Circular polarization and wideband filtering function switching device based on metasurface

Yulin Liang, Mingsong Chen, Lin Peng, Zihan Li, Shuo Tian
Guangxi Key Laboratory of Precision Navigation Technology and Application, Guilin University of Electronic Technology, Guilin, 541004, Guangxi, China

INTRODUCTION

This article proposes a switchable metasurface device with dual functions of circular polarization and filtering. The device unit structure consists of two layers of dielectric substrates, three layers of metal surface and two PIN diodes. The simulation results show that by simultaneously controlling the ON and OFF states of the top and bottom PIN diodes, the metasurface device can achieve dual-function switching. When the two PIN diodes are OFF, the metasurface can realize wideband filtering. When the PIN diodes are turned ON at the same time, the metasurface has a line-to-circular polarization conversion function.

SIMULATION

The device is excited by the y-polarized wave propagating in the -z direction, and the simulation results are shown in Fig. 2. When the PIN diodes on the top and bottom layers of the metasurface are not biased (OFF), the proposed metasurface device has a broadband filtering function. The $S_{11}$ parameter curve has two resonance points at 3.32 GHz and 3.63 GHz in the operating frequency, and the operating bandwidth below -10 dB is 3.22–3.72 GHz.

CONCLUSION

In summary, we propose a metasurface device with switchable circular polarization and wideband filtering functions. The metasurface is a multi-layer structure, and PIN diodes are flexibly embedded. When a bias voltage (ON state) is applied to the top and bottom PIN diodes of the device, it can realize wideband line-to-circular polarization conversion. When the top and bottom PIN diodes are in the OFF state, the metasurface device can realize the wideband filtering function. The dual-function switching feature of the metasurface is very suitable for wireless communication systems.