

Modern Antenna

Junping Geng · Chaofan Ren ·  
Kun Wang · Han Zhou · Jing Zhang

# Spoof Surface Plasmon Polaritons Antenna

 Springer

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Junping Geng  
Department of Electronic Engineering  
Shanghai Jiao Tong University  
Shanghai, China

Chaofan Ren  
Department of Electronic Engineering  
Shanghai Jiao Tong University  
Shanghai, China

Kun Wang  
Department of Electronic Engineering  
Shanghai Jiao Tong University  
Shanghai, China

Han Zhou  
Department of Electronic Engineering  
Shanghai Jiao Tong University  
Shanghai, China

Jing Zhang  
Department of Electronic Engineering  
Shanghai Jiao Tong University  
Shanghai, China

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ISBN 978-981-16-4720-8

ISBN 978-981-16-4721-5 (eBook)

<https://doi.org/10.1007/978-981-16-4721-5>

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# Preface

With the continuous development of communication science and technology and the increasing demand of society, wireless communication technology is developed rapidly. As the bottleneck of wireless transmission system, antenna has also been paid much attention. Different antennas are used in different communication systems to satisfy different application environments and performance requirements.

Recently, spoof surface plasmon polaritons (SSPPs) have been proposed in microwave band in view of the surface plasmon polaritons (SPPs) in optics. Due to their small loss, deep subwavelength, tunable dispersion and conformality, SSPPs has unique advantages in miniaturization and high integration. SSPPs have been combined with other techniques to design a variety of excellent microwave RF devices, such as filters, transmission lines and power dividers. At the same time, the strong binding of SSPP structure to waves and the slow wave characteristics have also been applied to design the antenna. Antennas based on SSPPs have performed many advantages such as high gain, low profile, miniaturization and broadband. However, there are few books about SSPPs antenna principle and practical engineering applications, and there is no systematic theory and summary.

Based on the existing research of Prof. Junping Geng of Shanghai Jiao Tong University, this book analyzes the working mechanism of SSPPs and introduces the working principle and radiation characteristics of directional antenna, omnidirectional antenna, reconfigurable antenna and phase-mode antenna based on SSPPs structure.

The content of this book includes the following nine aspects:

Firstly, the research background and significance of SSPPs are expounded, and the current research status at home and abroad based on SSPPs is shown. The advantages of SSPPs are summarized.

Secondly, the basic principles of SSPPs structure such as dispersion relation, transmission mode and RCS characteristics are introduced.

Thirdly, compacted antenna with multi-bands are needed, especially in the cases such as mobile communications or radar systems. Consequently, the multipole antenna research based upon SSPPs is carried out.

Most of the antennas on the basis of SSPPs work in the even mode, and few studies report the odd mode. Based on the existing research, the SSPPs terminal antenna with asymmetric feeding is analyzed in Chap. 4 and a broadband and efficient terminal antenna is designed.

In applications such as routers, antennas are usually expected to have high gain, horizontal omnidirectional characteristics. Hence, in Chap. 5, three kinds of low-frequency omnidirectional SSPPs antennas are introduced.

Then, in Chap. 6, in order to solve the problem of polarization and non-circularity of antenna pattern, a novel rotating SSPPs structure (R-SSPPs) is proposed. By studying its basic electromagnetic characteristics and combining it with different feeding methods, an end-emitting circularly polarized antenna and a side-ray polarized omnidirectional antenna are designed.

Even though the single side arms SSPPs structure was mounted vertically on the ground to realize end-fire radiation in odd mode, its profile at lower frequency band is still relatively large for conformal design, especially to combine the SSPPs antenna into the shell to load bearing on high-speed vehicle. Therefore, in Chap. 7, a method to decrease the profile of the vertical polarized antenna with special-shaped SSPPs structure, such as T-shaped and m-shaped SSPPs structures, is introduced.

In Chap. 8, a large-angle pattern reconfigurable antenna based on SSPPs is designed and optimized. Through a reconfigurable circuit controlled by PIN diodes, this antenna realizes the switching between the odd mode and even mode of SSPPs, so as to achieve the purpose of switching the radiation beam from broadside lobe to end-fire lobe.

Finally, a novel phase-mode SSPPs antenna with dual port is introduced, which can work in odd mode, even mode and mixed modes with the characteristic of spatial lobe scanning simply by varying the phase difference between the two ports of one antenna element.

Shanghai, China

Junping Geng

**Acknowledgements** The author would like to thank R. W. Ziolkowski, University of Technology Sydney, Global Big Data Technologies Centre, for several enlightening technical discussions. The author would also like to thank Prof. Ronghong Jin, University of Shanghai Jiao Tong University, for multi-discussion to the contents. The author would also like to thank Dong Wang, Kaijie Zhuang, Chaofan Ren, Erwei Liu, Kun Wang, Han Zhou, Xuxu Cheng, Jiawei Han, Weinan Gao, Jing Zhang, Silei Yang, Jingzheng Lu, Da Su and Yangzhou Zhang for their support and assistance during the manuscript preparing.

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