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The Charecteristics of Wave Segments

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ABSTRACT : *The process of communication involves the transmission of information from one location to another. This research is about to find the electromagnetic wave in which wave is created by a local disturbance in the electric and magnetic fields. As we will study that the modulation is used to encode the information onto a career wave, and may involve analog or digital methods. From the origin of wave, it will propagate outwards in all directions. If the medium in which it is propagating (air for example) is the same everywhere, the wave will spread out uniformly in all directions.*

I. INTRODUCTION:

This research is about to find the electromagnetic wave which is one of the most glorified subjects in physics with fascinating history of Michael Faraday , James Maxwell and Heinrich Hertz and many others contributing to the field. One of the most difficult subjects in the colleges curriculum even for various science and engineering g students due to the amount to mathematics involved and its abstract nature. This makes it difficult task to teach the materials effectively to the students, especially at the introcuctorycollege physics level. It is even more difficult to convey the concept of the electromagnetic wave production and its propagation. The consequences and gravity of common mistakes among Physics textbooks makes it a pressing issue to be investigated and corrected. In several books we have available and surveyed, it has been found that the authors of the books use a very similar model to describe the wave propagation. Electric field lines near the antenna are drawn from the positive charge to the negative charge as a function of the charge movement. The completion of the charge movement corresponds to the cycle of the electric fields wave propagation outward. The corresponding magnetic field are usually not described in detail, but always given such that the direction of the cross product between the electric field and magnetic field points away from the dipole. In addition, wireless data services are becoming more and more frequent in our daily life. More and more people are using cell phones or PDAs (Personal Data Assistants) to the access to internet for weather, traffic or stock information while on the road. Using a laptop, computer to surf the web or conduct M-commerce activity through WLAN or Bluetooth in university campuses or a star buck's café is more often seen and subscribers to the satellite TV/Internet or wireless local loop (WLL) in residential areas just keep increasing.

The amazing of wireless communication lies in the fact that information is carried by an electromagnetic wave which propagates in free space and can potentially reach anywhere in any direction and distance . This provides the advantage of mobility and accessibility in that one or both communication ends are free from being attached to fixed cables. Sensors in the most remote areas on earth can communicate with others, and beyond the globe radio links between space crafts, satellites, and space and ground stations are able to convey important information for various civilian, scientific and military applications. Such exibility comes at a price: wireless communication channels involve complex environments inside which electromagnetic waves are propagating .Such environments generally pose great challenges on the wireless systems because:

[1] The waves propagating in these environments are not confined in space, as opposed to those in a transmission line;
[2] These environments usually contains numerous scatterers that interacts with the propagating wave in a very complicated manner,e.g. the buildings in a city ,trees, hills or mountains in rural areas and even rain drops in a atmosphere.
[3] Often times the wireless channels are shared by multi users, therefore wave signals of any individual users are susceptible to the interference from other users in the same environment. In order to overcome these constraints, in depth knowledge of the wave propagation behavior in complex wireless channels is needed. Characterizing such behavior by conducting physical measurement is extremely expensive and inefficient.

Wave Propagation in Forested Environments: Propagation of electromagnetic waves in forest environments at medium and high (1-100 MHz) frequencies is examined for the case both the transmitting and receiving points are situated within the vegetation. A dissipative slab in the presence of a reflecting ionosphere is employed to describe the forest configuration. If the effect of the ground –forest interface is disregarded, the radiated field of an arbitrarily oriented, small dipole is found to consist preliminary of two separate waves: a lateral wave which skims along the tree tops, and a sky wave which is produced by a single hop reflection at the ionosphere layers. These two fields constituent are compared and their domains of preponderance are calculated for a large range of the pertinent parameters; it is then found that the lateral wave plays the major role since the sky wave is restricted to a narrow frequency band and its amplitude is appreciable only at large distances. The lateral waved field is examined in detail and is shown to yield a simple physical picture for the propagation mechanism in forests .Its features are found to be qualitatively consistent with the field behavior reported in the literature and the quantitative aspects agree well with the available experimental data. The observed variation of the fields distance, the height-gain effect, the vegetation factor, the basic path loss, depolarization effects are separately examined and are all shown to express merely one or another of the intrinsic properties of a lateral wave. The grounds proximity effect produced by the presence of a planar-conducting ground is also estimated and shown to be of minor importance in most cases.

II. UPLINK ARRAY DEMONSTRATION WITH GROUND BASED CALIBRATION:

A set of small,, separately steerable reflector antennas has been used as a transmitting phases array for the purpose of demonstrating techniques that can be used in the larger array to serve the future uplink transmission needs of NASA’s Deep Space Network. We envision an operational array with 100 or more antennas that could generate the order of 1 TW of effective isotropic radiated power (EIRP). The demonstration is a small scale version of this with five antennas and about 1 MW of EIRP. Each antenna has a 1.2, diameter aperture and a 2 W power amplifier, and the array operates in the 14.0 to 14.5 GHz communication satellite band. The main technical challenge for an uplink array is to ensure that the career phases of the signals from antenna elements are aligned when the signals arrive at the receiver on a distance spacecraft. This requires a method of phase calibration. In the demonstration, we have shown that active receivers attached to the earth near the array can be used as calibration targets. Measurements made at these receivers have been successfully used to calculate the phase adjustment needs at each antenna to achieve the desired alignment. Even though the destination spacecraft is in a direction and at a distance very different from that of the calibrator. When the calculated adjustment are applied at the antennas, the combined power at a space craft has been shown to a within 1 dB of that expected for perfect alignment. Commercial satellites in geostationary earth orbit were used of these tests. Other objectives for the demonstration all successfully accomplished include:

[1] Show that new and simple electronics architecture, specially designed for phase and delay stability can implement all functions of NASA deep space uplinks at low cost, supporting mass production for larger arrays.
[2] Shows that phase alignment can be maintained for at least a few hours without recalibration. Infect, stability over several days has been demonstrated.
[3] Shows that data can be transmitted on the aligned carriers at substantial speeds with no degradation in bit error rate compared with single antenna transmission at the same EIRP.

III. RADAR CALIBRATION USING LEO TARGETS:

This method is based on a radar calibration approach in conjunction with the concept of phase conjugation. The system infrastructure is designed so that each array element can operate in both uplink and downlink modes. A group of orbiting space objects, such as low earth orbit (LEO) satellites is potential calibration targets. The abundance of such targets and their orbiting behavior can supply calibration opportunities at any required array attitude. Aerospace software, STK, can be employed to investigate such calibration opportunities. However there is critical issue associated with this method which lies in the fact that the calibration targets usually fall into the near field zone of the whole array. A path length compensation technique is provided to resolve this problem. This performance of this calibration method is studied statistically by modeling the random positions of array element phase centers and the calibration targets, as well as signal phase fluctuation, in a Monte Carlo simulation.

IV. RADAR CALIBRATION USING THE MOON:

This method is also a radar calibration approach, but with all array elements operating in uplink mode only to save the unit cost of each element .Correspondingly the calibration has to be conducted in uplink mode as well. Orthogonal PN (Pseudo noise) codes and the proper application in this all transmitter array calibration scenario. The moon is selected as calibration target since it falls within the array far field zone, therefore the undesired near field effect does not exist. The difficulty of this method stems from the facts that the moon cannot be treated as a point target, instead it appears in a distributed target from the perspective of the earth ground array. Synthetic aperture radar (SAR) imaging technique can be employed to overcome this difficulty. In addition, the lunar surface is essential a random rough surface and the back scattering of the incoming waves by such a surface must be modeled statistically.

V. CALIBRATION USING VLBI INFRASTURE:

This last method is a different one based on the existing VLBI or VLA (Very Large Array) infrastructures. Celestial radio emitters, Quasars, serve as beacon sources and the downlink phase differences between array elements can be measured through cross-correlation of the received signals. Such phase differences are treated as references for determining the phase calibration values for uplink operation of the array.

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