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Laboratory measurement 2

Measurement on Differentiators and Integrators

Differentiator

There are two basic types of the differentiator – passive and active. The passive one, which we will measure on, can be again divided into two sub-types, that are shown on the figure – RC and LR differentiator.

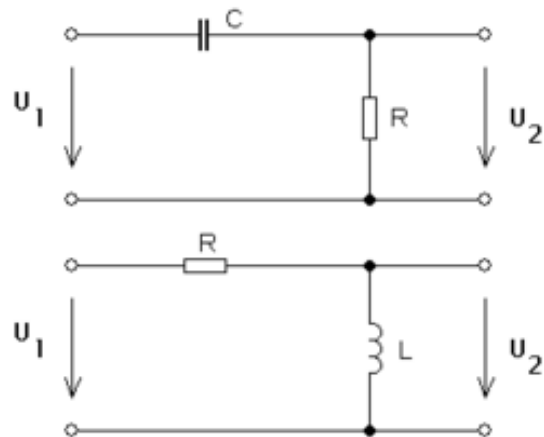
This circuit provides derivation of the input signal by the formula

$$u_2(t) = \frac{1}{C_d} \frac{du_1(t)}{dt}$$

where C_d is the differentiator constant

For the RC type $C_d = RC$

and for the LR type $C_d = L/R$



Integrator

The integrator has also two basic types – passive and active, and the passive one can be RC type or LR type – see the figure..

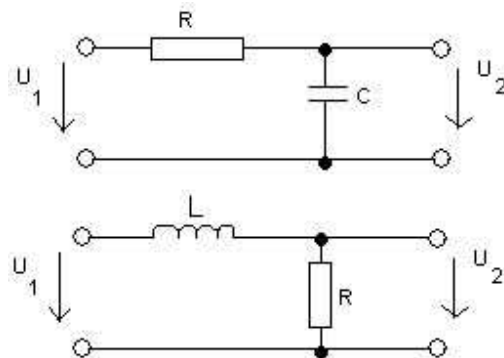
This circuit provides integration of the input signal by the formula

$$u_2(t) = C_i \int_0^t u_1(t) dt$$

where C_i is the integrator constant

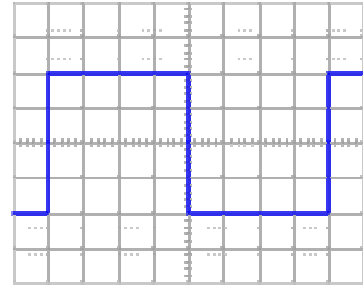
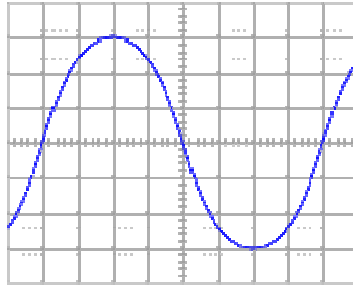
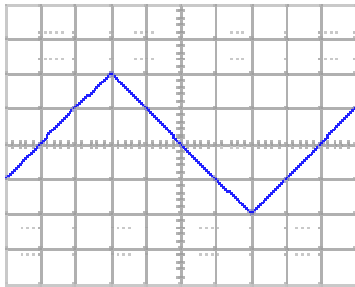
For the RC type $C_i = RC$

and for the LR type $C_i = L/R$

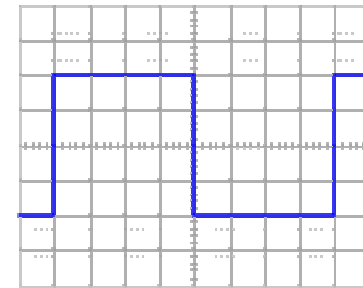
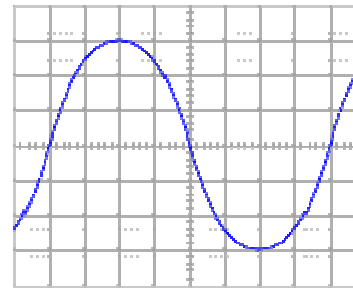
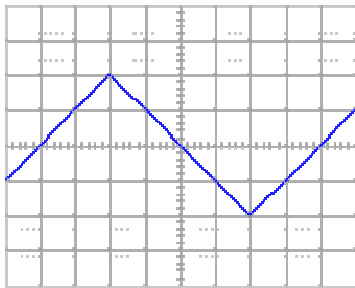


Your assignment

1) Estimate the circuit response to the triangle, rectangle and sinusoidal input signal and draw your estimated responses into the same figure like the input signal waveform.

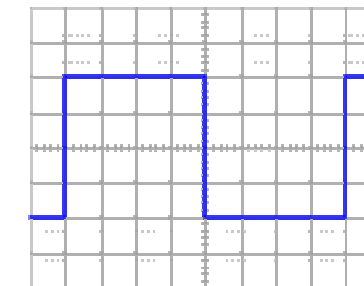
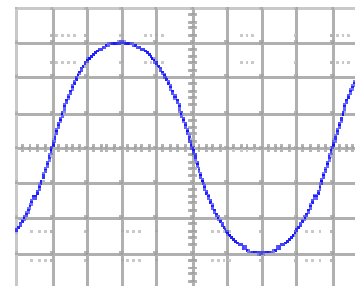
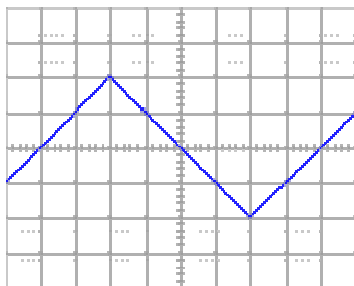
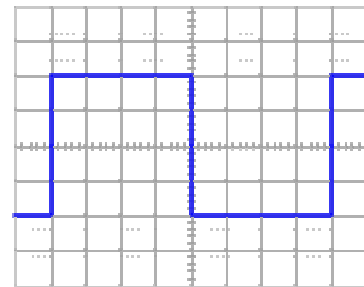
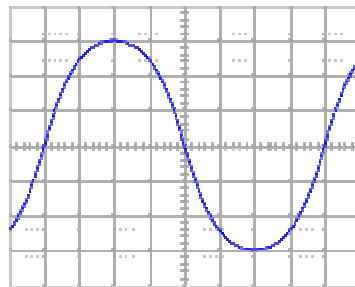
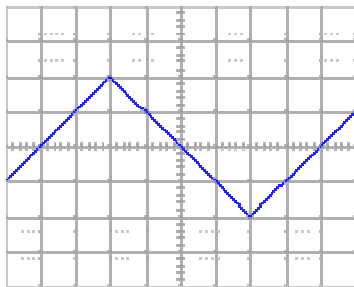


Estimated differentiator



Estimated integrator

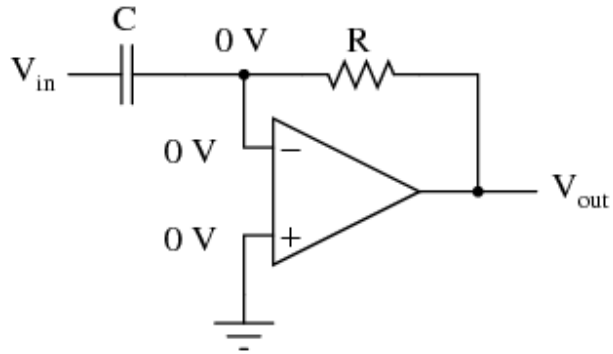
2) You will be given the rectangle generator based on the 555 timer from the previous measurement. Connect the output of the generator to your chosen circuit (either RC or LR differentiator or integrator) and verify the circuit response to this waveform. After that you will be given the sinusoidal generator and verify the waveforms too. Draw them into the input signal graphs.



If you have a spare time

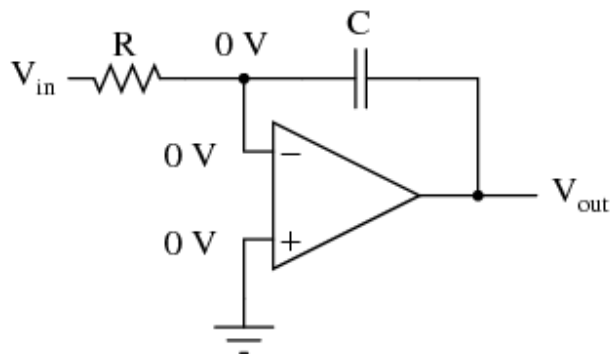
Active differentiator

Differentiator

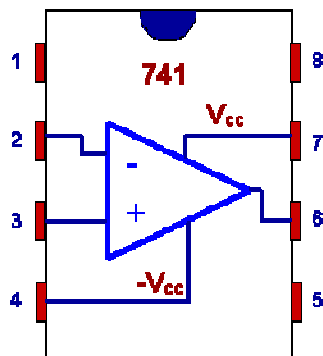


Active integrator

Integrator



741 Operational amplifier pinout





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