Binary addition and Binary subtraction

KODA YADAVA RAO
III B.Sc (M.P.C)
2122001052030

The binary addition & subtraction is similar to the decimal number system. But the main difference between these two is Binary number system uses two digits like 0 & 1 whereas the decimal number system uses digits from 0 to 9 and the base of this is 10. There are some specific rules for the binary system like when we add & subtract binary numbers then we must be very careful while carrying otherwise borrowing digits because these will occur more frequently. This articles discusses an overview of the addition & subtraction of binary numbers in detail below.

What is Binary Addition & subtraction?

If a computer is accomplished in handling 5-digit numbers like -1101 where the minus is sign bit and remaining digits are magnitude bits then this 5 bit number can be represented like 11101, here in this digit, the first digit 1 specifies the negative sign as well as remaining 4 digits are the magnitude of the numbers.

In the same way 01101 denotes the 1101 binary numbers.

A negative (-) number is also denoted using the concept of the magnitude of the numbers 1's complement. So the binary number -1101 may be denoted as 10010 where the first digit is a most significant bit of MSB. It means the negative number as well as and 0010 is the 1's complement of the magnitude.

In the same way, 11011 specify the number like 0100.

Similarly the 2's complement method is also used for representing a -ve binary number.

Binary Addition

For binary addition taken an example of 11011 & 10101.

```
      1 1 1 1      (carry)
      1 1 0 1 1    (27)
(+)   1 0 1 0 1    (21)
    -------------
    1 1 0 0 0 0    (48)
```

Here the step by step binary addition rules is explained below.

1+1 => 10, so 0 with a carry 1

1+1+0 => 10. So 0 with carry 1.

1+0+1 => 10 => 0. So 0 with carry - 1.

1+1+0 => 10 => 10 = 0 with carry - 1

1+1+1 => 10+1 => 11 => 1 with carry - 1

1+1+1 = 11

Carefully note that 10+1 => 11 and this is equal to 2+1 = 3. Therefore the necessary outcome is 111000.

Examples:- The binary addition examples show in the below.

Ex: 10001 - 11101 = 101110

```
     1 0 0 0 1
 -   1 1 1 0 1
 -------------
   1 0 1 1 1 0
```

Ex: 1110 - 1111 = 11101

```
     1 1 1 0
 -   1 1 1 1
 -----------
   1 1 1 0 1
```

A	B	A+B	Carry
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

Binary Subtraction

First Method :-

For binary subtraction taken an example of 1010010.

Binary subtraction rules is explained below.

If the input 11 = 0 then borrow to the next step is 0.

If the input 01 = 1 & borrow is 0. So 10 = 1 then borrow to the next step is 1.

If the input 11 = 0 & borrow is. So 11 = 0 then borrow to the next step is 0.

If the input 01 = 0 & borrow is 0. So 00 = 0 then borrow to the next step 1.

If the input 10 = 1 & borrow is 0. So 10 = 1 then borrow to next step is 0

Final step. If the input 10 = 0 & borrow is 0. So 10 = 1, then borrow to the next step is 0.

So the final result will be 1010010.

Second Method :-

0011011

1's complement can be achieved by converting 0's to 1's and 1's to 0's. So the result will be like the following

0011011 ---> 1100100 (1's complement)

2's complement can be achieved by adding 1 to 1's complement. So the result will be like the following.

```
   1100100
 + 0000001
 ---------
 = 1100101
```

Now add the subtrahend's 2's complement & minuend

```
        1100110l  (subtrahend)
        1100101   (2's complement)
        ---------
(MSB) (1) 1010010
```

Example:-

1011011 - 10010 = 1001001

```
   1 0 1 1 0 1 1
       1 0 0 1 0
   -------------
   1 0 0 1 0 0 1
```

A	B	A-B	Borrow
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

LED

* A Light Emitting Diode is a semiconductor device that emits light when current flows through it.
* electrons in the semiconductor recombine with electron holes.
* the releasing energy in the form of photons.
* the colour of the light is determined by the energy required for electrons.
* white light is obtained by using multiple semiconductors.
* the conducting layer of light-emitting phosphor on the semiconductor device,

* parts of a conventional LED the flat bottom surfaces of the anvil and post embedded inside acts anchors
* To prevent the conductors from being forcefully pulled out via mechanical strain.
* ultra-high-output LEDs are designed for viewing in direct sunlight.

5V and 12 V LED's are ordinary miniature LED's.

examples for [illegible] - which predicts an exponential rise in light.

Strip :

An LED strip, tape or ribbon light is flexible circuit board populated by surface-mount lights.

Flashing :

Flashing LED's are used as attention seeking indicators without requiring external electronics.

Flickering :

Integrated electronics simple electronic circuits integrated into the LED package.

Bi-color :

Bi-color LED's contain two different LED emitters in one case there are two types of these.

RGB tri-color :

Tri-color LED's contain three different LED emitters in one case each emitter is connected to a separate lead.

Decorative - multicolor :

Decorative - multicolor LED's incorporate several emitters of different colors supplied by two lead out wires.

Digital RGB :

Digital RGB addressable contain their own "smart" control electronics.

Filament :

An LED filament consists of multiple LED chips connected in series on a common longitudinal substrate.

Department of Physics
Government Degree College (Men)
SRIKAKULAM

From : Gondu. Nithin
III rd BSc (MPC)
H.T No : 2122001057021

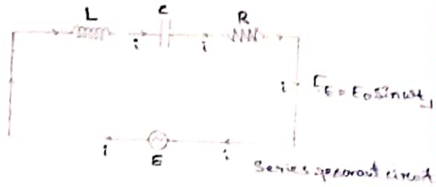
* Information is taken from Google search.

LCR CIRCUITS

The circuit that consists of a resistor (R), an inductor (L) and a capacitor (C) is known as "LCR" circuit.
In LCR circuit the three components, resistor, inductor and capacitor may be connected in either series or in parallel connection.
The LCR circuits are oscillators that they produce a periodic, oscillating electronic signal hence these are called as "Resonant circuits".
Each LCR circuits have its own resonant frequency i.e. an input frequency at which the circuit exhibits distinctive behaviour.

It measures the physical property known as Impedance (Z) which indicates resistance to flow of an alternating current.
It can be calculated from the current (I) flowing to the measurement target and the voltage (V) across the target's terminals.

The LCR circuits are divided into two types: 1. Series LCR circuit.
2. Parallel LCR circuit.



Series resonant circuit

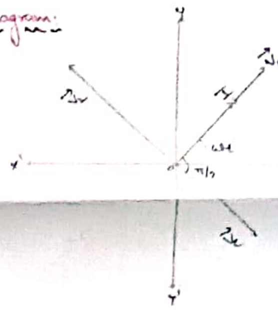
Series LCR (or) Resonant circuit

In this circuit resistor, inductor and capacitor are connected in series.
In this circuit, current (I) is always constant and voltage is equal to the sum of all individual voltages.
In series resonant circuit, the resonant frequency of an alternating current at which impedance of a series LCR circuit, becomes minimum due to maximum current.

$\therefore$ Impedance $(Z) = \sqrt{R^2 + (X_L - X_C)^2}$

Here, R = Resistance
X_L = Inductive reactance $= \omega L$
X_C = capacitive reactance $= \frac{1}{\omega C}$
ω = angular velocity

Phase diagram:



⇒ Current is lag voltage with phase difference $\pi/2$.

The resonant frequency $f_r = \frac{1}{2\pi\sqrt{LC}}$, is independent of resistance.
At the resonance, the current is maximum and the impedance of the circuit is minimum.
At the resonance, the power factor is unity and impedance is purely resistive.

i.e. $Z_r = R$

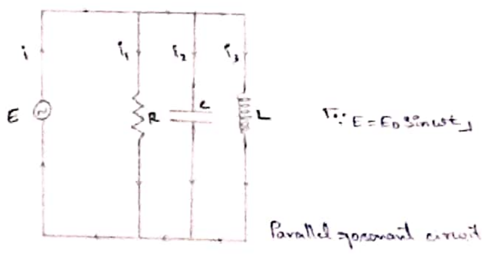
This circuit is called as acceptor, due to it accepts a particular frequency and rejects all others.
At resonance, it magnifies the voltage, which is equals to Q-factor, the magnified voltage is equals to $Q = \frac{\omega L}{R}$

Parallel LCR (or) Resonant circuit:

In this circuit resistor, inductor and capacitor are connected in parallel combination.
In this circuit, voltage is constant and total current is equals to the sum of all individual currents.
It has the resonant frequency of an alternating current is equals at which impedance of a parallel LCR circuit, becomes maximum due to minimum current (I).

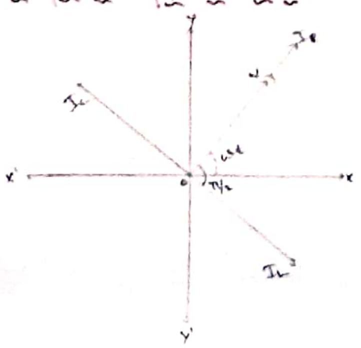
$\therefore$ Impedance $(Z) = \frac{L}{RC}$

The resonant frequency $f_r = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$, is depending on resistance.
At resonance, the current in the circuit is minimum and impedance is maximum.
It has the power factor is unity but impedance is equals to L/RC.
This circuit is called as rejector as it rejects only frequency.
At resonance, the circuit magnifies the current that equals to the Q-factor $Q = \frac{\omega L}{R}$



Parallel resonant circuit.

Phase diagram for parallel resonant circuit:



⇒ current (I) is leading voltage (V) with phase difference $\pi/2$

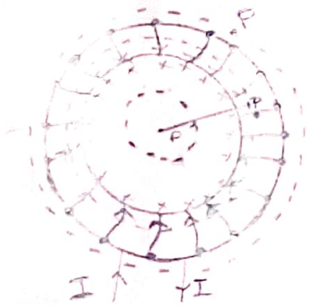
From: Chinthala Chakradhar
IIIrd B.Sc (MPC)
HT No: 5152001052012

⇒ Information is taken from the google search and IV sem physics Text book.

Ajay Kumar
[redacted] 2133 00105200
IIIrd B.Sc [M.P.C] 6th Se

DEFINATION :- The magnetic Field generated in the Solenoid is out side it, While the magnetic Field generated in the toroid is Inside the core.

The magnetic Solenoid has a uniform magnetic Field and the toroid has a non uniform magnetic Field



* For Point In the open space Interior to the Solenoid
  ∴ Inside = 0, ∴ $B_{inside} = 0$
* For Point In the open Space Exterior to the Solenoid
  ∴ Inside = 0   ∴ B = 0
* For Point in between the toroid

$\oint \vec{B} \cdot \vec{dL} = \mu_0 I_{inside}$ $B = \mu_0 n I$

$\oint B\,dL \cos\theta = \mu_0 I_{inside}$ where, $n = \frac{N}{2\pi r}$

$B \oint dL = \mu_0 I_{inside}$

$B \cdot 2\pi r = \mu_0 I N$ For ideal toroid

$= \frac{\mu_0 N I}{2\pi r}$

* The magnetic Field of current Carrying toroid is Independent of the radius.
This is because the magnetic Field of the toroid is given as

$B = \mu_0 n I$

where 'n' is the number of turns
'I' is the electric current
'μ_0' is the Permeability

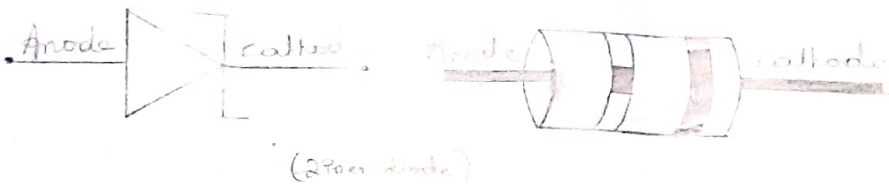
Uses :- A solenoid is a basic term For a coil of wire that we use as an electro magnet
* It generates a magnetic Field For Creating linear motion From the electric current.

Examples :- * Hotel door lock
* water Pressure valves in air conditioning Systems
* MRI Machines
* Hard disk drives.
* speakers.
* Micro Phones
* Power Plants and cars

Zener Diode

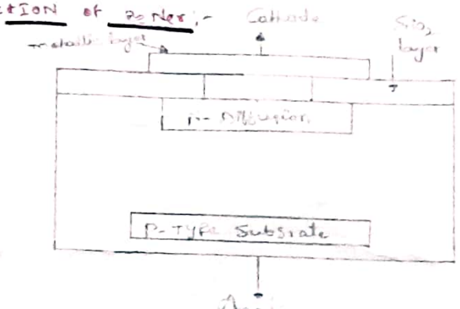
DEFINITION :- A zener diode is a highly dopped semi conductor device specially designed to function in the reverse direction. it is engineered with a wide range of zener voltage (V_Z) and certain types are even adjusted to achieve various voltage regulation

CIRCUIT Symbol of Zener diode



(Zener diode)

CONSTRUCTION of Zener :-



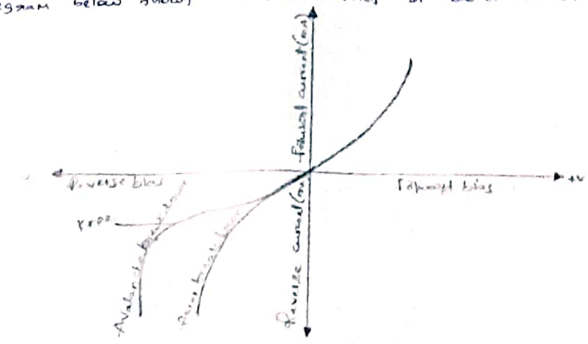
Alloy diffused structures have all Junction covered by the layer of silica oxides to prevent the Junctions In Generally alloy diffused structures gives better perfomance at lower zener voltages on the contrary passivated and diffused structures gives better perfomance at higher voltages

Zener Diode work in reverse bias :-

a Zener diode functions similarly to a regular diode when forward-biased. However in reverse-biased mode, a small lekage current flows through the diode. As the result voltage Increases and reaches the pre-determined break down voltage (V_Z), current begins to flow through the diode. The current reach a maximum level determined by series resistor, after which it stabilises and remains constant across a wide range of applied voltage

V-I characteristics of Zener diode

The diagram below shows V-I characteristics of Zener diode.



when reverse biased voltage is applied to a zener diode, it allows a only small amount of lekage current until the voltage is less than zener voltage.

V-I characteristics of a zener diode can be divided into two parts as follows:

(1) **forward characteristics** :- The first quadrant in the graph represents the forward characteristics in zener diode. from the graph, we understand that is almost Identical to the forward characteristics of p-n Junction diode

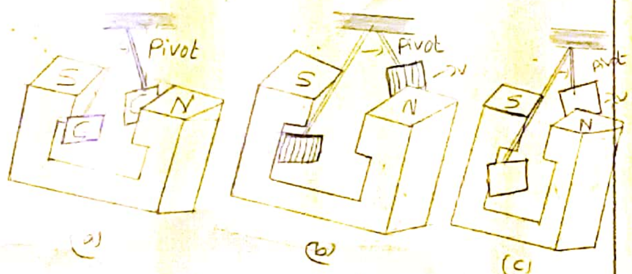
(2) **reverse characteristics of zener diode** :- When a reverse voltage is applied to a Zener voltage, a small reverse saturation current to flow across the diode. This current is due to thermally generated miniority carriers. As a reverse voltage Increases, at a certain value of reverse voltage, the reverse current Increases drastically and sharply This is an Indication that the breakdown has occured. we call this voltage breakdown voltage or zener voltage, and V_Z denotes it.

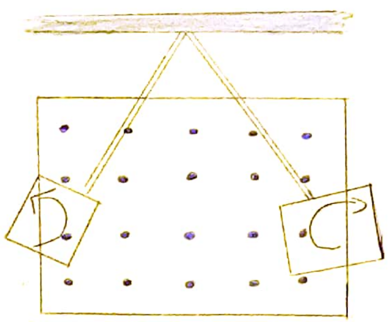
G. NAGABHUSHANA RAO
B.Sc (M.P.C) 3rd
H.T.No:- 2122 ...

Department of Physics
Government Degree College (M)
SRIKAKULAM

Eddy currents and electromagnetic damping

As discussed in motional emf, motional emf is induced when a conductor moves in a magnetic field or when a magnetic field moves relative to a conductor. if motional emf can cause a current loop in the conductor, we refer to that current as an eddy current. Eddy currents can produce significant drag, called magnetic damping, on the motion involved.





Which swings a pendulum bob is metal, there is significant drag on the bob as it enters and leaves the field, quickly damping the motion if, however, quickly damping the motion, if, however the bob is a slotted metal plate, as shown in Figure. there is a much smaller effect due to the magnet. There is no discernible effect on a bob made of an insulator.

Department of Physics, Government Degree College (MEN), SRIKAKULAM

Ch. Lavanya

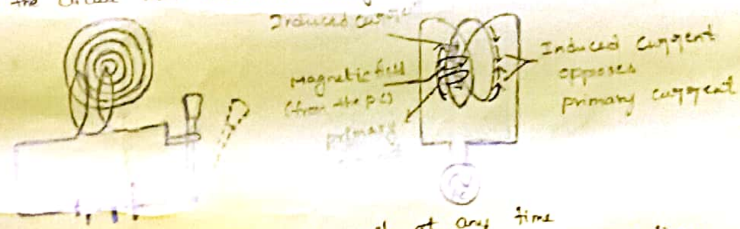
B Ramanamma
III B.Sc [MPC]
Ht.No- 2122001052009
Sub- physics

Self Induction and Mutual Induction :-

1. Self Induction :-

It is the property of the coil due to which the coil opposes any change in the strength of current flowing through it by inducing an emf in itself.

The property of self inductance is a particular form of electromagnetic Induction. In the case of Induction, the magnetic field is created by a changing current in the circuit itself induces a voltage in the same circuit. Therefore, the voltage is self induced.



Coefficient of self Induction :- Let I is current flowing through the coil at any time, ϕ be the magnetic flux linked with all the turns of the coil at that time.

We also know that, $\phi \propto I$

$\Rightarrow \phi = LI$

Here 'L' is proportionality constant and is called coefficient of self Induction.

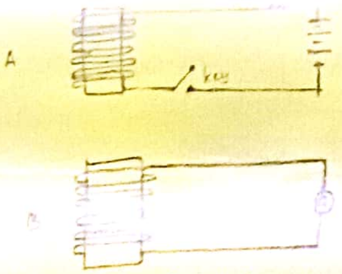
If $I = 1A$ Then $\phi = L$

Now, by Faraday's law : $E = -d\phi/dt$

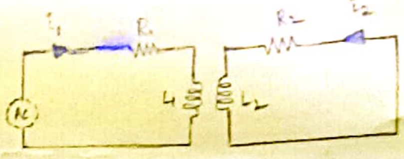
$\Rightarrow \boxed{E = -d(LI)/dt}$ or $\boxed{E = -L\,dI/dt}$ (self Induced emf)

2. Mutual Induction :-

When one circuit induces current flow in a nearby circuit, it is known as Mutual Induction. It is the property of two coils due to which each opposes any changes in the strength of current flowing through other by developing an induced emf.



(figure - 1)



(figure - 2)

On pressing the key, current A increases from zero to maximum value. It takes some time to reach the maximum value. During this time current is commonly increasing hence the ϕ associated with A also increases. Since B is near to A, ϕ associated with it also increases. Thus an emf is Induced in the coil and according to the Lenz's law, the Induced current in B would oppose increase in I in A by flowing in a direction opposite to the cell current in A.

Similarly, on releasing the key, the current in coil A decreases hence the ϕ associated with it decreases. As B is nearby, so ϕ associated with B also decreases and hence an induced emf is developed. The direction of Induced current would be in the direction of the cell current so as to oppose the decrease in the current.

Coefficient of Mutual Induction :-

We know that $\phi \propto I$

$\Rightarrow \boxed{\phi = MI}$

Here 'M' is constant of proportionality and is called coefficient of mutual - induction or mutual inductance of the two coils.

Name :- A. Karthik
Group :- BSc. MPC
Reg. No :- 2122001052001

Gauss law

According to Gauss law, the total flux linked with closed surface is $1/\epsilon_0$ times the charge enclosed by the closed surface.

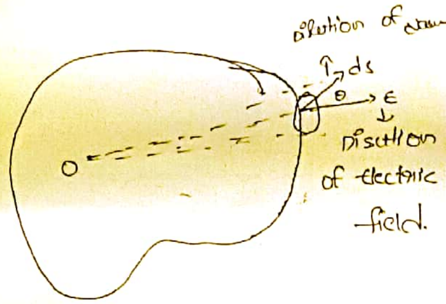
$$\oint \vec{E} \cdot d\vec{s} = \frac{1}{\epsilon_0} q$$

The Gauss law formula is expressed by $\phi = q/\epsilon_0$

where,

q = Total charge within the given surface

ϵ_0 - The electric constant.



Proof :-

Let a charge +q placed at O within a closed surface.. consider a point P on the surface at distance 'r' from 'O'.

Now small area ds around P. The normal to the surface ds make an angle θ with the direction of electric field E.

The electric flux $d\phi_E$ outwards through the surface area ds is given by.

$$d\phi_E = E \cdot ds = E ds \cos\theta \quad \text{---- (1)}$$

from distance r from charge +q.

from coloumb's law, the electric intensity at a point O

$$E = \frac{1}{4\pi\epsilon_0} + \frac{q}{r^2} \quad \text{---- (2)}$$

Now eq (2) substitute in eq (1)

$$d\phi_E = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2} ds \cos\theta$$

$$= \frac{q}{4\pi\epsilon_0} \frac{ds\cos\theta}{r^2}$$

But $\frac{ds \cos\theta}{r^2}$ is the solid angle $d\omega$. Then, $d\phi_E = \frac{q}{4\pi\epsilon_0} d\omega$.

The total electric flux pass through the whole surface, then,

$$\int d\phi_E = \frac{q}{4\pi\epsilon_0} \int d\omega$$

$$\therefore \phi_E = \frac{q}{4\pi\epsilon_0} + 4\pi$$

$$\boxed{\phi_E = \frac{q}{\epsilon_0}}$$

Let the closed surface enclosed several charges like q_1, q_2, q_3 ---- then the total electric flux is given by

$$\phi_E = \frac{1}{\epsilon_0}(q_1 + q_2 + q_3 + \cdots\cdots)$$

$$\boxed{\phi_E = \frac{1}{\epsilon_0} \Sigma q}$$

De Morgan's Law

What is Demorgan Law

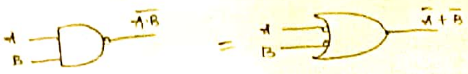
*) The complement of the union of the two sets A & B will be equal to the Intersection of A' (complement of A) & B' (complement of B)

This is called Demorgans law of union.

*) It can be represented by $(A \cup B)' = A' \cap B'$

*) Diagrams :

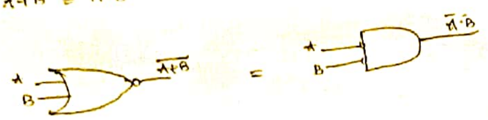
$\overline{A \cdot B} = \bar{A} + \bar{B}$ → Demorgans First law

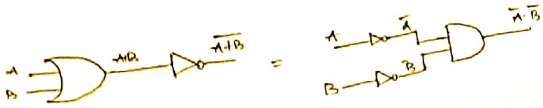


→ First law Truth table

Inputs		Truth table outputs for each Term				
B	A	A·B	$\overline{A \cdot B}$	$\bar{A}$	$\bar{B}$	$\bar{A}+\bar{B}$
0	0	0	1	1	1	1
0	1	0	1	0	1	1
1	0	0	1	1	0	1
1	1	1	0	0	0	0

→ $\overline{A+B} = \bar{A} \cdot \bar{B}$ → Demorgans Second law





→ Second law Truth table

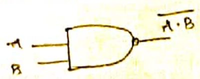
Inputs		Truth table outputs for Each Term				
B	A	A+B	$\overline{A+B}$	$\bar{A}$	$\bar{B}$	$\bar{A} \cdot \bar{B}$
0	0	0	1	1	1	1
0	1	1	0	0	1	0
1	0	1	0	1	0	0
1	1	1	0	0	0	0

Demorgan's Equivalent Gates :

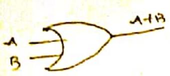
Standard logic gates

1) AND Gate

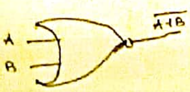
2) NAND Gate



3) OR Gate

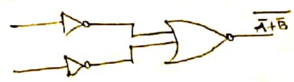


4) NOR Gate



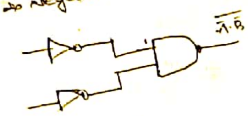
Demorgans Equivalent gates

→ Negative NOR-Gate

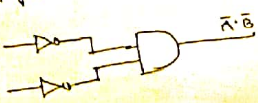


→ Negative OR-Gate

→ Negative NAND Gate



→ Negative AND Gate



Name : Kondala Rama krishna

Group : III[rd] BSC MPC

HT.No : 2122001052032

The Information is taken from google Search

Department Of Physics
Government Degree College (M)
SRIKAKULAM

K. Deepa
2122001052028
III rd Bsc (MPC)
6th Sem

HYBRID PARAMETERS

The h-parameters are dependent on conductivity parameters of transistor which vary with intrinsic carrier concentration since intrinsic carrier concentration varies with temperature the h-parameters vary with temperature.

Every linear circuit having input and output can be analyzed as two port networks. In these networks there are four parameters called hybrid or h-parameter. Out of these four parameters, one is measured in ohm, one in mho and other two are dimension less. Since these parameters have mixed dimension, so they are called hybrid parameters.

h_i = Input resistance with output shorted (Ω)
h_r = Reverse voltage gain with input open (V)
h_f = Forward current gain with output shorted
h_o = Output conductance with input open.

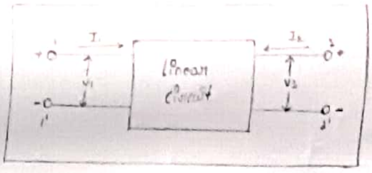


Figure -1

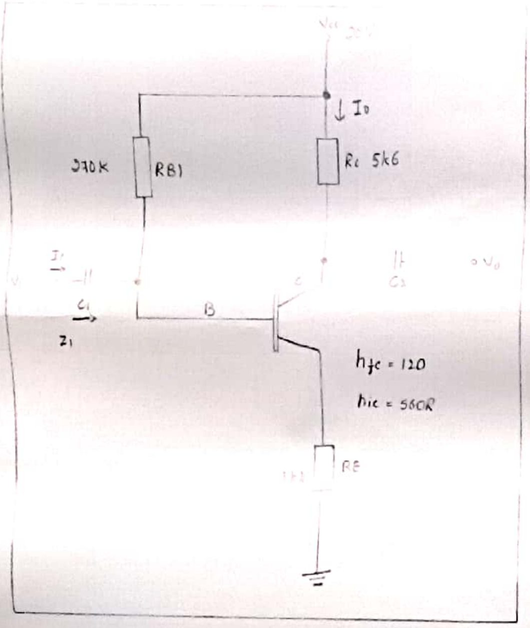


Figure-2

Every linear circuit having input and output terminals can be analysed by four parameters (one measured in ohm, one in mho and two dimensionless) called hybrid or h parameters.

Hybrid means "mixed". Since these parameters have mixed dimensions they are called hybrid parameters. Consider a linear circuit shown in figure 1. This circuit has input voltage and current labbled V_1 and i_1. This circuit also has output voltage and current labbled V_2 and i_2. Note that both input and output currents (i_1 and i_2) are assumed to flow into the box: input and out put voltages (V_1 and V_2) are assumed positive from the upper to the lower terminals. These are standard conventions and do not necessarily correspond to the actual directions and polarities.

It can be proved by advanced circuit theory that voltages and currents in figure 1. can be related by the following sets of Equations:

$$V_1 = h_{11}i_1 + h_{12}V_2 \quad \text{--- (1)}$$
$$i_2 = h_{21}i_1 + h_{22}V_2 \quad \text{--- (2)}$$

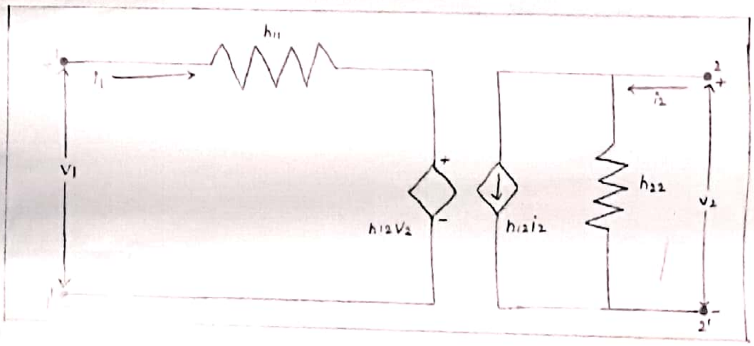


Figure- 3

In the Equations, the hs are fixed constants for a given circuit and are called h parameters. Once these parameters are known, we can use Equations (1) and (2) to find the voltages and currents in the circuit. If we look at Eq (1), it is clear that h_{11} has the dimension of ohm and h_{12} is dimensionless. Similarly, from Eq (2), h_{21} is dimensionless and h_{22} has the dimension of mho.

Topic :

Name : G. Yudeswararaju
III B.Sc (M.P.C)
H.T.NO : 2122001052019

P-N Junction Diode

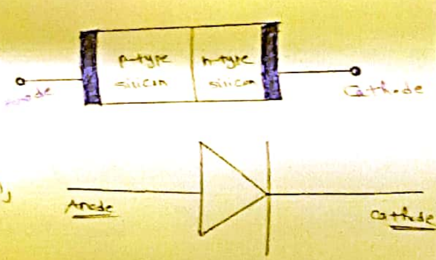
P-N Junction diode : A p-N Junction diode is a basic semiconductor device that Controls the flow of electric current in a circuit.

* It has a positive (P) side and negative (N) side created by adding impurities to each side of a silicon semiconductor.
* the symbol for a p-N Junction diode is a triangular pointing to a line.
* But for now, let's talk about the make-up of p-n Junction diode. It's actually quite a little thing. most of them are made with silicon which allows the diode to operate at higher temperatures, important to prevent overheating of your electronics.

To make a p-n Junction diode, a different impurity is added to each side of a silicon semiconductor, there's an equal no. of holes to electronics. If there are more electrons than holes, then it becomes the n-side. and Negative side, However, just because there is a positive

Just because there is a positive and Negative side, it doesn't mean the material is in anyway electrically charged, the material is still electrically neutral. It's just that the added impurities either leaves holes (or) add more electrons.

Working : If a Current is flowing in the same direction as the p-n Junction diode is called forward bias, then things will work smoothly with the positive holes moving towards the negative side and vice versa. This keeps the other direction, called reverse bias, then it forms a barrier in the middle of the Semi-Conductor blocking and stopping the flow of current



P-N Junction diode uses :

* The ability to Control the flow of Current in this way makes the p-N Junction diode a simple yet powerful semiconductor device.

Applications with these :

to Convert AC input to DC output.

* It Can be used as a solar cell. When the diode is forward biased, It can be used in LED lighting applications.
* It is used as rectifier in many electric circuits and as a voltage-controlled oscillator in varactors.

Different types of Capacitors

Capacitors are manufactured in many styles, forms, dimensions, and form a large variety of materials. They all contain at least two electrical conductors, called plates, separated by an insulating layer (dielectric). Capacitors are widely used as parts of electrical circuits in many common electrical devices.

Capacitors, together with resistors and inductors, belong to the group of passive components in electronic equipment. small capacitors are used in electronic devices to couple signals between stages of amplifiers. as components of electric filters and tuned circuits, or as parts of power supply systems to smooth rectified current. Larger capacitors are used for energy storage in such applications as strobe lights. as parts of some types of electric motors. or for power factor correction in AC power distribution systems. standard capacitors have a fixed value of capacitance but adjustable capacitors are frequently used in tuned circuits. Different types are used depending on required capacitance. working voltage, current handling capacity, and other properties.

while, in absolute figures, the most commonly manufactured capacitors are integreated into dynamic random - access memory. flash memory. and other device chips. this article covers the discrete components.

⇒ General characteristics

⇒ Types and styles

⇒ Comparison of types

⇒ Electrical characteristics

⇒ Additional information

⇒ Market segments

⇒ see also

⇒ References

⇒ External links

Name :- BHYRI. MUKUNDHA RAO

H.T.NO :- 2122 00 105 2006

Maxwell's Equations for Electromagnetic Waves

Name: Dileep Panigrahi
Class: B.Sc 3rd MPC
H.T. No: 212260105a014

Maxwell's Equation :

① Gauss law in Electricity

$\oint E \cdot ds = \frac{1}{\varepsilon_0} q$ ⟶ ①

② Gauss law in Magnetism

Magnetic flux around the cross section is zero

$\oint B \cdot ds = 0$ ⟶ ②

③ Faraday's law :

$\oint E \cdot dl = \frac{-d\phi_B}{dt}$ ⟶ ③

④ Ampere's law :

$\oint B \cdot dl = \mu_0 i$ ⟶ ④

Differential forms of Maxwell's Equation :

We know that charge density

$\rho = \frac{\text{charge}}{\text{volume}} = \frac{q}{V}$

Charge $= q = \rho V$

$= \rho \iiint dv$

$= \iiint \rho \, dv$ ⟶ ⑤

From Gauss Divergence Theorem

$\oint A \, ds = \iiint \text{div} \, A \, dv$

① So $\oint E \cdot ds = \iiint \text{div} \, E \, dv$ ⟶ ⑥

Substitute eq ⑤ & ⑥ in ① we get

$\iiint \text{div} \, E \, dv = \frac{1}{\varepsilon_0} \iiint \rho \, dV$

$\nabla \cdot E = \frac{1}{\varepsilon_0} \rho$

$\left(i \frac{\partial}{\partial x} + j \frac{\partial}{\partial y} + k \frac{\partial}{\partial z} \right) = \frac{1}{\varepsilon_0} \rho$

② $\oint B \cdot ds = 0$

From Gauss Divergence Theorem

$\oint B \, ds = \iiint \text{div} \, E \, dv$ ⟶ ⑦

Substitute eq ⑦ in ②

$\iiint \text{div} \, B \, dv = 0$

$\vec{\nabla} \cdot \vec{B} = 0$

③ $\oint E \cdot dl = \frac{-d\phi_B}{dt}$

We know that Magnetic flux $\phi_B = B \cdot A$

$= B \oint ds$

$= \oint B \, ds$ ⟶ ⑧

From Stokes Theorem

$\oint A \cdot dl = \iint \text{curl} \, A \, ds$

$= \iint (\nabla \times A) \, ds$

So, $\oint E \, dl = \iint (\nabla \times E) \, ds$ ⟶ ⑨

Substitute eq ⑧ & ⑨ in ③

$\iint (\nabla \times E) \, ds = \frac{-d \oint B \, ds}{dt}$

$\nabla \times E = \frac{-dB}{dt}$

④ $\oint B \, dl = \mu_0 i$

We know that Current Density

$j = \frac{\text{Current}}{\text{area of cross section}} = I/A$

Current $(i) = jA$

$= j \oint ds$

$= \oint j \, ds$ ⟶ ⑩

From Stokes Theorem.

$\oint B \, dl = \iint (\nabla \times B) \, ds$ ⟶ ⑪

Substitute eq ⑩ & ⑪ in ④ we get

$\iint (\nabla \times B) \, ds = \mu_0 \oint j \cdot ds$

$\nabla \times B = \mu_0 j$

HALL EFFECT

B. Chaitanya
2122001052008
III rd BSc (MPC)
6th Sem

Definition:

When a piece of metal or Semiconductor is placed in magnetic field, more precisely in transverse magnetic field, and direct current is allowed to pass through it, then the Electric field gets developed across the Edges of metal or Semiconductor Specimen. This phenomenon is called Hall Effect.

Consider a piece of metal is placed in magnetic field. And the magnetic field is perpendicular to the metal or Semiconductor Specimen. Now, direct current is passed through the metal or Semiconductor Specimen in such a way that direction of flow of current is along the positive direction of x- axis.

The magnetic field is applied in such a way that magnetic field acts along the positive direction of z- axis. According to co-ordinate geometry, x- axis, Y- axis, and z- axis are perpendicular to Each other. Thus, the Current carrying path is perpendicular to the path along with magnetic field is acting.

Applications of hall Effect:

- Hall Effect devices generate a very low Signal level. Therefore, they need amplification And it is very suitable for instruments in Labaratory.
- Magnetic field Sensing Equipment
- For the measurement of direct Current, Hall Effect tong tester is used.
- It is used in phase angle measurement
- Proximity detectors
- Hall Effect Sensors and probes
- Linear or angular displacement transducers