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Session 3
Electronic circuits analysis
– Exercises –

Electronic Components and Circuits

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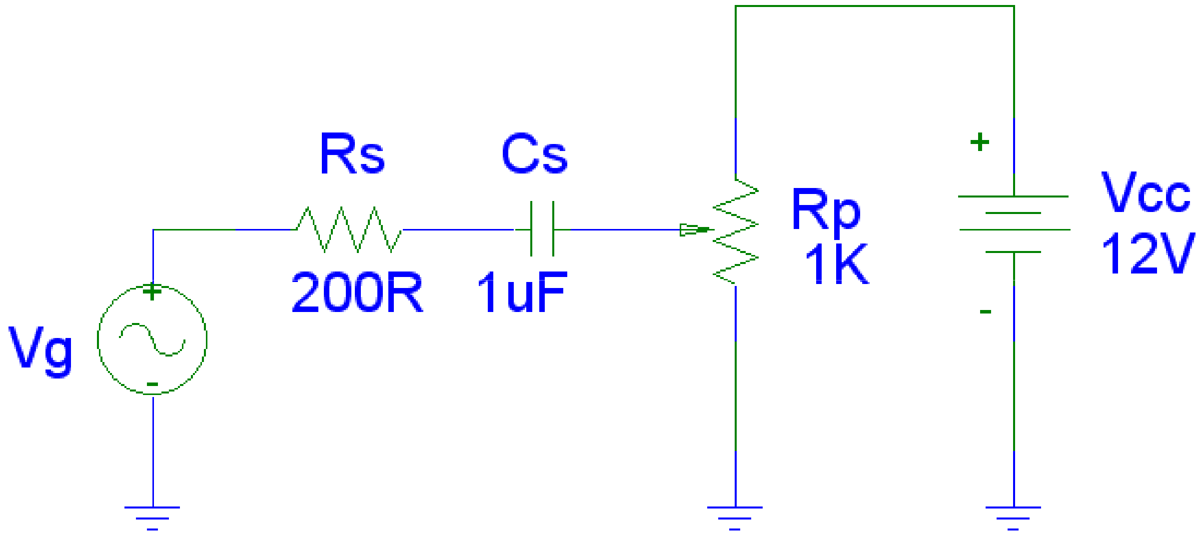
Electronic circuits analysis

OBJETIVES

- Example of superposition theorem
- Example of Thevenin and Norton theorems
- Examples of transient response: time constants
- Examples of SPR sinusoidal permanent regime and frequency response: attenuation, delay and cutoff frequency

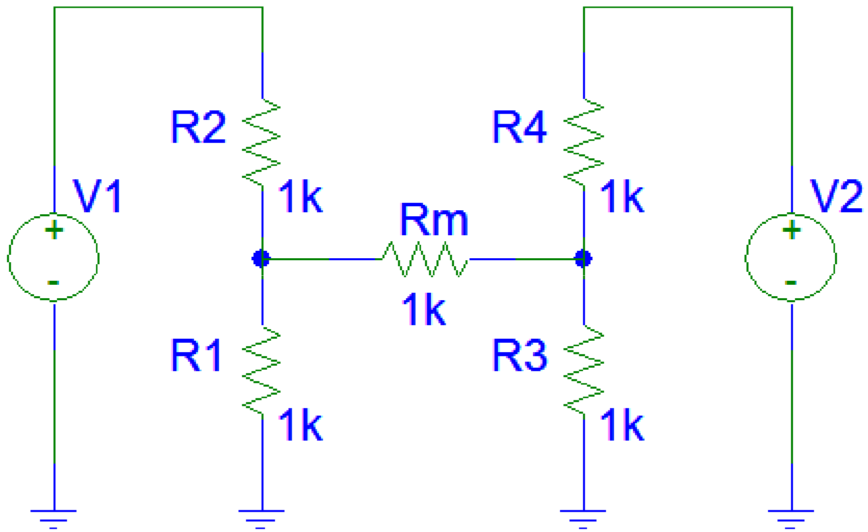
Example of superposition theorem



The circuit of the figure provides the superposition of an attenuated DC voltage (Vcc and Rp) and AC coupling of the voltage Vg. The nominal value of the variable resistor Rp is 1kΩ and it is set to halfway ($\alpha = 0.5$). The capacitor has a nominal value of 1 μF and the value of the resistance Rs is 200 Ω.

- Calculate the DC power dissipated in the variable resistor Rp.
- Calculate the AC (rms) current through the capacitor Cs.
- Calculate the total power dissipated by the resistance Rs.
- Data: Vg sinusoidal 1 volt peak and 10 kHz.

Example of Thevenin/Norton Theorems



- Given the two-channel potentiometer circuit with measuring resistance Rm between both of them, calculate the current through Rm as a function of the voltage inputs V1 and V2 and the resistors R1, R2, R3, R4.
- Apply the Thevenin equivalent of each potentiometer circuit. What is the expression reduced to if all resistances are equal.
- In the case of V1 = V2 (Wheatstone bridge) you may use the same methodology. Observe that it is in equilibrium if all resistances are equal.
- Do it again using the superposition theorem.

RC circuit response exercise

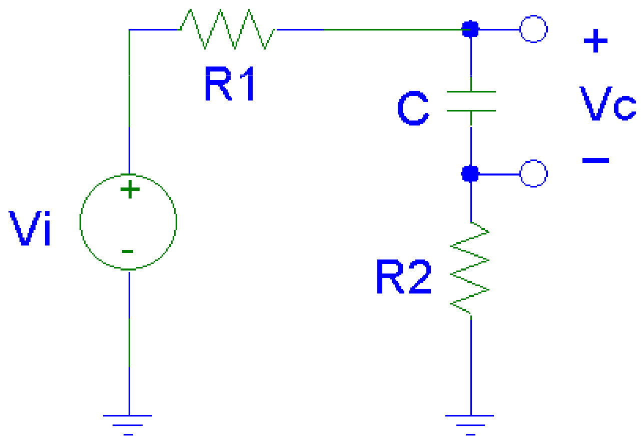


Figure 1

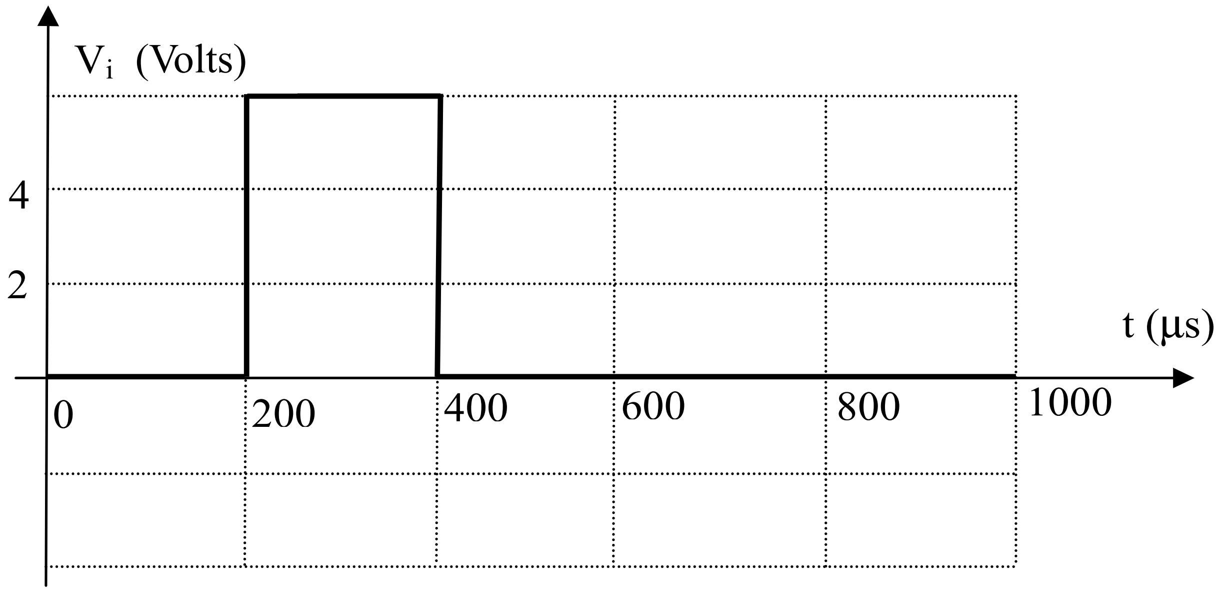


Figure 2

DATA: R1 = 1 kΩ C = 100 nF R2 = 1 kΩ

a) *Draw an equivalent circuit and calculate the time constant.*

b) *Plot the time response Vc (t) if Vi (t) is as in Figure 2.*

c) *Plot Vi (t) and Vc (t), if Vi (t) is sinusoidal 6V (peak-peak) and 500Hz.*

RC circuit response problem

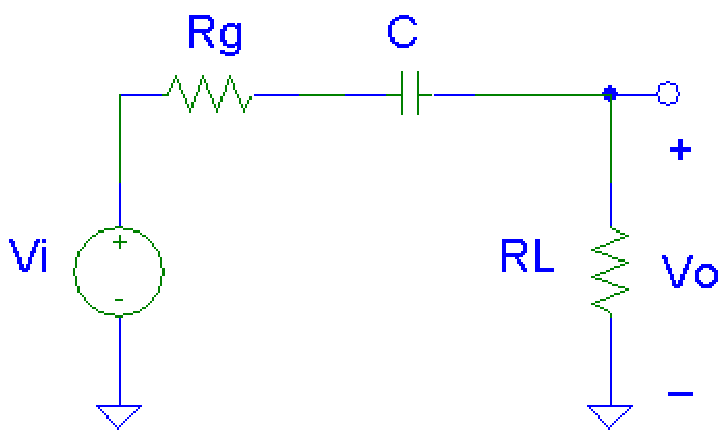


Figure 1

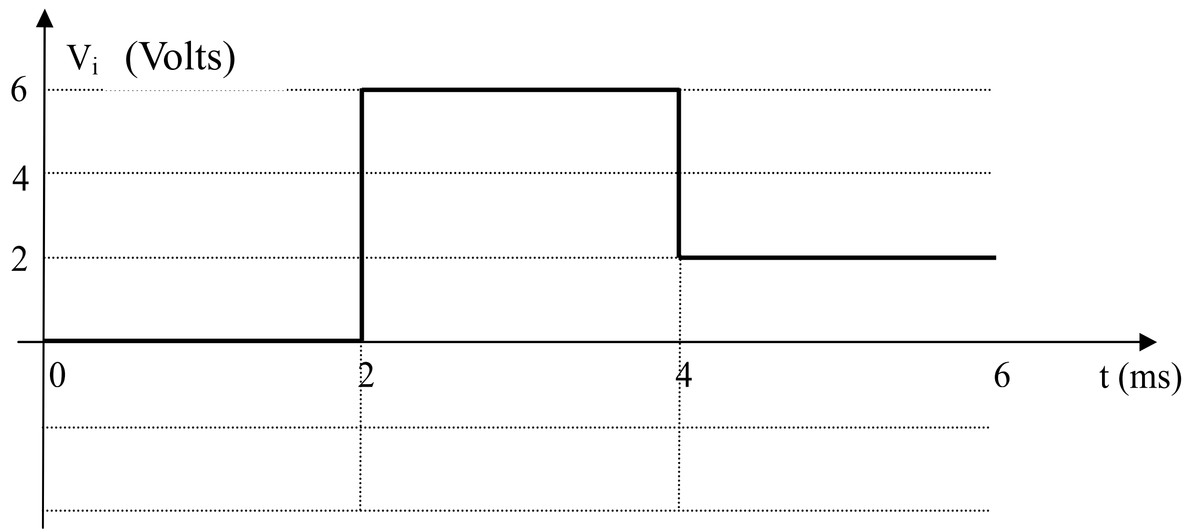


Figure 2

<u>DATA (a) :</u> Rg = 1 kΩ; C = 100 nF; RL = 1 kΩ

a) Plot the time response Vc (t) and Vo (t) if Vi (t) is as shown in Figure 2.

<u>DATA (b):</u> Rg = 150 Ω; C = 620 nF; RL = 360 Ω

b) Plot Vi (t) and Vo (t), if Vi (t) is sinusoidal 6V (peak-peak) and 500Hz.