



8th International Congress of Information and Communication Technology, ICICT 2019
Analysis of Implementation Methods of Left and Right Handed
Transmission Lines in Antenna Array

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Abstract

The left and right hand transmission lines have dual/multiple frequency characteristics, wideband phase shifting characteristics, miniaturization characteristics, and zero/negative order resonance characteristics, and the antenna array can be realized based on these characteristics of the right and left hand transmission lines. Here, the application of the left and right hand transmission lines in the antenna array is summarized.

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Selection and peer-review under responsibility of the 8th International Congress of Information and Communication Technology, ICICT 2019.

Keywords: Left and right handed transmission line, antenna array;

1. Introduction

At present, the application research of the left and right hand transmission lines in the antenna feeder system is mainly concentrated on the antenna unit and the single microwave device. On the antenna array and the array feeder

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The paper was supported by the National Natural-Science Foundation of China (Grant No. 61701527, 61601499) and the National Natural-Science Foundation of Shaanxi Province (Grant No. 2018JQ6023).

system, the corresponding literature reports are few. The research team of the University of Science and Technology of China has done a lot of work in this area.

2. Implementation Method Analysis

In [1], the L-band 4×4 hand microstrip antenna array is designed by the interdigitated left-right hand transmission line. Since the cross-type left and right hand microstrip antennas are small in size, they can be placed in the same array area compared with the traditional rectangular microstrip antenna. Put more left and right hand antenna units, as shown in Figure 1, under the same area, you can place a uniform amplitude feeding of 24 yuan traditional microstrip antenna array and 40 yuan miniaturized interdigitated left and right hand microstrip antenna array, left and right hand microstrip antenna The gain of the array is 3dB higher than that of the traditional microstrip antenna array. In [2], a phased array antenna with 4-element planar series feed is designed based on the left and right hand transmission line phase shifter. As shown in Fig. 2, the left and right hand transmission lines are used as the feed network. The phased array antenna can realize continuous scanning, and has a wide scanning angle compared with the leaky wave antenna of the right and left hand transmission line itself as a radiation unit, and the phased array antenna has small volume, small beam tilt in the edge direction direction, and is simple and easy to manufacture. Advantages such as integration; the literature [3] proposes a cross-shaped left and right hand transmission line unit, and combines the left and right hand transmission lines and the squall line to compensate each output port due to the traditional right The phase difference caused by the different lengths of the feeders is designed as a series feed network of 20-element antenna arrays operating in the same phase as the X-band, as shown in Fig. 3. The literature [4] proposes a new type of micro-feed with left and right hand transmission lines. With an array antenna, as shown in Figure 4, the antenna utilizes the phase lead characteristic of the left-hand transmission line to compensate the phase lag of the right-hand transmission line, thereby ensuring the in-phase feeding between the antenna elements and avoiding the antenna beam bias caused by the phase delay. The antenna gain is further improved. Compared with the same type of antenna, the antenna has the advantages of small size, frequency bandwidth and simple design of the feed network. The literature [5] proposes a novel series feed based on the left and right hand transmission lines. The dual-line polarized microstrip array antenna structure realizes vertical polarization and horizontal polarization excitation of the antenna element by means of upper microstrip line feed and lower layer coupling feeding, respectively, thereby enabling the antenna unit to have high polarization isolation. Degree, low cross-polarization and wide-band operation, and use the combination of right-hand microstrip transmission line and left-hand microstrip transmission line to achieve zero phase delay. The series feeding of microstrip antenna arrays is now available. In [6], the phase advance characteristics of the left and right hand transmission lines are used to propose a novel feeding network for microwave and millimeter wave system antenna arrays. As shown in Fig. 5, the feeding network can be based on The design needs to adjust the phase difference between the antenna array units, thereby controlling the deflection of the radiation pattern of the antenna array, and the feeding network has the advantages of simple structure and small loss.

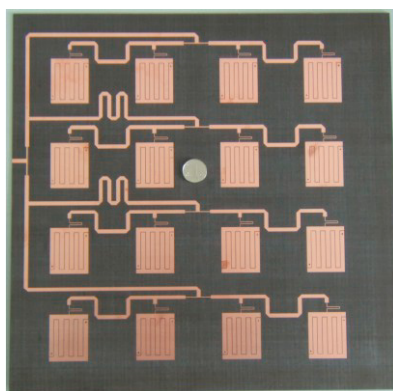


Fig. 1 Antenna array reported in [1]

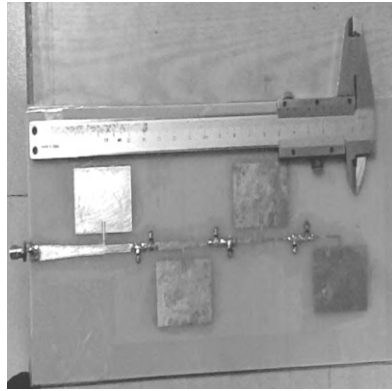


Fig. 2 Antenna array reported in [2]

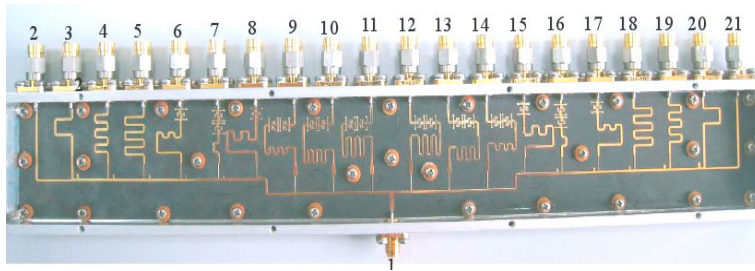


Fig. 3 Array feeder system reported in [3]

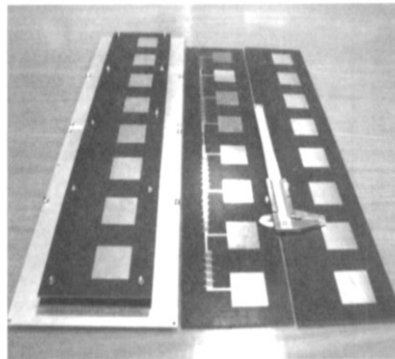


Fig. 4 Antenna array reported in [4]

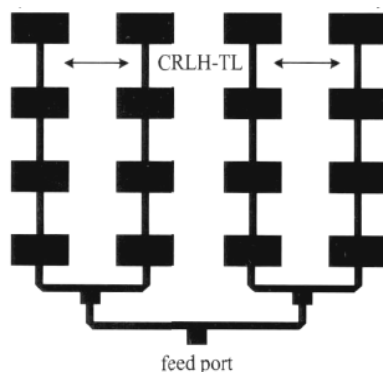


Fig. 5 Antenna array reported in [6]

3. Conclusion

The left and right hand transmission lines have dual/multiple frequency characteristics, wideband phase shifting characteristics, miniaturization characteristics, and zero/negative order resonance characteristics, and the antenna array can be realized based on these characteristics of the right and left hand transmission lines. At present, the application research of the left and right hand transmission lines in the antenna feeder system is mainly concentrated on the antenna unit and the single microwave device. On the antenna array and the array feeder system, the corresponding literature reports are few. Here, the application of the left and right hand transmission lines in the antenna array is summarized.

4. Acknowledgement

The paper is supported by the National Natural-Science Foundation of China (Grant No. 61701527, 61601499) and the National Natural-Science Foundation of Shaanxi Province (Grant No. 2018JQ6023).

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