

Study on Different Type of Reconfigurable Antenna

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Abstract :- Reconfigurable Antenna Is an alternative to multi-band Antenna. Different techniques are use to achieve multi-band and wideband operation of antenna. Reconfigure Antenna Provide the ability to dynamically adjust various antenna parameters. It has received a lot of attention in areas like communication. Reconfigurable means antenna has the ability to modify its characteristics, such as operating Frequency, Polarization or radiation pattern. Reconfigurable antennas have the potential to add functionality to mobile communication. Reconfigurability in antenna allows us for spectrum reallocation in multi-band communication systems therefore reducing the number and size of antenna in a system. Reconfigure antenna are designed to support multiband and wideband wireless applications in different frequency bands. This paper provides different type of reconfigurable antenna and its working like Frequency Reconfigurable Antenna, Radiation Pattern Reconfigurable Antenna, Polarization Reconfigurable Antenna, Radiation and Frequency Reconfigurable Antenna.

Keywords: - Frequency Reconfigurable, MEMS switch, Patch Antenna, Polarization Reconfigurable, Reconfigurability, slot antenna.

I. INTRODUCTION

Wireless communication systems are attracted toward multifunctionality. This multifunctionality provides users with options of connecting to different kinds of wireless services for different purposes at different times. It is very important to develop single radiating element which is having a capabilities of performing different functions and multi-band operation in order to minimize the antenna's weight and area. An antenna that have the ability to modify its characteristics, such as operating frequency, polarization or radiation pattern is referred to as a reconfigurable antenna[1]. Reconfigurable antenna is used for to reduce the number of antenna necessary for Multiband function, but they can also be designed to work in complex systems such as emerging applications include software defined radio, cognitive radio, MIMO systems. Reconfigurability can be achieved using slot configuration in the microstrip rectangular patch antenna with switching devices are connected inside the slot with on & off State working [2]. Switching devices such as PIN diodes, MEMS switches and optical switches are used for switching purposes.

This paper provides detail information of all type of reconfigurable antennas. Section I introduce the concept of frequency reconfigurable antenna. This section provides the geometry of frequency reconfigurable antenna. Section II elaborates the concept of radiation pattern/beam reconfigurable antenna. Section III deals with the concept of polarization reconfigurable antenna. Section IV presents reconfigurable single printed antenna capable of both radiation pattern and frequency reconfiguration. Section VI concludes the paper.

1. Frequency Reconfigurable Antenna

Latest communication systems demand transmitters and receivers with multi-band operation, as a result different techniques for achieving frequency reconfigurability have been proposed in system where weight and area are critical issue.

The reconfigurable patch module (RPM) proposed by J.T.Bernhard et al. consists of a 3x3 array of square patches connected together by the RF MEMS switches as depicted in Fig.1. Ideally, the RF MEMS switch has two operational states ON and OFF. The ON state represents a short circuit, while the OFF state exhibits an open circuit. When all the switches are in the OFF state, the total radiation pattern is formed by the pattern radiated by each small patch as shown in Fig. 1(a). As a result, the antenna resonates at a higher frequency band. On the other hand, when all switches are turned ON, the antenna effective area is clearly larger than the area of a singular patch array. The antenna accordingly resonates at a lower frequency band as shown in Fig. 1(b). Fig. (a) Antenna geometry when switches are turned OFF (b) Antenna geometry when switches are turned ON [4].

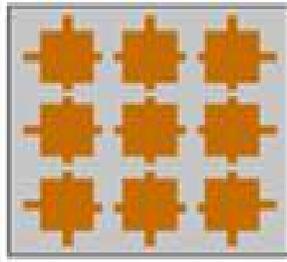


Fig.1. (a) Open Configuration

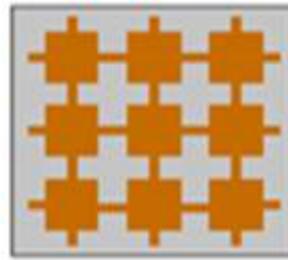


Fig.1. (b) Closed Configuration

II. Radiation Pattern Reconfigurable Antenna

Radiation pattern reconfigurability is based on the some modification of the spherical distribution of radiation pattern. Pattern reconfigurable antennas are usually designed using movable/rotatable structures or by using switchable and reactively-loaded parasitic elements. The antenna is designed to be able to reconfigure its radiation pattern during operation such that it maintains its broad pattern in the absence of interferences, and is capable of narrowing its pattern, when the interfering signals arrive at the antenna, to suppress these undesired signals as much as possible.

The total radiation pattern from the microstrip antenna originates from three things: direct space wave, edge diffracted space wave and edge diffracted surface wave. The Basic idea about the pattern reconfigurable antenna is antenna mounted on electrically thick substrates so that edge-diffracted surface wave field can be strong and which is having the magnitude higher than the diffracted space wave field.

The element of microstrip antenna is surrounded with a parasitic ring loaded with switches. The structure of this antenna is shown in fig. 2. Reconfigurable antenna is based on some modification of the EM propagation characteristics of the surface waves, and thus the radiation pattern could be modified through the use of a metallic switch-loaded parasitic structure. Then next the modified radiated surface waves contribute to the main beam pattern in a controlled manner, hence pattern reconfigurability achieved. The switches provide two different ring configurations and the two states of the switches i.e ON and Off Controlled the pattern reconfigurability. The switches can be RF MEMS, electronic or photonic-controlled or diode switches.

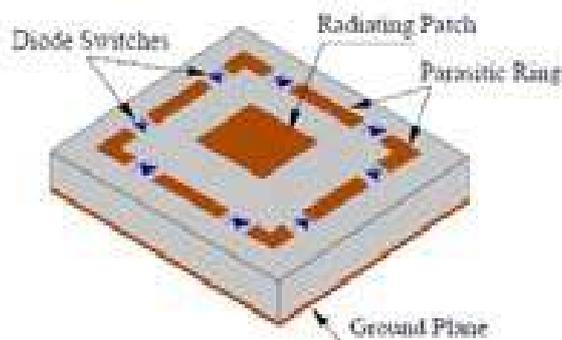


Fig.2. Radiation pattern reconfigurable patch antenna Geometry

III. Polarization Reconfigurable Antenna

Polarization reconfigurable antennas are capable of switching between different polarizations modes. The capability of switching between horizontal, vertical and circular polarizations can be used to reduce polarization mismatch losses in portable devices. Polarization reconfigurability can be provided by changing the balance between the different modes of a multimode structure. Antenna with polarization diversity is very important due to the rapid growth of wireless communications and radar systems.

A design of microstrip antenna with switchable slots was introduced to accomplish circular polarization Diversity. Two orthogonal slots are introduced into the radiating patch and two pin diodes are used to switch the slots on as shown in Fig.3.

By activating the switches on the antenna radiates with either right hand circular polarization (RHCP) or left hand circular polarization (LHCP) by sharing the same feeding probe. The feeding probe is located on the diagonal line of the patch. The antenna radiates either RHCP or LHCP at a time, depending upon the operating state of the diode switches. Therefore, there is no coupling is induced between the two polarizations.

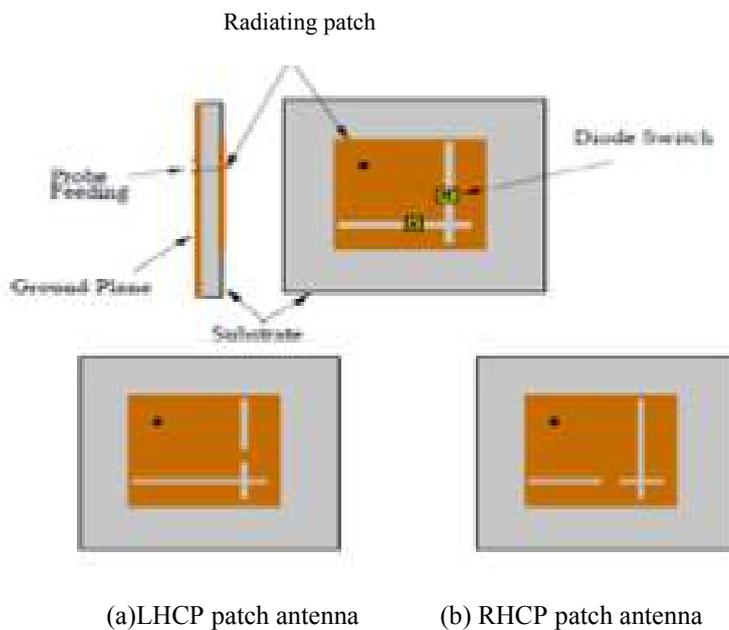


Fig.3.A Patch Antenna with Switchable Slot for RHCP/LHCP Diversity

IV. Radiation and Frequency Reconfigurable Antenna

In general, most antennas are capable of either frequency or pattern reconfigurability. However they can be made combination of both frequency and pattern reconfigurable simultaneously. Frequency and Pattern reconfigurable microstrip antenna is done by using multiple switch connections.

V. CONCLUSION

In this paper theoretical survey on Reconfigurable antenna is presented. After study on different type of reconfigurable antenna we can concluded that Reconfigurable antenna have their applications in diversified areas like communications. They possess the properties to modify their radiation characteristics, frequency of operation, polarization or even a combination of these features in real time. Reconfigurable antennas have the potential to add substantial degrees of freedom and functionality to mobile communications.

REFERENCES

- [1] Sonia Sharma, Monish Gupta, C.C.Tripathi Reconfigurable Antennae: A Review IJECT Vol.2, Issue 3, Sept. 2011\
- [2] Dimitrios peroulis, Kamal Saraland and Linda P.B.K presents “Design of Reconfigurable Slot antennas” *IEEE Transactions on Antennas and Propagation, Vol. 53, N).2, FEBRUARY 2005* \
- [3] Abdelnasser Eldek, Abubaker Abdallah, Mahmoud Manzou IReconfigurable Microstrip Double-Dipole Antennas for Personal Wireless Communications,"Wireless Engineering and Technology, 2011, 2, 60-69, April 2011 \
- [4] S. V. Shynu, G. Augustin, C. K. Aanandan, P. Mohanan, and K. Vasudevan Design of Compact reconfigurable dual frequency microstrip antenna using varactor diodes, *Progress In Electromagnetics Research*, PIER 60, 197–205, 2006 \
- [5] Huda A. Majid, Mohamad K. A. Rahim*,Mohamad R. Hamid, and Muhammad F. Ismail “Frequency Reconfigurable Microstrip Patch-Slot Antenna with Directional Radiation Pattern”. *Progress In Electromagnetics Research, Vol. 144, 319-328, 2014*