Sinusoidally Modulated Reactance Surface Antenna Using Parallel Capacitors

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Ⅰ.Introduction

Recently, there are some researches on the sinusoidally modulated reactance surface antennas (SMRS antennas) [1] which corresponds to a type of a periodic leaky wave antenna. This SMRS antenna utilizes -1th floquet mode to radiate and has a low profile and high directivity characteristic. In this paper, we offer a different methodology to design a SMRS antenna from previously designed models.

Ⅱ. SMRS antenna using parallel capacitors

According to the previous researches, the SMRS antenna were designed by varying surface reactance between two microstrip lines and this was adjusted by controlling the gap between strips. After that, a new methodology was suggested loading capacitors between the strips and the capacitances were varied to modulate the surface reactances. Instead of this series capcitances between the strips, we suggest another method to modulate the surface reactance using parallel capacitors between the strips and ground planes using vias and this is shown in Fig.1.

With this suggested model, we simulated the eigenfrequencies of the unit cell according to the parallel capacitances in order to calculate the surface reactance of the unit cell. The surface reactance of the unit cell can be calculated using the equation (1).

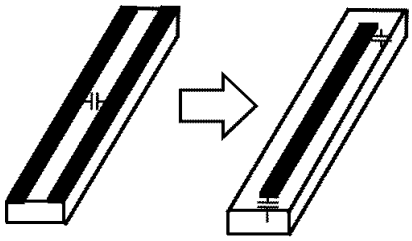

Figure 1. Previous antenna unit cell using series capacitors (Left) and suggested antenna unit cell using parallel capacitors (Right)

$$Z = Z_0 \sqrt{1 - \left(\frac{\phi}{a} \times \frac{c}{\omega}\right)^2} \quad \cdots (1)$$

In the above equation, Z_0 is the impedance of the free space, ϕ is phase difference between unit cell, c is the speed of light, a is the width of the unit cell and w is eigenfrequency of the unit cell. The calculated result show that by varying the parallel capacitances, the surface reactance can be modulated with simulated eigenfrequencies and this leads to a succesful design of SMRS antenna.

Ⅲ. Conclusion

In this paper, a new unit cell model using parallel capacitors for SMRS antenna was suggested and the feasibility of the idea was verified via simulated results.

Acknowlegement

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References

[1] A. M. Patel and A. Grbic, "A printed leaky-wave antenna based on a sinusoidally modulated reactance surface," *IEEE Trans. Antennas Propag.*, vol. 59, no. 6, pp. 2087-2096, Jun. 2011.