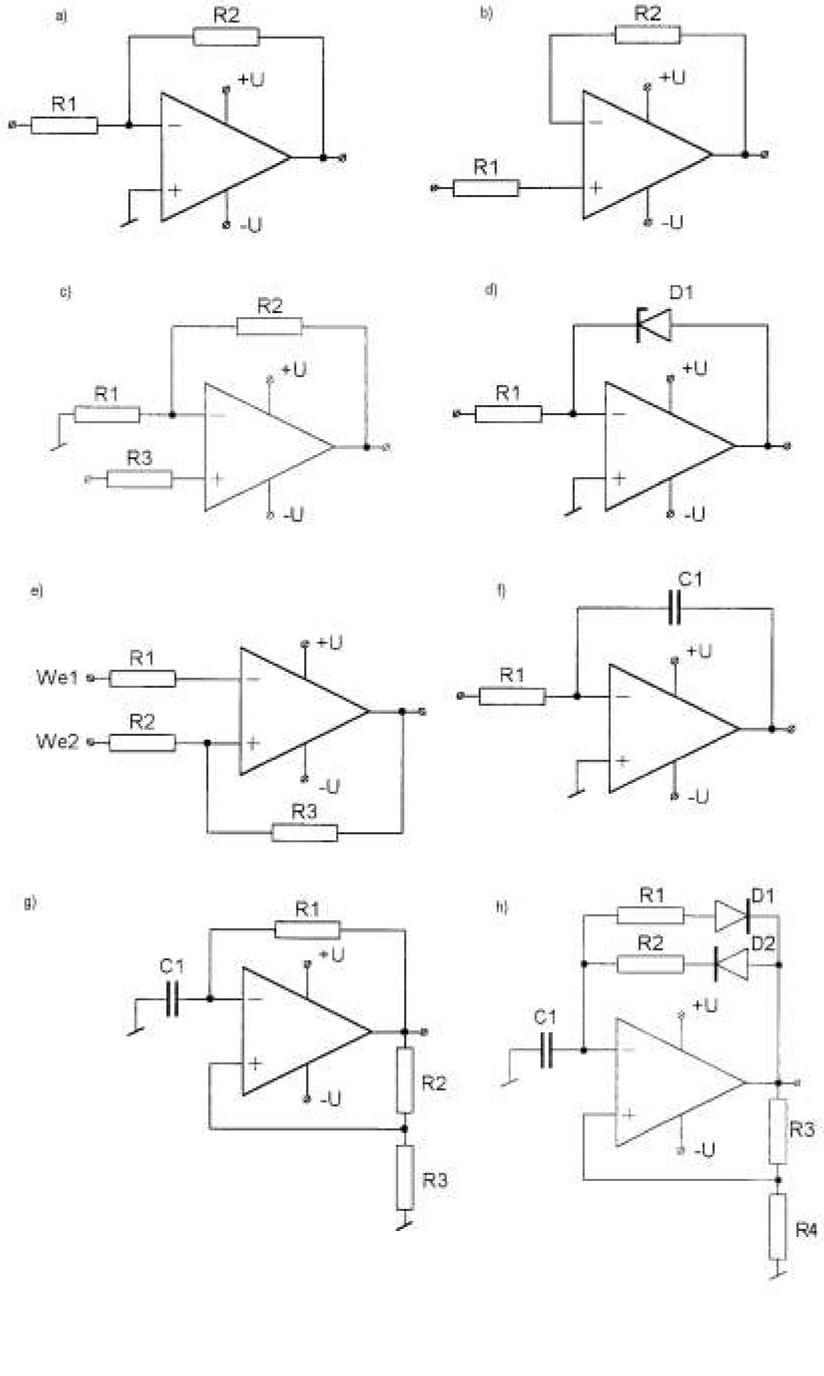

Fig. 16.2