Electronic oscillators between real and virtual

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Our study is developed in the framework of the Comenius "Hand's on Science" Project. We intended to find the way to illustrate the oscillating regimes of a circuit composed by a capacitor, an inductor and a resistor. First we have studied the role of each element.

1. The capacitor stores energy in the form of an electrostatic field and is used in different ways in electronic circuits: to store charge for high-speed use (the flash), to eliminate ripples by absorbing the peaks and filling in the valleys, to block DC voltage. The lightning in the sky, appears because we can consider that a huge capacitor where one plate is the cloud and the other plate is the ground is charged, and the lightning is the discharging between them. Our first goal is to study the behavior of the capacitor when it is connected to a battery and to calculate it's capacitance. We developed a VI (virtual instrument) using LabVIEW, for modeling the capacitor's voltage dependence on time during it's charging and discharging.(figure 1)

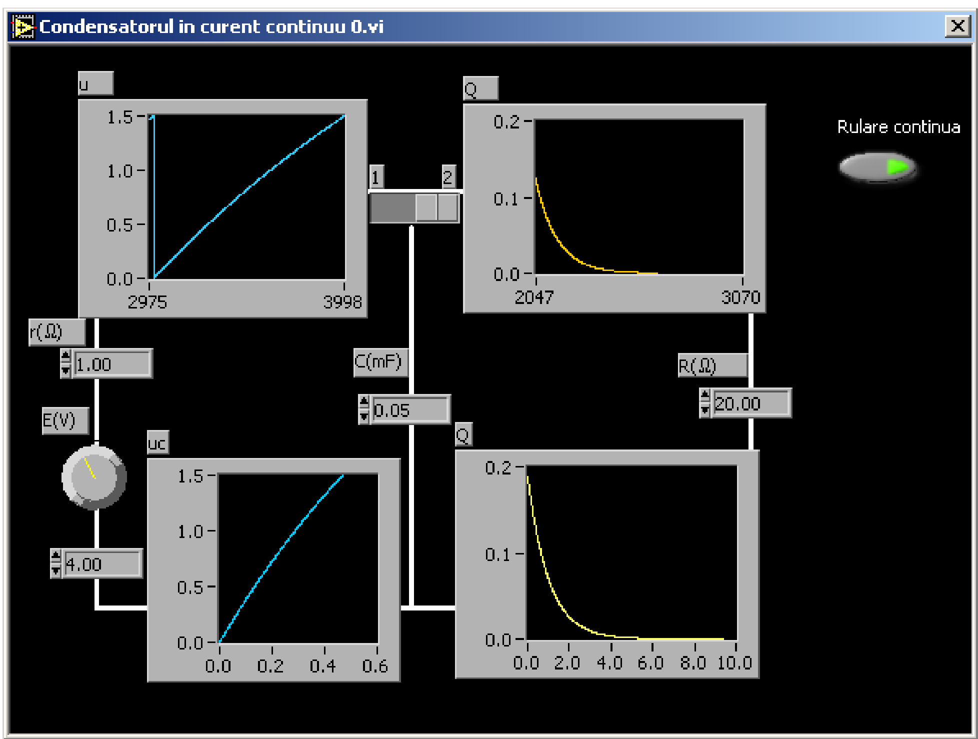

fig1

Than we have used a data acquisition board NIDAQ-6013 connected to the capacitor for the registration of the voltage dependence on time (fig. 2).The DAQ-software was developed with LabVIEW. The values of the elements were: R=4,4 kΩ, E=4,2V, C=47 μF. From the diagram we can measure the time constant τ, as the time when the voltage rises to 63% from it's maximum value.

From τ =RC we can find for the capacitance the value: C=0,049 mF= 49 μF, which fitted very well.

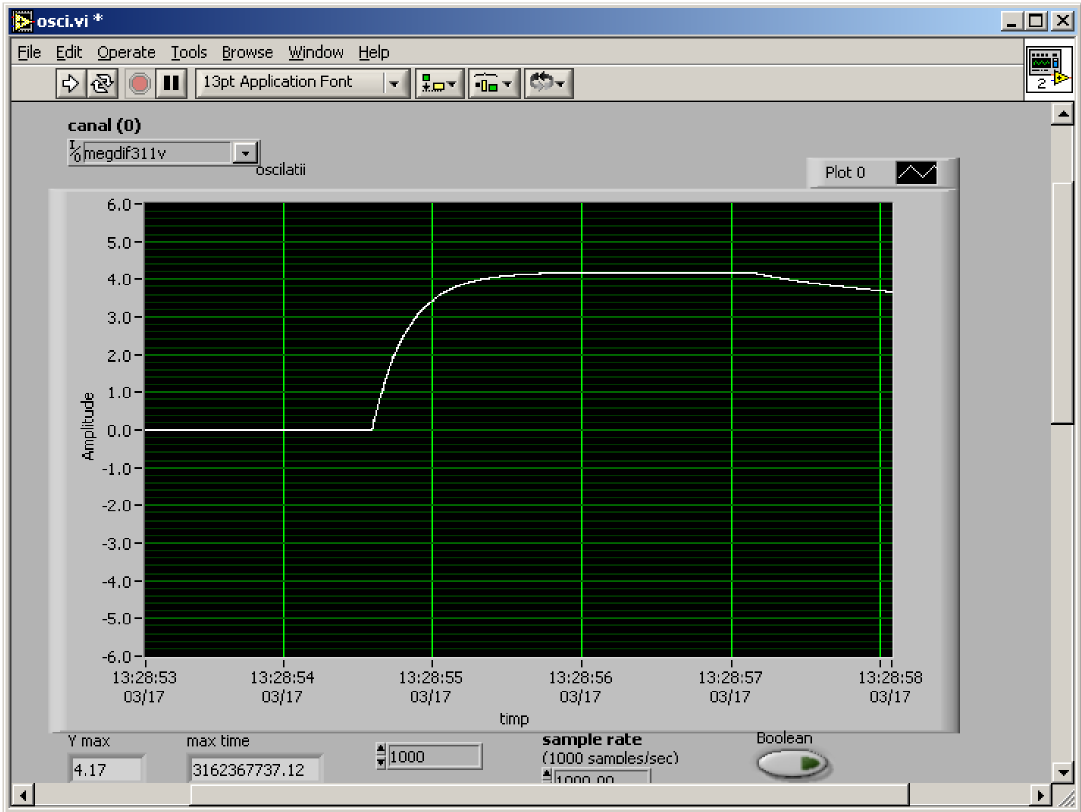

fig. 2

The inductor stores energy in the form of a magnetic field and generates an induction current every time the magnetic field flows in it's cross-sectional area. First we developed a VI (virtual instrument) for modeling the behavior of the coil during the connection and disconnection from the battery (fig. 3).

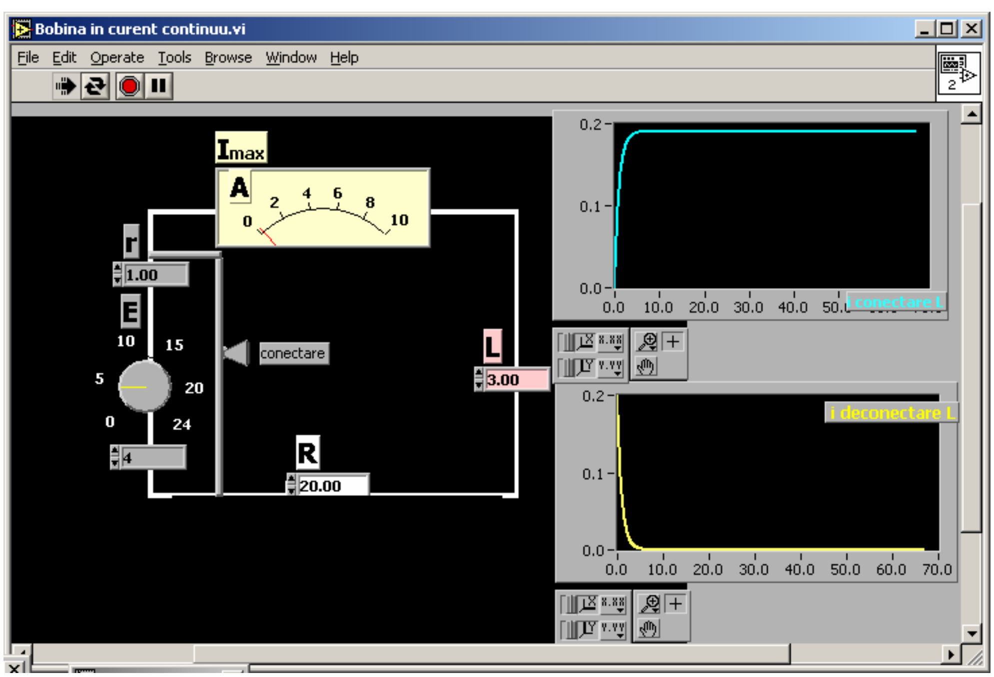

fig 3

Than we have used a data acquisition board NIDAQ-6013 connected to the inductor for the registration of the voltage dependence on time (fig. 4).The DAQ-software was developed with LabVIEW. The values of the elements were: R=20Ω, E=4,2V. From the diagram we can measure the time constant τ, as the time when the voltage falls from maximum to 63% from it's maximum value. From τ =L/R we can find that: τ =25ms, L=0,5 H and the iron core is μ_r=16,67.

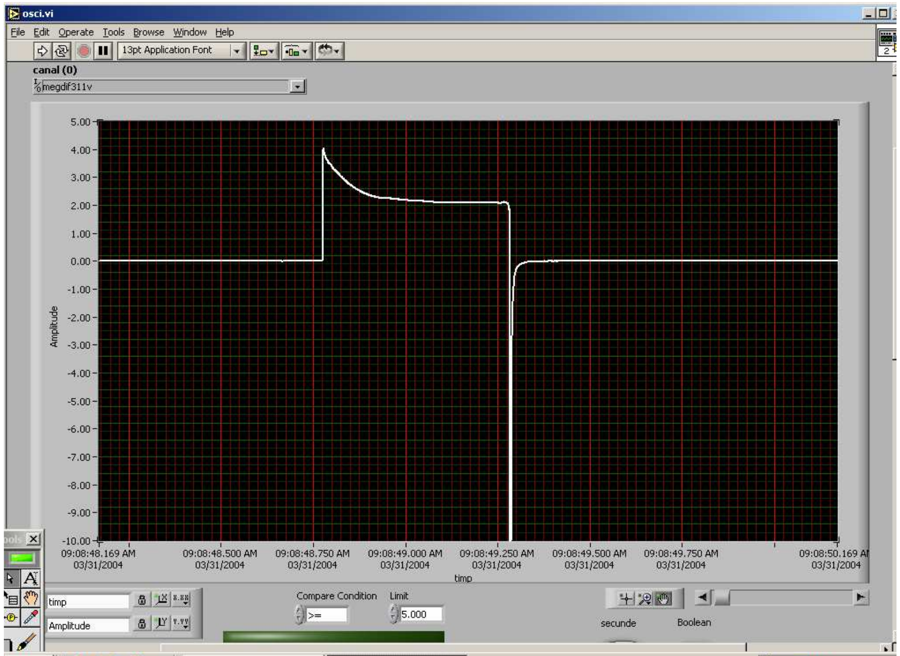

fig 4

Electronic oscillators- contain a capacitor which is charged from a battery, than is connected to the inductor. When the capacitor is discharging through the inductor, this will create a magnetic field. Once the capacitor discharges, the inductor will try to keep the current in the circuit moving, so it will charge up the other plate of the capacitor. Once the inductor's field collapses, the capacitor has been recharged (but with the opposite polarity), so it discharges again through the inductor. This oscillation will continue until the circuit runs out of energy due to **resistance** in the wire. It will oscillate at a frequency that depends on the size of the inductor and the capacitor.

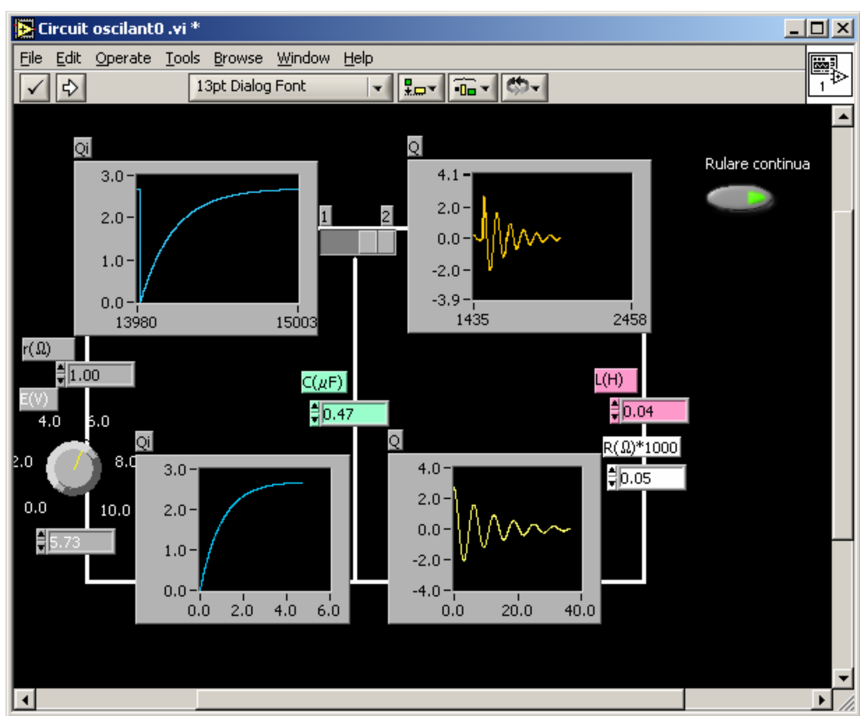

fig. 5

We developed a VI (virtual instrument) using LabVIEW, for modeling the behavior of the electronic oscillator in time. (fig. 5)
Than we have used a data acquisition board NIDAQ-6013 connected to the capacitor (fig. 6), for the registration of the voltage dependence on time.The DAQ-software was developed with LabVIEW. By changing the values of the resistance during the discharging we can illustrate the oscillation regime like you can see in the fig. 7.

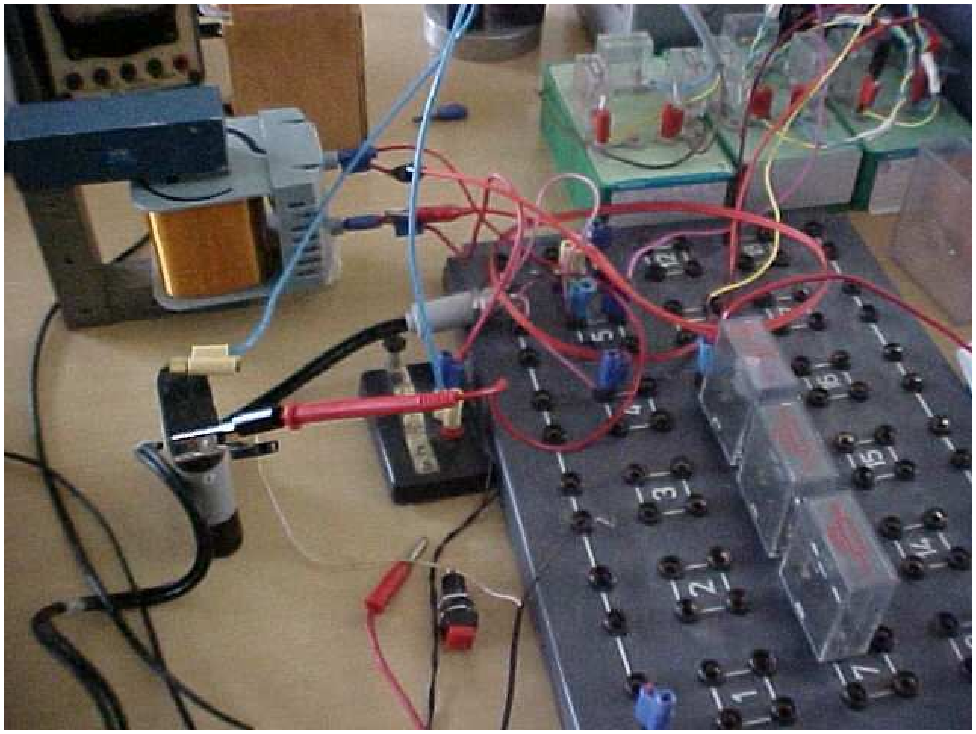

fig.6

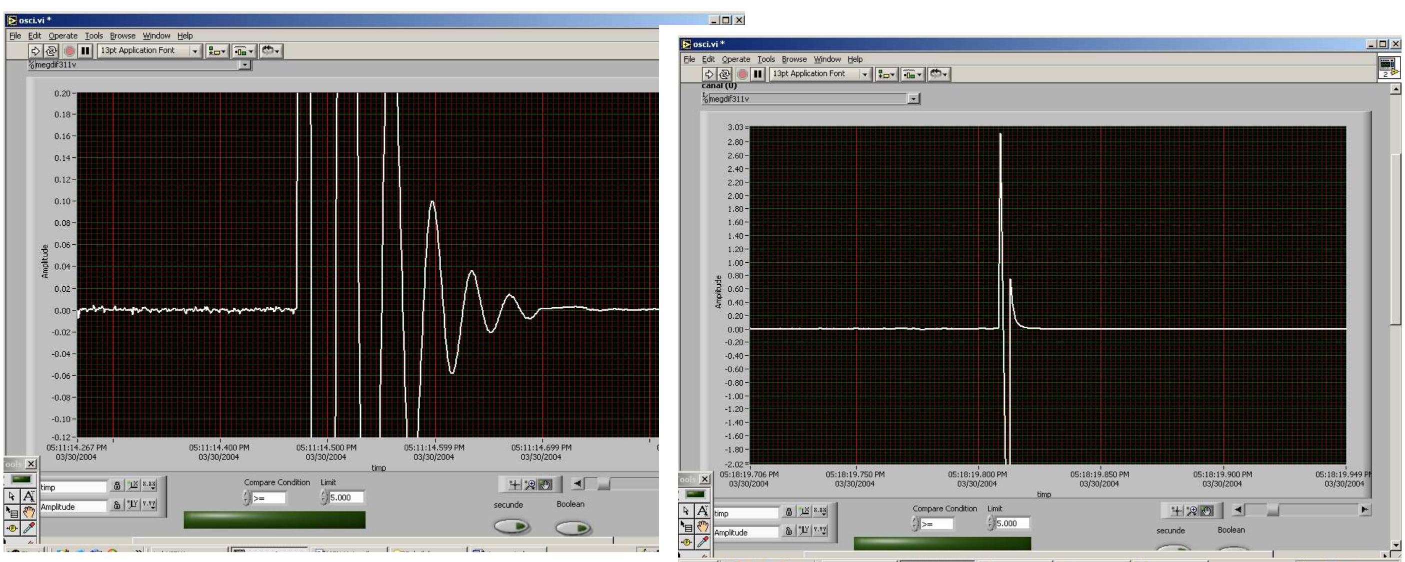

fig.7

Keywords: LabVIEW, DAQ-data acquisition, DAQ-software, VI-virtual instrument, electronic oscillator, capacitor, inductor.