Radiation Mechanism of Antenna

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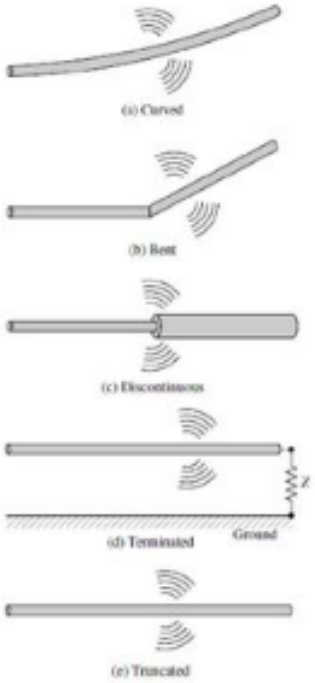
1.3.1 Single Wire

$$l\frac{dI_z}{dt} = lq_l\frac{dv_z}{dt} = lq_l a_z$$

To create radiation, there must be a time-varying current or an acceleration (or deceleration) of charge.

1. If a **charge is not moving**, current is not created and there is **no radiation**.
2. If charge is moving with a uniform velocity:
   a. There is no radiation if the wire is straight, and infinite in extent.
   b. There is radiation if the wire **is curved, bent, discontinuous, terminated, or truncated**, as shown in Figure 1.10.
3. If charge is **oscillating in a time-motion**, it **radiates** even if the wire is straight.



The internal forces receive energy from the charge buildup as its velocity is reduced to zero at the ends of the wire.
Charge acceleration is due to an **exciting electric field** and **deceleration** is due **to impedance discontinuities** or **smooth curves** of the wire.

Radiation Mechanism of Antenna

1.3.2 Two-Wire

- Applying a voltage source connected to a two-conductor transmission line which is connected to an antenna.

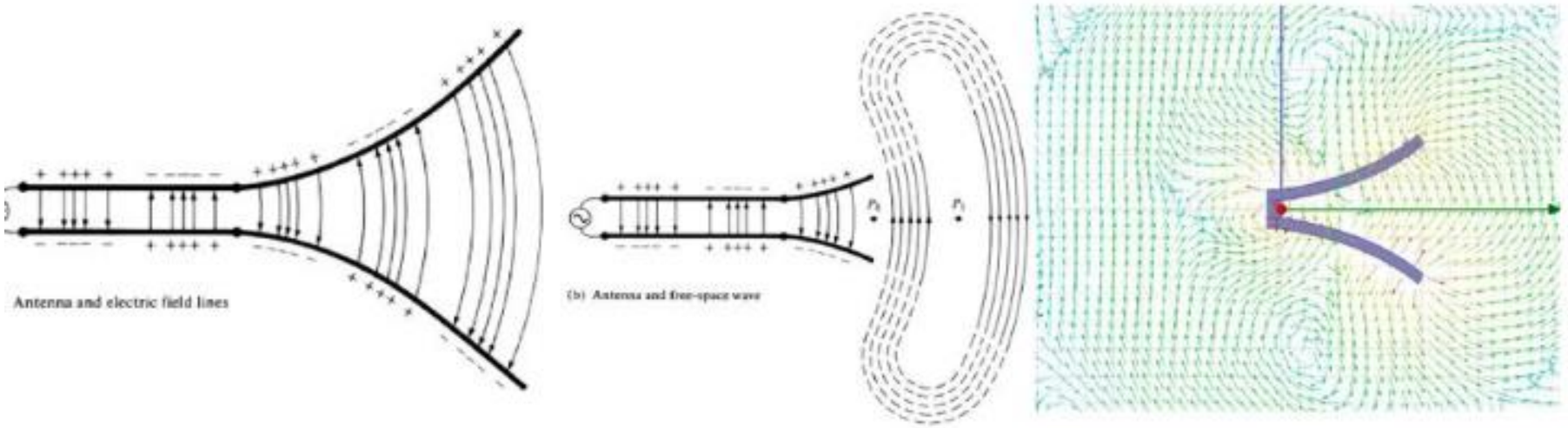


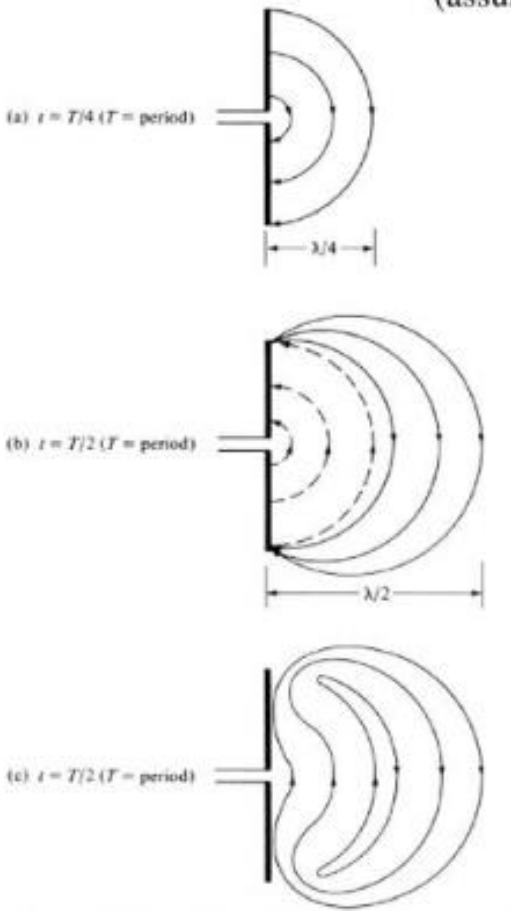
Figure 1.11 Source, transmission line, antenna, and detachment of electric field lines.

Electric charges are required to excite the fields but are not needed to sustain them and may exist in their absence. This is in direct analogy with water waves.

Radiation Mechanism of Antenna

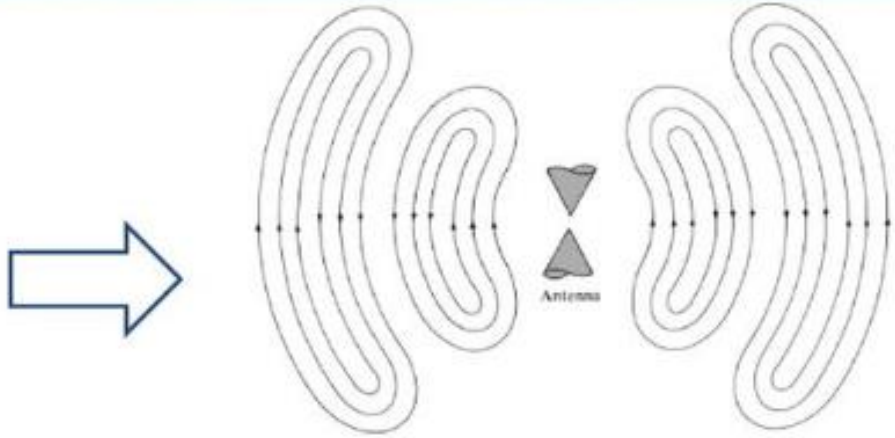
1.3.3 Dipole

The electric lines of force are detached from the antenna to form the free-space waves.
(assuming a sinusoidal time variation)

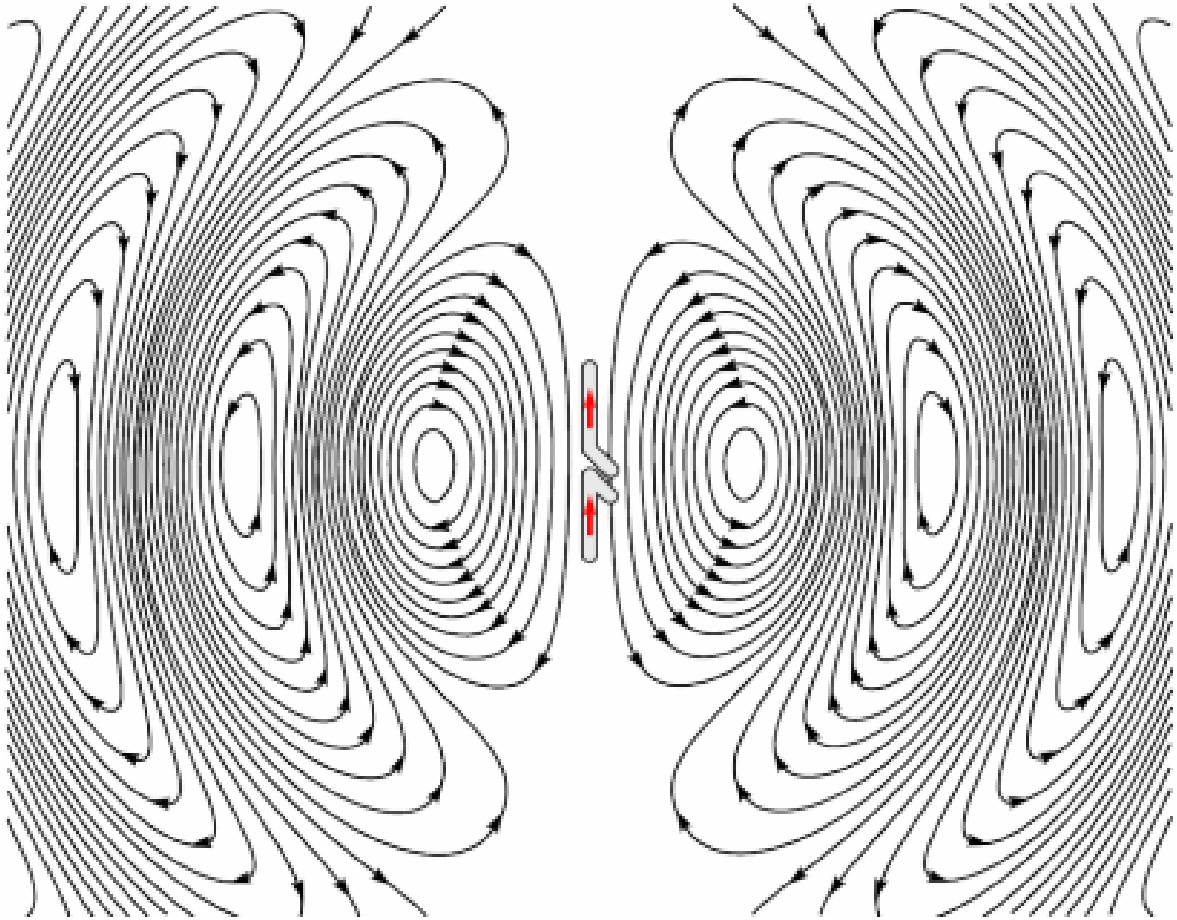


- If the disturbance persists, new waves are continuously created which lag in their travel behind the others.

- There is no net charge on the antenna, then the lines of force must have been forced to detach themselves from the conductors and to unite together to form closed loops.



Radiation Mechanism of Antenna



Literature

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- J. D. Kraus, Antennas, McGraw-Hill, 1997
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