

Parallel dc circuits - lab report example

[Science](#), [Physics](#)



Parallel DC circuits

Introduction to Robotics and Electronics: Parallel DC circuits Understanding how electrical circuits work is important in the design of electrical appliances that are more efficient in power consumption. One of the ways of understanding electrical circuits is through simulation software. In this Lab, NI Multisim software is used to study various electrical waveforms. The sine wave, a square wave and the triangular waveforms were carefully displayed using NI Multisim software. The peak to peak Voltage and the peak voltages were determined from the graphs obtained, and the periodic time of the waves determined. The electrical power for a simulated circuit was defined. Hence, NI Multisim is an essential software that enables the user to observe the operation through simulation without performing that operation.

Introduction

Simulation software plays an important role in understanding how circuits operate in electronics. Electronic simulation software applies mathematical models to show the behaviour of an actual electric circuit. Electronics simulators include Circuitlogix, electronic work bench, NI Multisim among others. By simulating a circuit's behaviour and response before building it, greatly improves efficiency and provides insights and relevant information concerning the behaviour and stability of electronics circuit designs.

Periodic time is the time taken to complete one electrical oscillation. The periodic time is inversely related with the frequency of the wave and can mathematically be expressed as shown in equation 1

..... (1)

In many electrical circuits, it is important to determine the rate at which

electrical energy is transferred into other forms of energy. To calculate power P for electrical appliances, we find the product of the current (A) through it and the Potential difference (V) across it. Thus,

..... (2)

For resistors in series, the same current flows each of the resistors whereas the total sum of the voltage across each resistor equals to the total voltage applied. Therefore, the combined resistance is given by

$R = R_1 + R_2 + R_3 \dots R_n$ (3)

For resistors connected in parallel then the equivalent resistance is given by equation 4 below

..... (4)

Methodology

Among the equipment provided in order to perform signal measurements using the simulation software include; Universal Power Supply, Digital Storage Oscilloscope (DSO), Function

Generator, Digital Multimeter, BNC Leads, Breadboard, Colour Coded Resistors, NI

Multisim software and loose connection wires.

To study various waveforms on the DSO, the 3MHz Function Generator (TG300 Series) was connected to CH1 of DSO (Tektronix) using BNC leads. A sine wave of 1 kHz frequency and a root mean square voltage of 1.4145V was displayed on the screen. The period of the sine wave was determined using equation 1 in the introduction. Furthermore, the peak to peak voltage of a sine wave was measured and recorded as required. The waveforms and its FFT graphs were then printed out using the PC communication software.

Similarly, a square wave with parameters 2 kHz frequency and 2V_{peak} was shown on the screen. The period of the waveforms and the peak-to-peak voltages were determined. The FFT graphs were printed out as required. The above procedure was repeated for 1.5 kHz, 2V_{peak} triangular waveform, and a similar analysis was done and recorded.

A parallel resistor circuit was drawn using the NI Multisim software available on desktop PC. Using the Multisim virtual ammeter available on the software, current on the branches and the total current from the battery were measured and recorded. Using the current and the voltage supply from the battery the power delivered by the battery was calculated as shown in the results below. A 1 kilo ohm resistor was then connected in series with a parallel combination that was created, and the above steps were repeated.

Results and Discussion

The Figure 4 in the appendix is the print screen that shows how the circuit connection was made. The 1 kHz signal waveform that was obtained is shown in the graph below.

The period for the above waveform was determined using equation 1.

$$= 0.000986 \text{ s}$$

The peak-to-peak voltage was read from the screen to be 2.06V

The FFT 2kHz, 2V_{peak} square wave was printed out as shown in the figure below

Using Figure 2 above the period of the waveform was determined as shown below.

$$= 0.0005 \text{ seconds}$$

The peak to peak voltage for the waveform was 2.08V.

The FFT graph shown below illustrates the triangular waveform that was obtained as required in the methodology

In a similar way, using the above waveform, the time was calculated as shown below. It is important to notice that the period displayed on
 $= 0.0006667$ seconds

The NI Multisim software available on desktop PC was used to draw the parallel DC circuit provided in the Lab 1 manual as shown in Figure 4 in the appendix. Using Multisim virtual ammeter, the branch and total currents were obtained as shown in the diagram. Notably, the total current from the battery was obtained to be 6.137mA. The d.c current through R1 was registered to be 3.21 mA, while the d.c current through R2, R3, and R4 were noted to be 1.75mA, 1.17mA and 6.14 mA respectively (Duncan and Heather 12).

According to Kirchhoff's laws, current into a junction is equal to the total current out of the same junction.

Current into a junction = current out of the junction

$$I_4 = I_1 + I_2 + I_3$$

$$6.14 \text{ mA} \approx 3.21 \text{ mA} + 1.75 \text{ mA} + 1.17 \text{ mA}$$

The power delivered by the battery can be calculated using equation 2. Thus,

$$= 0.06137 \text{ Watts}$$

Conclusion

Simulation software plays an important role in understanding how circuits work in electronics. In this Lab, it was clearly illustrated how these software's can be used in signal measurement and analysis. Several parameters, for

example, the frequency of the wave can be altered, and the resultant waveforms are studied and compared with standard measurements. It can be concluded that Simulation software is playing an important role in understanding how circuits operate in electronics. NI Multisim is a critical software that enables the user to observe the operation through simulation without performing that operation.

Work Cited

Duncan K. and Heather K. GCSE Physics, 4th Ed. Barcelona: Book print S. L, 2011. Print.

Mohankrishnan N. A Graded Process for Basic Electronic Circuit Design that Works. Department of Electrical Engineering, University of Detroit Mercy . Detroit, MI 48219-0900, 2013. Print.

Appendix