

## 4 Integral and differential system

### 1) Task

In the system with Fig.1 (integrator) determine:

- The voltage transmittance of the system;
- integrator output voltage as a function of time

### 2) Task

In the circuit from Fig.1 (integrator), assuming  $R = 1 \text{ k}\Omega$ ,  $C = 1 \text{ }\mu\text{F}$  ( $R_c = \infty$ ):

- Draw the response of the system to unit jump excitation;
- Draw the frequency characteristics (amplitude and phase) of the system.

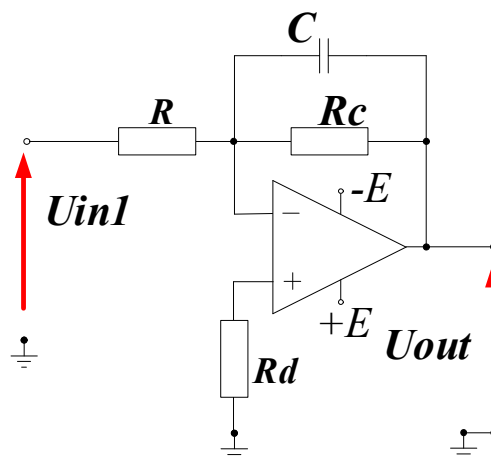


Fig.1 . Real Integrator

### 3) Task

For the system from Fig.1 (lossy integrator i.e.  $R_c \ll \infty$ ), determine the voltage transmittance of the system.

### 4) Task

In the circuit from Fig.1 (lossy integrator), assuming  $R = 1 \text{ k}\Omega$ ,  $R_c = 10 \text{ k}\Omega$ ,  $C = 1 \text{ }\mu\text{F}$ , you should:

- Draw the system's response to unit jump excitation;
- Draw the frequency characteristics (amplitude and phase) of the voltage transmittance of a system excited by a sinusoidal voltage over a wide range of frequencies.

### 5) Task

Select the values of the elements in the circuit from Fig.1 (lossy integrator) so that it performs the function of integrating a rectangular input signal with amplitude  $U_{INm} = 1 \text{ V}$  and frequency  $f = 2.5 \text{ kHz}$ , into a triangular signal with amplitude value  $U_{OUT} = 2 \text{ V}$ .

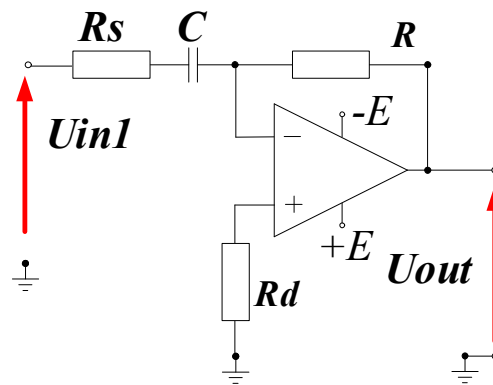


Fig.2 . Actual differential system.

6) Task

In the system from Fig.2 (differential system) determine:

- a) The voltage transmittance of the system
- b) The output voltage of the system as a function of time

7) Task

In the circuit from Fig.2 (differential circuit), assuming  $R = 1 \text{ k}\Omega$ ,  $C = 1 \text{ }\mu\text{F}$ , ( $R_s = 0$ ), draw the frequency characteristics (amplitude and phase) of the .

8) Task

In the system from Fig.2 determine the voltage transmittance of the system . ( $R_s \neq 0$ )

9) Task

Select the values of the elements in the circuit from Fig.2 (modified differential circuit) so that it realizes the function of differentiating the triangular input signal with amplitude  $U_{INm} = 1.6 \text{ V}$  and period  $T = 1 \text{ ms}$ , into a rectangular signal with amplitude value  $U_{OUT} = 1 \text{ V}$ .