



## Modification for time varying retarded case



- Time-varying and retarded cases in transmission lines and antennas often require more complex mathematical and computational treatments.

- Here are some modifications and considerations for these scenarios:

- **Time-Varying Currents and Voltages:**

- In time-varying cases, you'll need to work with time-dependent electric and magnetic fields.

- Maxwell's equations will be expressed as partial differential equations that account for the time evolution of fields.



- **Retarded Time:**

- When dealing with retarded time, you should use the concept of the "retarded time" or "time delay" to account for the finite speed of electromagnetic wave propagation.

- This delay accounts for the time it takes for an electromagnetic wave to travel from the source to a specific point in space.

- **Electromagnetic Wave Propagation:**

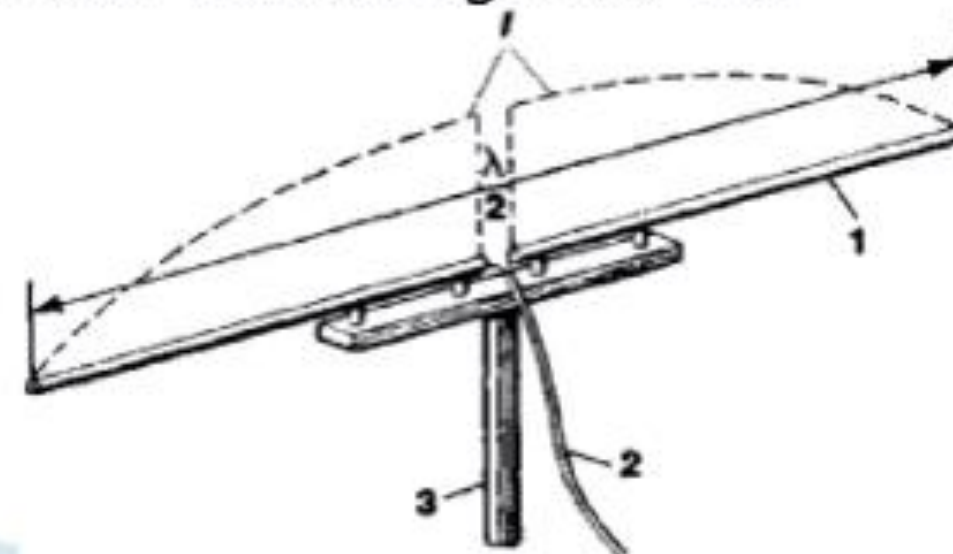
- In time-varying and retarded cases, electromagnetic waves do not propagate instantaneously.

- You must use the speed of light (or the propagation speed in the specific medium) to determine the time delay for wavefronts reaching different points in your system.

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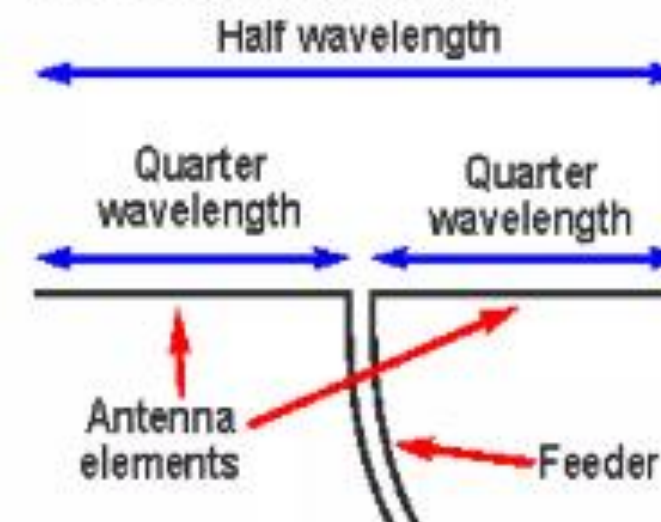
# INTRODUCTION

- ▶ Antenna is an electrical device which converts electric power into electromagnetic waves and vice versa.
- ▶ Half wave dipole antenna consists of two identical conductive elements such as metal rods which are bilaterally symmetrical.
- ▶ The "half-wave" term means that the length of this dipole antenna is equal to a half-wavelength at the frequency of operation.



# WORKING

- ▶ It is basically fed in the center where the impedance falls to lowest.
- ▶ The voltage and current levels vary along the length of the radiating section of the antenna.
- ▶ For a dipole antenna that is an electrical half wavelength long, the inductive and capacitive reactance cancel each other and the antenna becomes resonant.





## APPLICATIONS

- ▶ Set-top TV antenna
- ▶ FM broadcast receiving antennas
- ▶ Shortwave antenna
- ▶ Dipole towers
- ▶ Dipole arrays



Rabbit ears dipole antenna



## ADVANTAGES

- ▶ It receives balanced signals.
- ▶ The two pole design enables to receive signals from a variety of frequencies.
- ▶ Most of the radiating signal is transmitted closer to the horizon so, loss is less.
- ▶ It does not require an antenna “tuner” to work efficiently.



# DISADVANTAGES

- ▶ The outdoors antennas are large and wide.
- ▶ This type of antenna is not used for space communication.
- ▶ The installation of outdoors antenna are difficult.