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Design and Implementation of Re-configurable Antenna

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Abstract- This paper introduces a design of advanced and efficient technique used for antenna reconfiguration. Conventional antennas are designed for specific application as it operates at a particular frequency range. On the other hand reconfigurable antenna provides performance enhancement and gives single antenna structure to operate at various frequency range. In order to obtain this, we use the technique of frequency reconfiguration i.e. PIN diode switching through which it can switch among different frequency band. Antenna design is simulated and analyzed using HFSS software.

Keywords- Reconfigurable antenna, PIN diode, frequency reconfigurability, microstrip patch.

1 INTRODUCTION

A. BACKGROUND

With increase in number of wireless communication system and development of modern satellite communication, many applications require integrated, adaptive, multifunctional terminals. Reconfigurable antenna represents recent innovations in antenna design that dynamically changes frequency, pattern polarization to modifiable structures that can be adapted.
The reconfigurable antennas have the advantage of being able to produce good radiation pattern with better bandwidth compared to patch antennas. This reconfigurability can be achieved by inserting technique.Current microwave and wireless systems are however designed for single predefined missions and hence incapable of reconfiguring their functionalities

ANTENNA

Antennas are metallic structures designed for radiating and receiving electromagnetic energy. An antenna acts as a transitional structure between the guiding devices. Microstrip antennas are well known for their features such as low profile, light weight, low cost, conformability to planar and non-planar surfaces, rigid, and easy installation.

The feature of self-similarity of a fractal antenna can also provide a basis for the design of multiple-frequency antennas. These antennas have the advantage that they radiate similar patterns in a variety of frequency bands. The various fractals shape that posse self-similarity have been applied to multi-band or miniaturized antenna design
Disadvantages of Current wireless systems

1. Capacity constrained networks
2. Issues related to quality and coverage
3. Limited Bandwidth

Hence there is need for the design of reconfigurable antenna which operates on multiple frequencies

RECONFIGURABLE ANTENNAS

Reconfigurable antenna is an antenna which changes its frequency by dynamically varying its radiation properties such as Radiation pattern, polarization & frequency of operation.
Reconfigurable antennas are having advantages of:

1. Antenna elements operate on multiple frequencies
2. Band Switching or tuning operational band is easy.
3. Size, cost and complexity of the antenna system
4. Efficiency

Reconfigurability can be achieved by various switching techniques are:

1. MEMS
2. VARACTOR diode
3. PIN diode

I. MEMS

RF MEMS (micro electromechanical) switches are introduced in the past decade as the elements. Basically, they are a miniature version of a standard mechanical switch. The fabrication technology of the RF MEMS switches has a lot in common with the fabrication technology of VLSI circuits. There are two basic configurations; the serial SPST switch and the shunt SPST switch. Mostly used mechanical structures are the cantilever and the bridge. They are both shown in Fig. Although there are other reported designs, the cantilever in most cases operates as the series switch and the bridge usually operates as the shunt switch.
MEMS are nothing but the miniaturization of the sensors and transducers that were constructed on a highly integrated VLSI circuit or processor. In large RF MEMS devices and components, the micro electromechanical operation is used for the actuation or the adjustment of a separate RF device or components, like varactor capacitor [1]

Advantages

Needs very low driving voltage, high tuning speed (1-100 ns), high power handling capability, very reliable since there are no moving part, extremely low cost.

Disadvantages

Needs high DC bias current in their "ON" state which consumes a significant amount of DC power, nonlinear behavior, poor quality factor, discrete tuning

II . Varactor Diodes

Theoretically, any reverse biased PN junction diode acts as a capacitance to a small alternate signal superimposed to the DC bias voltage. This capacitance is due to the charge in the depleted area of the reverse polarized PN junction, as shown in Fig. Since the charge is dependent on the reverse bias voltage, the capacitance is voltage controlled.

Advantages

The current flow through the varactor is small compared to PIN diode or MEMS, continuous tuning is achieved.

Disadvantages:

Varactors are non-linear and have low dynamic range, complex bias circuitry are required.

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III. PIN Diode

A PIN diode is a semiconductor device composed of a *p* and *n*-layer, separated by an intrinsic *i*-layer.
This diode operates at DC and low frequencies similar to an ordinary *pn* diode. However, due to the introduction of the intrinsic layer, the PIN diode can operate as a current controlled linear resistor for the RF signal. If one drives the PIN diode using only two bias states, namely the reverse and the forward bias, it will exhibit switch characteristics for the RF signal.It needs very low driving voltage, high tuning speed (1-100 ns), high power handling capability, very reliable since there are no moving part, extremely low costHere we select PIN diode switching technique for reconfiguration.

CONCLUSION

Thus we have studied the concept of reconfigurable antenna and advantages of it over conventional antenna.The various techniques for achieving reconfigurability are:MEMS switching, Varactor diode switching & PIN diode switching. Among three techniques we are implementing PIN diode switching techniques as it is having advantages over other two such as faster switching speed, high power handling capability, very reliable since there are no moving part, extremely low cost

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