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Antennas allow electrical signals to reach large distances via radiation. This is important because it allows the transfer of information to occur rather quickly. This mechanism of radiation is important because it is the fundamental principle that allows electromagnetic waves to propagate in space. In order to have radiation, one must have the some sort of acceleration of charges. A good way to think about this is having some sort of conducting wire with some length and width.Through the body of the wire there will be a current, if this current is allowed to accelerate there will be some radiation.

In order for charge to flow in an antenna, there must be some emf, this is accomplished by a power source. This power source accelerates the charges, these charge will flow through the wire until it reaches the opposite end, where it is decelerated due to being reflected, emitting some form of radiation (Antenna Theory). This basic mechanism can be extended even further, according to griffiths, moving charges give rise to magnetic fields. Once our charges in the antenna feel the emf from the source, they obtain said magnetic field as well as the electric field they already had. Typically emf source varies sinusoidally, this causes the magnetic and electric field due to the charges to vary sinusoidally as well. This gives rise to the electromagnetic radiation. This wave once created can propagate through space without the need of its source being present.

Antenna problems are typically complicated dipole problems that one could find in any Electrodynamics textbook. I explained the process of solving such problems in my last summary so I wont do it again here. The resulting electromagnetic wave depends on the source emf and the geometry of the antenna. This means it could be fairly complicated to solve such a problem. Typically antenna problems are solved and visualized using Matlab or other computational resources. This allows for clean visualizations of the resulting fields. Interestingly enough Mathworks has developed there own antenna toolbox that allows users to explore various antenna designs and the resulting properties. This is done using the method of moments. This software reduces integral equations (Electric and magnetic field equations) to a more simple system of linear equations, which can then be solved (W.D).

As discussed above the theoretical framework results from maxwells equations. Currently people are experimenting with the use of smaller antennas that can be used in things such as phones and computers. It is important that these antennas are able to receive or transmit over large frequency ranges while still being small.

The use of dielectric ceramic materials in antennas is a more recent advancement in the field. This is important because dielectric antennas are roughly 6-10 times smaller than conducting antennas. Although they are insulators they can still be made to radiate efficiently (Kingsley). Another important advancement in the field is the study of micro strip antennas. These antennas are typically used in phones and other wireless communication devices. Research is being conducted on how to make these antennas smaller and more efficient. It is

also important that they are made safe due to the close proximity that humans are to the radiation caused by the antenna (Hala).

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