Kirchoffs’s laws

Law

A little history about Kirchoff Home Page A little history about Kirchoff A little history about Ohm Kirchoff's current and voltage laws Ohm's law Circuit analysis example Bibliography A little bit about the life and times of Gustav Robert Kirchoff: Gustav Robert Kirchoff was a German physicist born on March 12, 1824, in Konigsber, Prussia. Gustav Kirchoff's first research topic was on the conduction of electricity. As a result of this research, Kirchoff wrote the Laws of Closed Electric Circuits in 1845. These laws were eventually named after their author, which are now known as Kirchoff's Current and Voltage Laws.

Because Kirchoff's Voltage and Current laws apply to all electric circuits, a firm understanding of these fundamental laws is paramount in the understanding of how an electronic circuit functions. Although these laws have immortalized Kirchoff in the field of Electrical Engineering, Kirchoff also had additional discoveries. Gustav Kirchoff was the first person to verify that an electrical impulse traveled at the speed of light. Furthermore, Kirchoff made major contributions in the study of spectroscopy and he advanced the research into blackbody radiation.

Gustav Robert Kirchoff died in Berlin in October 17, 1887. Gustav Robert Kirchoff (1824-1887) http://www. ece. utexas. edu/~aduley/lab/ Home Page | A little history about Kirchoff | A little history about Ohm | Kirchoff's current and voltage laws | Ohm's law | Circuit analysis example | Bibliography Jeremie Smithedu Date Last Modified: 11/20/00 | Ohm's law|| | Home Page [-> 0]A little history about Kirchoff[-> 1]A little history about Ohm[-> 2]Kirchoff's current and voltage laws[-; 3]Ohm's lawCircuit analysis example[-> 4]Bibliography[-> 5]| It's time for the nitty-gritty.

Let's define Ohm's Laws: Ohm's law can be stated in words as the current in a resistive circuit is directly proportional to its applied voltage and inversely proportional to its resistance. In equation form, Ohm's law statesV = I*RwhereV is the applied voltage, R is the resistance in Ohms, I is the current in amperes. Ohm's law demonstrates that if the applied voltage across a circuit is increased or decreased, the current generated in the circuit increases and decreases, respectively. Furthermore, as the resistance in a circuit increases, the current generated in the circuit decreases.

The following are algebraic variations of Ohm's law that demonstrate theses observations. I = V / R R = V / IUsing one of the three algebraic variations of Ohm's law, and any two known variables, one can solve for the other unknown quantity. | Home Page [-> 6]| A little history about Kirchoff[-> 7] | A little history about Ohm[-> 8] | Kirchoff's current and voltage laws[-; 9] | Ohm's law | Circuit analysis example[-> 10] | Bibliography[-> 11] Jeremie Smithedu[-> 12] Date Last Modified: 11/20/00 | Kirchoff's current and voltage laws|| |

Home Page [-; 13]A little history about Kirchoff[-; 14]A little history about Ohm[-; 15]Kirchoff's current and voltage lawsOhm's law[-; 16]Circuit analysis example[-; 17]Bibliography[-; 18]| It's time for the nitty-gritty. Let's define Kirchoff's Current and Voltage Laws: First Kirchoff's Current Law. Kirchoff's Current law can be stated in words as the sum of all currents flowing into a node is zero. Or conversely, the sum of all currents leaving a node must be zero. As the image below demonstrates, the sum of currents Ib, Ic, and Id, must equal the total current in Ia.

Current flows through wires much like water flows through pipes. If you have a definite amount of water entering a closed pipe system, the amount of water that enters the system must equal the amount of water that exists the system. The number of branching pipes does not change the net volume of water (or current in our case) in the system. http://www. physics. uoguelph. ca/tutorials/ohm/Q. ohm. KCL. html Now, Kirchoff's voltage law. Kirchoff's voltage law can be stated in words as the sum of all voltage drops and rises in a closed loop equals zero.

As the image below demonstrates, loop 1 and loop 2 are both closed loops within the circuit. The sum of all voltage drops and rises around loop 1 equals zero, and the sum of all voltage drops and rises in loop 2 must also equal zero. A closed loop can be defined as any path in which the originating point in the loop is also the ending point for the loop. No matter how the loop is defined or drawn, the sum of the voltages in the loop must be zero. http://www. physics. uoguelph. ca/tutorials/ohm/Q. ohm. KVL. html|

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First lets look at a series circuit using Kirchoff's Voltage law and Ohm's law to find the value of the unknown resistor R. In the following circuit, it is known that a 2 ampere current flows in the circuit. If we start at point A and create a clockwise loop around the circuit, the voltage at A is zero (or it can be considered ground). Then at point B the voltage must be 10 volts because the voltage supply creates a 10 V potential between point A and point B. At C the voltage is still 10 volts because points B and C can be considered the same points (voltage does not change along an ideal wire that has no resistance).

However, going to point D, there is a voltage drop across resistor R , and another voltage drop going to point E across the 2 ohm resistor. Since points A and E are the same points, the voltages there are the same, zero, and our loop is complete. Now using Ohm's Law in the form V = I R, one can find that the voltage drop (I * R) across the 2 ohm resistor is:(2 A) * (2 ohms) = 4 V. Thus, by Kirchoff ' s Voltage Law, the voltage drop across the unknown resistor must be: 10 V - 4 V = 6 V. Finally, using I = 2 A, and Ohm's law in the form R = V / I, the unknown resistance (R) is found to be R = 3 ohms.

Next, lets solve a circuit using Kirchoff's Current law and Ohm's law to find the unknown current in the following parallel circuit. In the circuit, the source voltage is 20 V and the resistor values are 5 ohms and 10 ohms, respectively. Because voltage does not change along an ideal wire that has no resistance, the full 20 V from the supply appears across each resistor. Next, using Ohm's Law in the form I = V / R we find: I1 = 20 V / 5 ohms = 4 A, and: I2 = 20 V / 10 ohms = 2 A, Finally, by Kirchoff ' s Current Law I(total) is found to be: I1 + I2 = IT IT= 4 A + 2 A = 6 A. Thus, I1 is 4 amps, I2 is 2 amps, and IT is 6 amps. Home Page [-; 32]| A little history about Kirchoff[-; 33] | A little history about Ohm[-; 34] | Kirchoff's current and voltage laws[-> 35] | Ohm's law[-; 36] | Circuit analysis example | Bibliography[-; 37] Jeremie Smithedu[-; 38] Date Last Modified: 11/20/00 | Bibliography||| Home Page [-; 39]A little history about Kirchoff[-; 40]A little history about Ohm[-; 41]Kirchoff's current and voltage laws[-> 42]Ohm's law[-; 43]Circuit analysis example[-; 44]Bibliography| All the below listed resources were referenced in the creation of this web site.

For further information, I recommend and use these resources. Robbins, Allan, and Miller, Wilhelm. Circuit Analysis: theory and practice - sixth edition. New York: Delmar, 2000. Nilsson, James, and Riedel, Susan. Electric Circuits - second edition. New Jersey: Prentice Hall, 1999. Cathey, Jimmie, and Nasar Syed. Basic Electrical Engineering - second edition. New York: McGraw Hill, 1997. http://www-groups. dcs. st-and. ac. uk/~history/PictDisplay/Ohm. html[-; 45]http://www. ece. utexas. edu/~aduley/lab/[-; 46]http://www. physics. uoguelph. a/tutorials/ohm/Q. ohm. KVL. htmlhttp://www. physics. uoguelph. ca/tutorials/ohm/Q. ohm. KCL. html | Home Page [-; 47]| A little history about Kirchoff[-; 48] | A little history about Ohm[-; 49] | Kirchoff's current and voltage laws[-> 50] | Ohm's law[-; 51] | Circuit analysis example[-; 52] | Bibliography Jeremie Smithedu[-; 53] Date Last Modified: 11/20/00 [-; 0] - http://ffden-2. phys. uaf. edu/211. fall2000. web. projects/jeremie%20smith/index. htm [-; 1] - http://ffden-2. phys. uaf. edu/211. fall2000. eb. projects/jeremie%20smith/page1. htm [-; 2] - http://ffden-2. phys. uaf. edu/211. fall2000. web.

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