Helical Antenna

Outlines

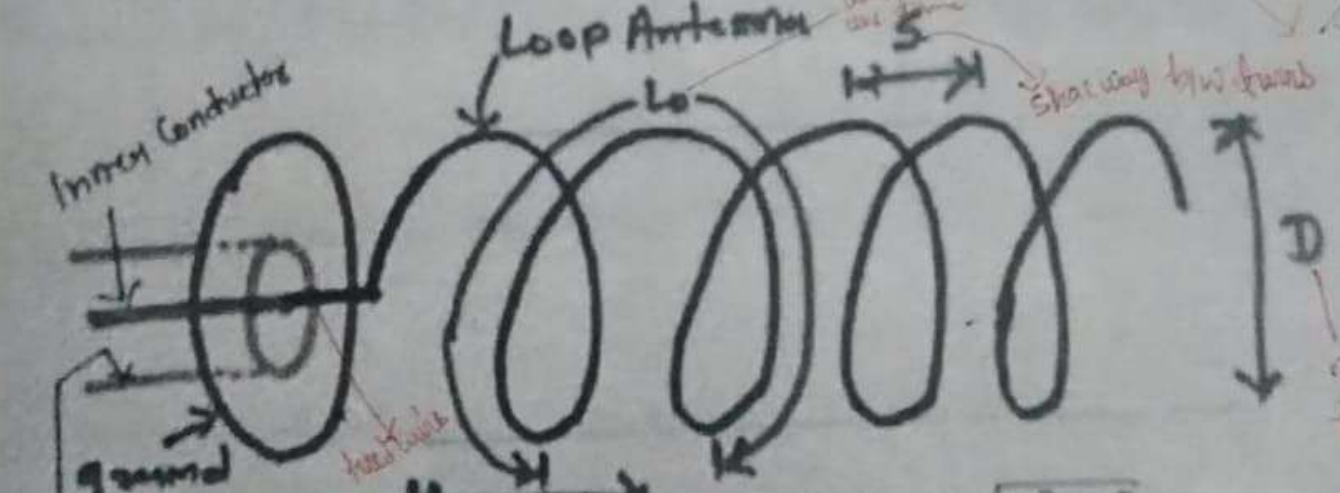
- basics of helical Antenna
- Properties of helical Antenna
- Structure of helical Antenna
- modes of helical Antenna
- Radiation by helical Antenna
- Applications of Helical Antenna

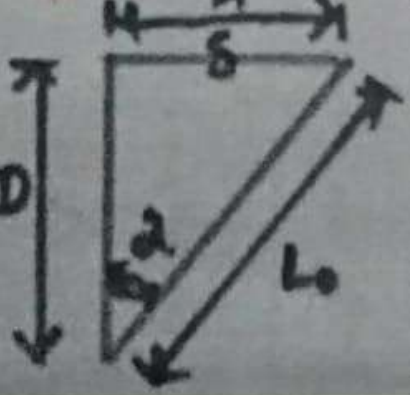
- Basics and properties of **Helical** Antenna
  - If a conductor is wound into helical shape and is fed with respect to ground is helical Antenna.

Properties

- It has broadband characteristics.
- It can provide Circular polarization

- Structure of **Helical** Antenna



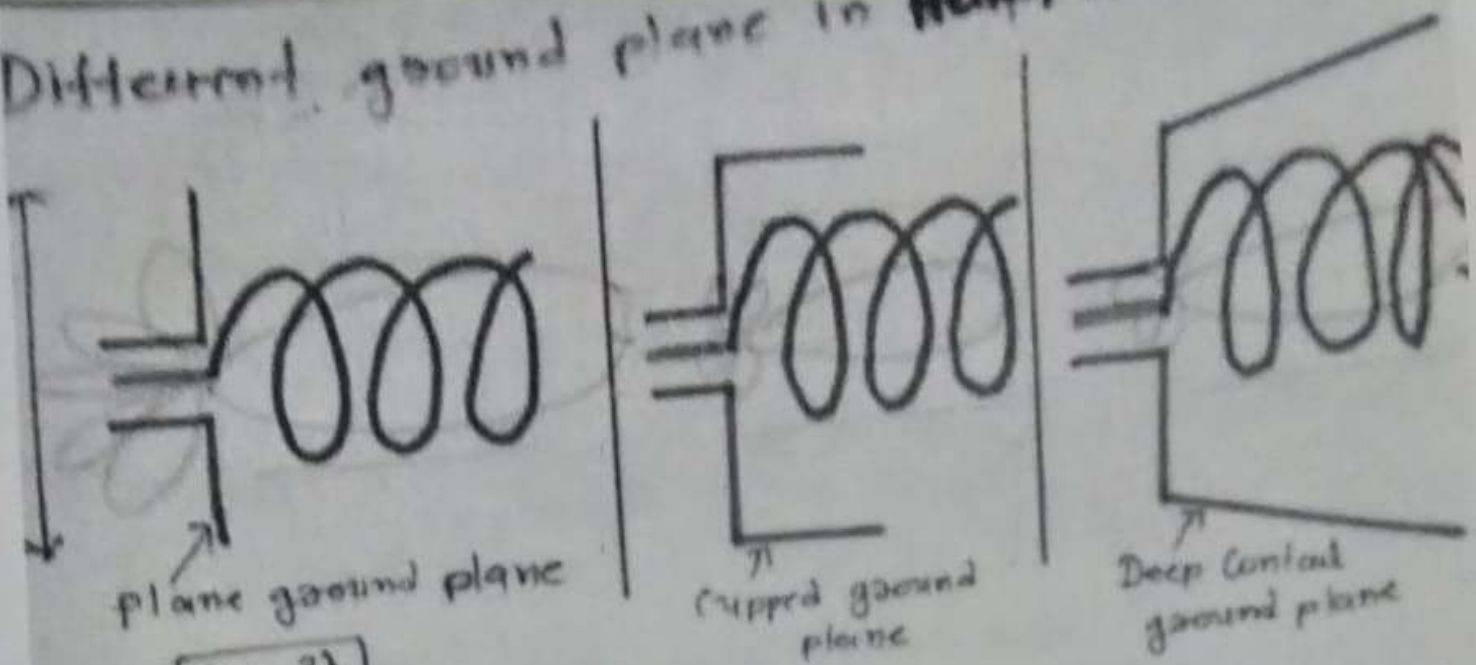


$\rightarrow L_o = \sqrt{S^2 + C^2}$

$\rightarrow \tan\alpha = \frac{S}{C}$

If $\alpha = 0$	If $\alpha = 90$	$0 < \alpha < 90$
this Antenna is Loop Antenna	this Antenna is Linear Antenna	this Antenna is helical Antenna

Different ground plane in Helical Antenna

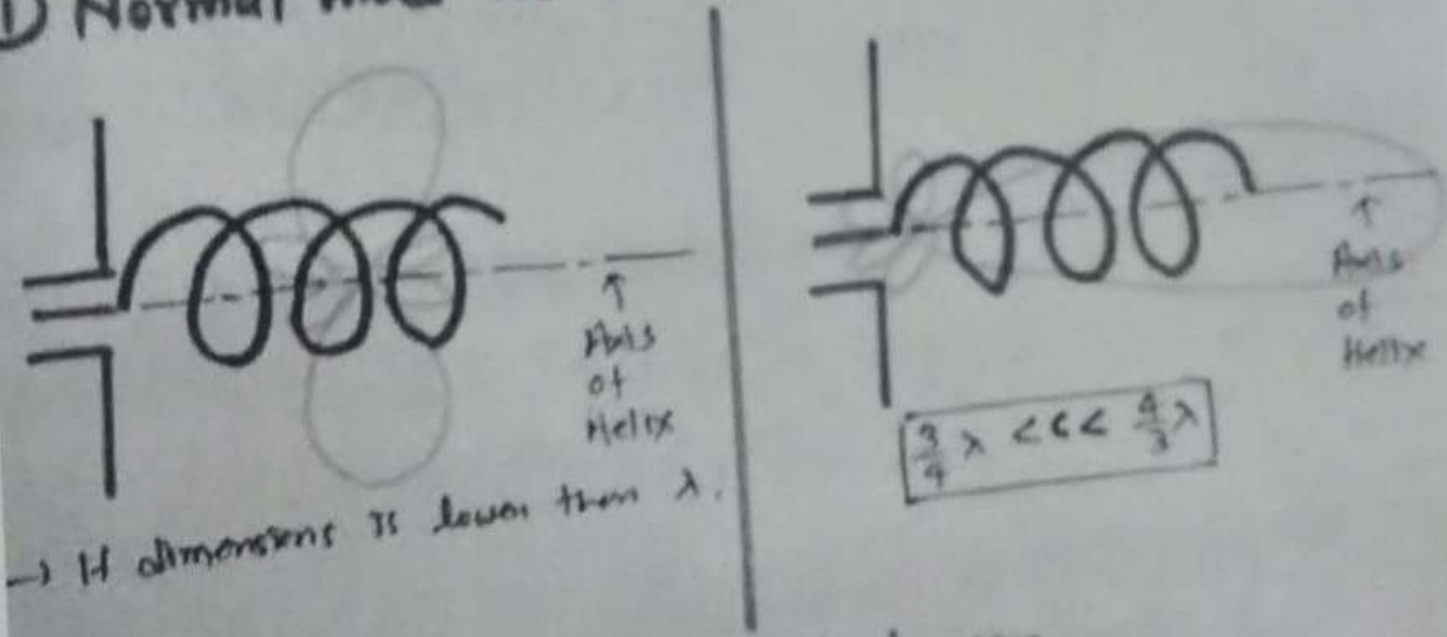


$D > \frac{3\lambda}{4}$

Modes of Operation of helical Antenna

① Normal mode helix

② Axial mode helix



→ H dimensions is lesser than λ.

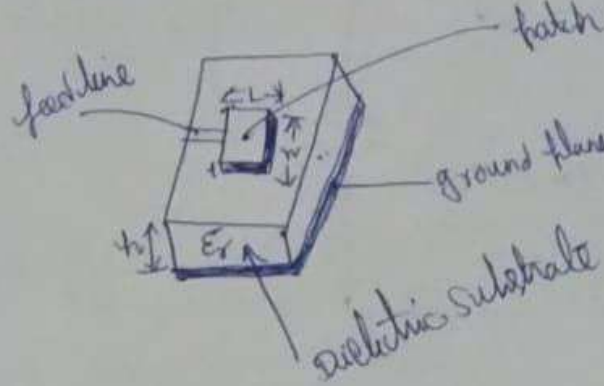
$\frac{3}{4}\lambda < C < \frac{4}{3}\lambda$

Applications of helical Antenna

- AM broadcast
- H is used to Null down AC line noise
- H is used to decrease TV sweep harmonics.
- Low freq. Applications - RFID
  - Gate making
  - Airport - Deep Controls

Microstrip patch antenna →

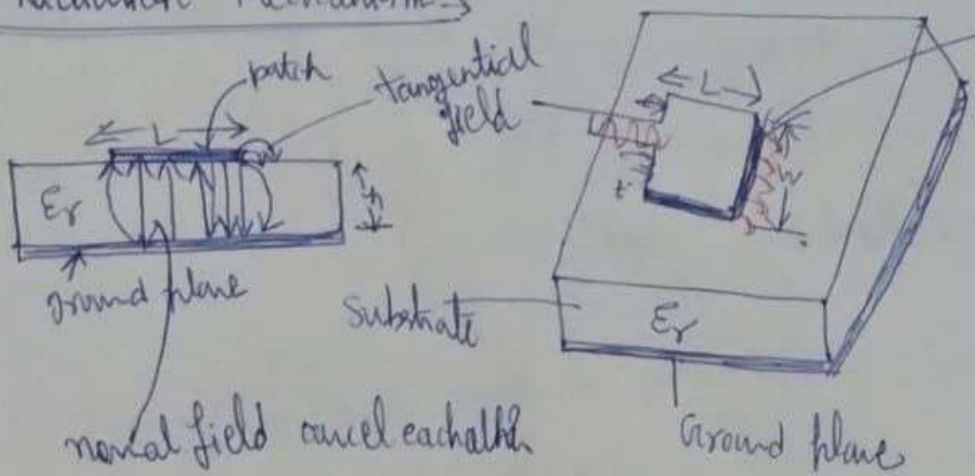
A Mstrip patch antenna consists of a radiating metal path on one side of a dielectric substrate which has a ground plane on the other side.



* Patch is made up of conducting material such as Cu & gold.
* ~~Avail~~ Available in any shape.
* The radiating patch and the feed lines are photoetched on dielectric substrate.

Er ↑ size antenna ↓

Radiation Mechanism →



* Thick dielectric substrate having low dielectric const Good perfomance, better radiat larger BW but it leads to larger antenna size

* MStrip patch antennas radiate primarily because of the fringing fields b/w the patch edge and ground plane.

* In order to design compact patch antenna substrate with high dielectric constant must be used.

Advantages → * Light weight, low cost, Ease of installation

Disadvantage → * Narrow b/w

(*) Lower gain

Applications

* Aircraft applications
* Space craft aff
* Mobile phones. GPS system

Linear Wire Antennas

Wire antennas are thin, conducting wire straight or curve segment. They are easy to construct.

Antennas which are in the form of linear are called linear wire antennas.

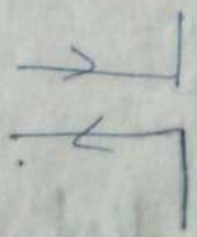
ex → Dipole Antenna

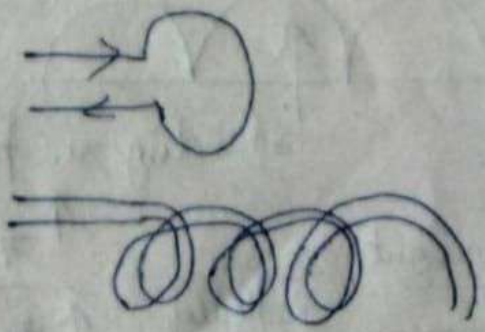
Classification of wire antennas →

Wire antennas are classified based on the shape of the wire and length.

Based on the shape of wire

- Linear (or) Straight wire antennas
  - ex → Dipole & monopole Antenna
- Curved wire Antenna
  - ex → Loop antenna & Helical Antenna

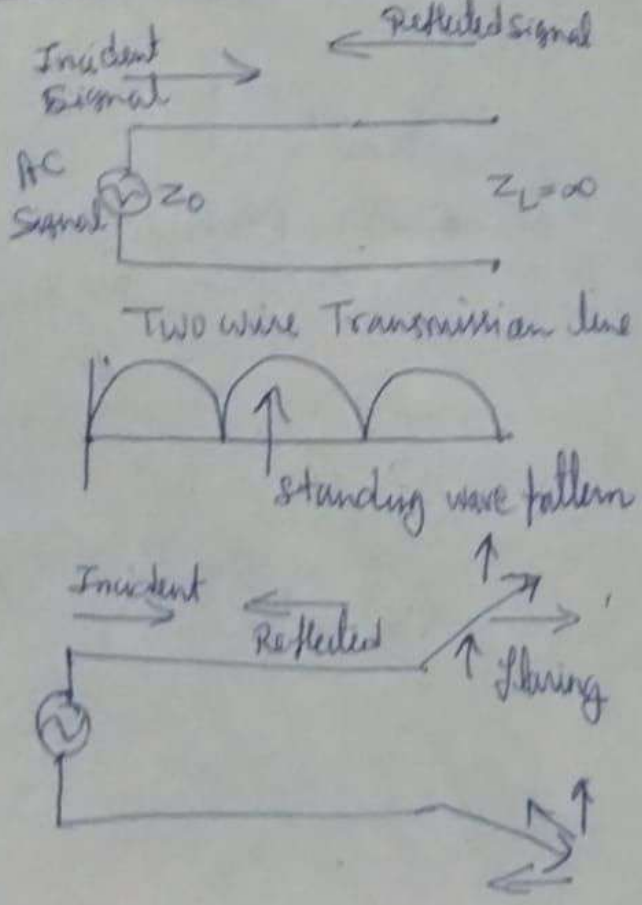




According to length of wire
linear wire antenna

- Infinitesimal dipole (Hertzian dipole) $l \leq \frac{\lambda}{50}$
- Small dipole $\frac{\lambda}{50} < l \leq \frac{\lambda}{10}$
- Half wavelength dipole $l = \lambda/2$
- Quarter wavelength $l = \lambda/4$

Radiation Mechanism of ~~Diff~~ Dipole Antenna



Reflection coefficient →

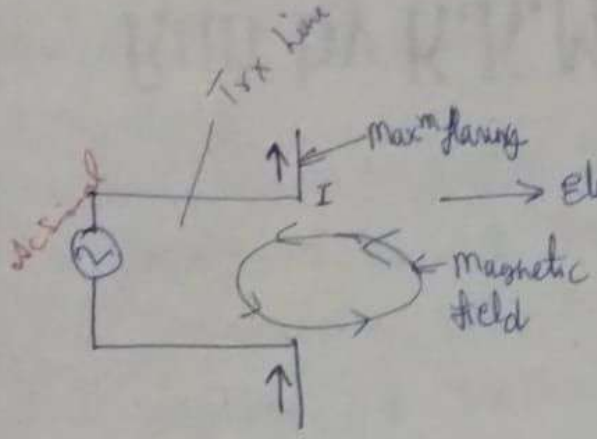
$$\rho = \frac{Z_L - Z_0}{Z_L + Z_0}$$

$$\rho = \frac{1 - \frac{Z_0}{Z_L}}{1 + \frac{Z_0}{Z_L}}$$

$\rho = 1$

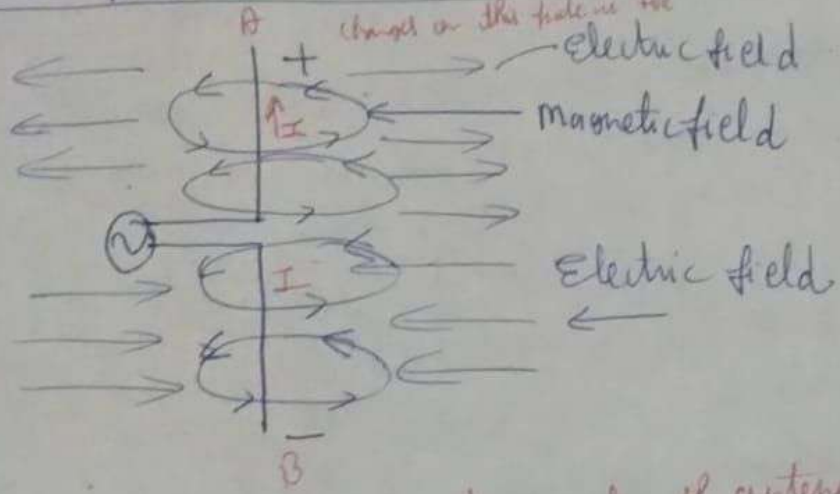
→ maxm reflection
→ minimum radiation

After flaring reflection will decrease hence incident & reflected signal will not get cancelled completely



Max^m flowing in Tx line is dipole antenna & it will provide max^m radiation

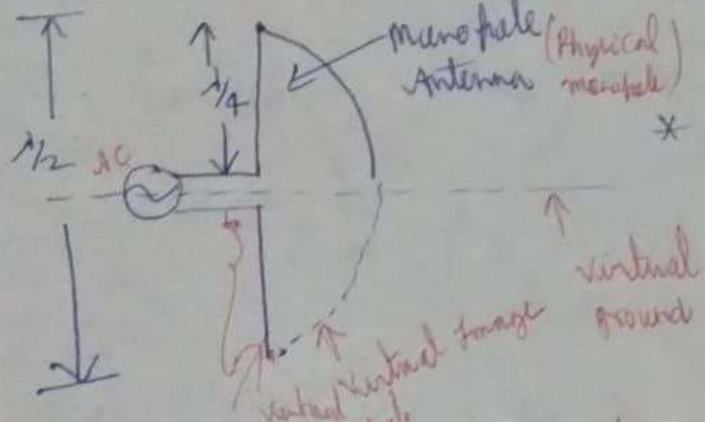
Electric field & Magnetic field of Dipole Antenna →



for +ve half cycle
A → +
B → −
for −ve half cycle
A → −
B → +

Monopole Antenna → (Quarter wavelength antenna)

* Physical Length of monopole Antenna is 1/4



* Monopole has lower radiation efficiency with respect to dipole.

* feed W.R. to ground

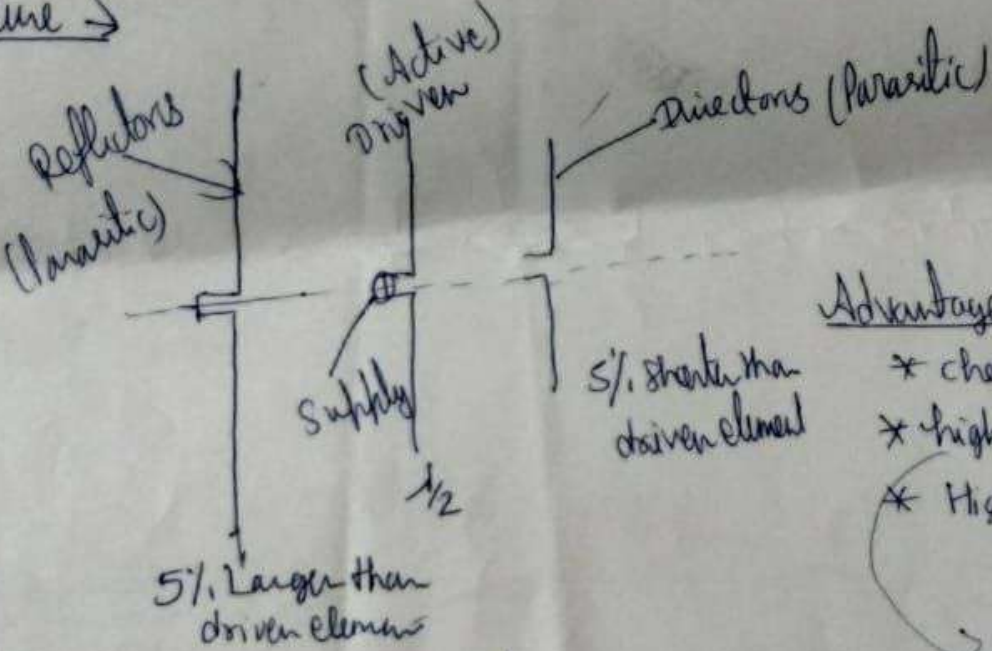
* Replica happens due to perfect reflection.

Yagi-Uda Antenna →

The Yagi-Uda array named after two Japanese scientist who developed it.

* operate above 10 MHz
* used for 40 to 60 ohm
* It has two types of elements
  - (a) Active elements (Driven element) → connected to power supply.
  - (b) Parasitic element (Reflector, Directors) → not connected to power supply

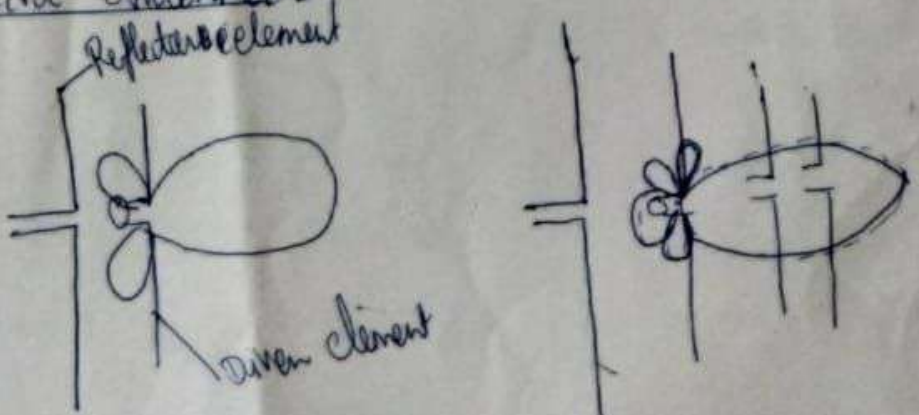
Structure →



Advantages →

* cheap * light in weight
* high gain about 9 dB
* High front to back ratio.
* 5 to 7 dB more gain to dipole array

Radiation of Yagi-Uda Antenna →



Disadvantages →

* For high gain antenna became very large.

Application →

* Home TV receiver
* for point to point communication.