

# CIRCUIT ANALYSIS

#### INTRODUCTION TO AC AND DC CIRCUIT ANALYSIS

#### Definitions

- ELECTRICAL CHARGE has four characteristics: I. Its magnitude is measured in condombs (C). The charge carried by an electron is q, =-1.60 10 PC A protest has the same amount of charge, but with
- positive polarity. 2. Charges are, therefore, of two types: positive and
- 3. Charges exist in discrete, integral multiples of A.g.,
- 4. Charges are conserved: They can be neither created. more digrateopy and
- CURRENT. In an electric circuit, the chorses movealong specified, closed paths. The motion of charges constitutes an electric conduction current. Current is measured in amperes (conformb/sec). That is, one ampere is the current that flows when one coulomb of charge flows per second. Or, current I/O in amperes is:
- $I(t) = \frac{dq(t)}{dt}$  ampones, where q(t) is the charge in coulombs, and t is the time in seconds.
- Conventions: A negative quantity of charge traveling from B to A along a conductor is equivalent to a positive quantity of charge going from A to B. Hence, current is a vector.
- Unidirectional transfer of electric charge through a conductor constitutes the direct electric current, or de. This is in contrast to ac (alternating current) which implies a time-reversal of direction of current south as a singuotidal wave,
  - VOLTAGE. Voltage difference (also known as potential difference) between two points is defined as the work [w(x) in joules] required to move a unit charge from one point to the other The unit of potential difference is the volt (F). Voltage (v) can be positive or negative.

Note that: 
$$v(t) = \frac{dw(t)}{dq}$$
 solt

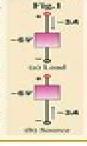
POWER. Power p(t) is the rate of doing work or the rate of change of energy. The electrical unit of power in the water a William

$$\rho(t) = \frac{dw(t)}{dt} \text{ joule sec or suits}$$

Note: 
$$v(t) I(t) = \frac{dw'(t) dq}{dq} = \frac{dw'(t)}{dt} = p(t)$$

Thus, poty-version is subject to the following sign convention: Whenever the reference direction for the current in an element is in the direction of the voltage drop across the element, see the formula p=rd. That is, the current must enter the positive terminal to use the above formula. Otherwise use proved, If p(r)>0. then the element absorbs power. If p(x) <0, then the element delivers power. See the following examples:

- In Fig. 1(a) the element is consuming absorbing 18W of powers, and in Fig. 1(b) the element is delivering EKW.
- EACT: The total power delivered must equal the total power absorbed in any circuit.
  - -BRANCH, A branch is an element (for example, resistor.) sources, etc.).
  - NODE. A node is a junction where two or more elements come together.
- GROUND. A ground in the voltage reference point which has been protection.

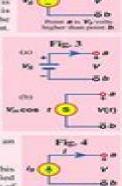


#### Ideal Independent Sources

\* IDEAL INDEPENDENT FOREIGE SOURCE. This element maintains a specified voltage between its terminals regardless of the nest of the circuit where it is

inserted. The voltage is completely independent of the current through the element. The symbol for the element is shown in Fig. 2.

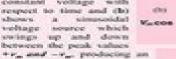
- Fig. 3 shows other sanistions of Fig. 2:
- Fig. 3(a) shows an ideal hottery which has a constant voltage with respect to time and disweltage source which owings up and down between the peak values alternative current.
- IDEAL INDEPENDENT CERRENT SOURCE. This element maintains a specified



Minimum Alle Steel Alle

Fig. 5

Fig. 8.



Ideal Dependent Sources

IDEAL DEPENDENT FORTIGE SOURCE, In a

dependent for controlled) voltage source, the voltage

across the source depends upon the voltage or current

across some other element in the network. There are

two types of controlled voltage sources:

- voltage controlled voltage source

emoter, where v, is a voltage

somewhere else in the circuit.

- current controlled voltage

and or is a constant.

IDEAL DEPENDENT

CERRENT SOURCE, In a

dependent (or controlled)

current soonce, the current

through the source depends

upon the voltage or current

through another element in the

network. There are two types

of controlled current sources:

voltage controlled current

Impre, where v, is a voltage

somewhere else in the circuit.

- current controlled current

Imply where I, is a current.

nomewhere else in the circuit.

and y's a constant.

and disca constant.

See Fig. 7.

MODEL CO.

See Fig. 8.

See Fig. 5.

See Fig. 6.

content through it independent of the voltage across it. See Fig. 4.

CONDUCTANCE Resistor Symbols Conductance (G) is defined as the reciprocal of resistance: that is, G=1/R. Conductance its inconsumed in significant (ST).

Resistance & Conductance

# Ohm's Law

- OHM'S LAW (at a given temperature) is given by wwidt work, and is based on the following convention: w = AR applies whenever the reference direction for the current in the revision is inthe direction of the voltage drop across the resistor. Chiberraline uses with AR.

- RESISTANCE, A resistor

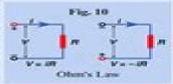
is a circuit element used to

model the resistance to the

flow of electrical change.

The unit of resistance is the

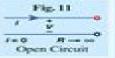
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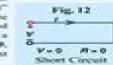


#### Open & Short Circuit

OPEN CIRCUIT. The graphical representation of an "open circuit" (R ) is shown in Fig. 11. Note: that the current can't flow due to infinite resistance. The terminals maintain an open circuit voltage.







#### weeffl, whose I, is a current 基金 somewhere else in the circuit Kirchhoff's Laws and B is a constant.

20

5.0

90

No. of Lot

S 0

-15 AV

KIRCHHOFF'S VOLTAGE LAW (KVL): The algebraic sam of all the violages around any closed publish a circuit equals pero dat every instant of time).

flows in the loop.

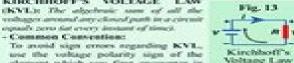
element which you first encounter in passing by that element. Example: If in Fig. 13 we choose to take the loop. clockwise, we bit the negative sign of the voltage source and the positive sign. of e. Thus -e try -0.

Fig. 14. 100.40 Kinghboff's Current Law

KIRCHHOFF'S CURRENT LAW EKCLit The algebraic sum of all the corrents at any male in a circuit equals some flat course business of theses.

- Common Conventions

Currents entering will be negative. Currents leaving will be positive. (Opposite method is also permitted.) if you are consistent.) Example: In Fig. 14. NCL for the mode is -12.4+10.4+1,+0.





# **Basic Circuit Analysis Study Guide**

John O'Malley

#### **Basic Circuit Analysis Study Guide:**

Schaum's Outline of Basic Circuit Analysis, Second Edition John O'Malley, 2011-02-17 The ideal review for your basic circuit analysis course More than 40 million students have trusted Schaum's Outlines for their expert knowledge and helpful solved problems Written by renowned experts in their respective fields Schaum's Outlines cover everything from math to science nursing to language The main feature for all these books is the solved problems Step by step authors walk readers through coming up with solutions to exercises in their topic of choice 700 solved problems Outline format supplies a concise guide to the standard college course in basic circuits Clear concise explanations of all electric circuits concepts Appropriate for the following courses Basic Circuit Analysis Electrical Circuits Electrical Engineering Circuit Analysis Introduction to Circuit Analysis AC DC Circuits Supports and supplements the bestselling textbooks in circuits Easily understood review of basic circuit analysis Supports all the major textbooks for basic circuit analysis courses **Schaum's Outline of Basic** Circuit Analysis John O'Malley, 1992 Confusing Textbooks Missed Lectures Not Enough Time Fortunately for you there s Schaum's Outlines More than 40 million students have trusted Schaum's to help them succeed in the classroom and on exams Schaum's is the key to faster learning and higher grades in every subject Each Outline presents all the essential course information in an easy to follow topic by topic format You also get hundreds of examples solved problems and practice exercises to test your skills This Schaum's Outline gives you Practice problems with full explanations that reinforce knowledge Coverage of the most up to date developments in your course field In depth review of practices and applications Fully compatible with your classroom text Schaum's highlights all the important facts you need to know Use Schaum's to shorten your study time and get your best test scores Schaum's Outlines Problem Solved DC Electrical Circuit Analysis Mehdi Rahmani-Andebili, 2020-10-09 This study guide is designed for students taking courses in electrical circuit analysis The book includes examples questions and exercises that will help electrical engineering students to review and sharpen their knowledge of the subject and enhance their performance in the classroom Offering detailed solutions multiple methods for solving problems and clear explanations of concepts this hands on guide will improve student s problem solving skills and basic understanding of the topics covered in electric circuit analysis courses Basic Engineering Circuit Analysis, **Study Guide** J. David Irwin, Chwan-Hwa Wu, 1999-12-22 This popular introductory circuits text known for its learn by doing format has been further improved with the additions of new problem solving techniques and other learning enhancements The presentations of the fundamental principles are replete with examples drill problems extension exercises and design problems Cd-Rom to Accompany Study Guide to Basic Engineeri Ng Circuit Analysis Bill Dillard,1999 Basic Engineering Circuit Analysis, Study Guide with Computer Simulation Techniques for Excel, MATLAB, and PSpice J. David Irwin, R. Mark Nelms, 2005-11-04 Irwin's Basic Engineering Circuit Analysis has built a solid reputation for its highly accessible presentation clear explanations and extensive array of helpful learning aids Now in a new Eighth Edition this

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designed for students taking courses in electrical circuit analysis. The textbook includes examples guestions and exercises that will help electrical engineering students to review and sharpen their knowledge of the subject and enhance their performance in the classroom Offering detailed solutions multiple methods for solving problems and clear explanations of concepts this hands on guide will improve student s problem solving skills and basic understanding of the topics covered in electric circuit analysis courses Exercises cover a wide selection of basic and advanced questions and problems Categorizes and orders the problems based on difficulty level hence suitable for both knowledgeable and under prepared students Provides detailed and instructor recommended solutions and methods along with clear explanations Can be used along with the core textbooks in AC circuit analysis and advanced electrical circuit analysis **Basic Engineering Circuit Analysis** with Egrade SLG and Student Study Guide Set Irwin,2001-01-01 Study Guide to Accompany Basic Engineering Circuit Analysis. Sixth Edition [by] J. David Irwin, Chwan-Hwa Wu Bill Dillard, 1999 Basic Circuit Analysis H Michael Thomas, 2012-12-19 This is a non calculus based circuit analysis text that can be offered in the first term It could also be used by students as supplementary material for self study and as an additional source of information Problem solutions are provided for all the problems in the book in order to provide the student with an extensive source of worked examples Both DC and AC steady state circuit analysis are covered by introducing circuit analysis concepts with DC circuits containing sources and resistors using simpler math and then expanding the analysis to AC circuits containing sinusoidal sources resistors capacitors and inductors using more complex math Topics such as series parallel and series parallel circuits Ohm s law Kirchhoff's voltage and current laws voltage and current divider rules superposition Thevenin and Norton equivalent circuits Pi T circuit transformations nodal voltage analysis method frequency analysis and Bode plots are covered Visit author Facebook Page at facebook com HMichaelThomas Books Advanced Electrical Circuit Analysis Mehdi Rahmani-Andebili, 2022-08-05 This study guide is designed for students taking advanced courses in electrical circuit analysis The book includes examples questions and exercises that will help electrical engineering students to review and sharpen their knowledge of the subject and enhance their performance in the classroom Offering detailed solutions multiple methods for solving problems and clear explanations of concepts this hands on guide will improve student s problem solving skills and basic understanding of the topics covered in electric circuit analysis courses **Circuit Analysis (Speedy Study Guide)** Speedy Publishing LLC, 2014-11-29 Electrical wiring and circuitry can be a very exacting undertaking with the great potential for negative results occurring if a circuit s connections are off by even one space A circuit analysis guide provides a breakdown of every possible symbol and mechanism within a circuit diagram in order to educate electricians engineers and so on about the proper ways to align a circuit and what common symbols to pay extra focus upon Studying it and class texts should lead to excellence Basic Engineering Circuit Analysis J. David Irwin, 2002 Publisher Description

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