RC Integrator and Differentiator

KEY PRINCIPLES TO BE DEMONSTRATED:

Applications of the charging and decay times of RC circuits

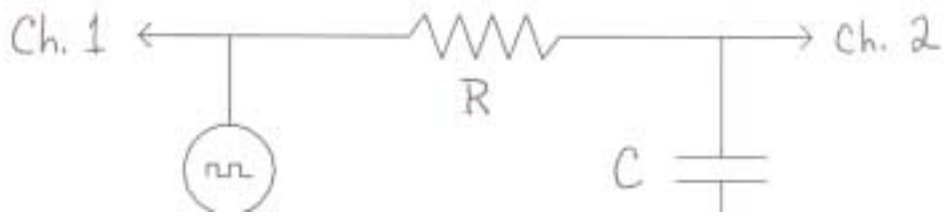
EQUIPMENT (LOCATION):

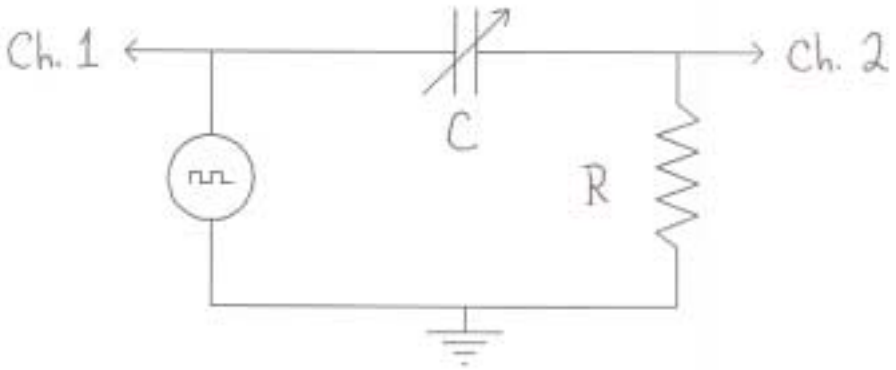
Pasco function generator (Cabinet #1, Shelf #3)
10μF capacitor (Cabinet #1, Shelf #3)
20kΩ, 1MΩ resistors (Cabinet #1, Shelf #3)
Connection board[with attached variable capacitor] (Cabinet #1, Shelf #3)
Dual trace oscilloscope (Cabinet #1, Shelf #3)

SET-UP/PROCEDURE:

Integrator

- Set up circuit as shown below with the oscilloscope on dual trace and auto trigger.

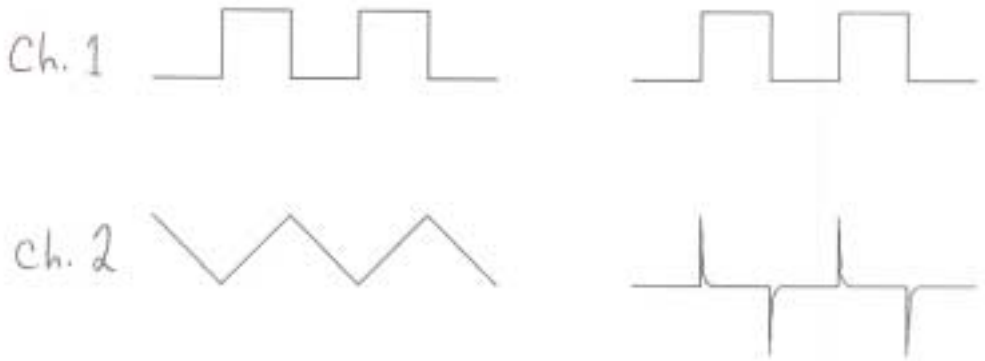




- With the tunable capacitor tuned to 295pF set the function generator to square wave at 60-100Hz and medium amplitude.
- To get a good picture on the scope set the time base to 2ms/div, Channel 1 to 5V/div and Channel 2 to 2V/div.
- Channel 2 should show spikes(delta functions) at the discontinuities of the square wave(series of step functions). Thus the circuit outputs the derivative of the input.
- The capacitor can be varied to show the change in slope of the output.

THINGS TO NOTE:

- The tunable capacitor varies between 50 and 295pF.
- Insure proper grounding of the oscilloscope probes to prevent rather large 60Hz waves from dominating the screen.



INTEGRATOR	DIFFERENTIATOR
$T = 1/150Hz = 6.6ms$	$T = 1/100Hz = 10ms$
$RC = 2X10^{4}(10X10^{-6}) = 200ms$	$RC = 10^{6}(295X10^{-12}) = .3ms$
$RC >> T$	$RC << T$