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# 基于开口环谐振器的微带带阻滤波器设计

## 摘 要

随着 5G 的即将普及，滤波器作为通信系统的重要器件，其性能的提高可以给整个通信系统的性能带来巨大提升。因此，滤波器如何减小尺寸、提升性能和降低成本，成为全世界专家和学者研究的热点。本文中设计了一种基于开口环谐振器的微带线带阻滤波器。由于采用了微带线结构，所以其拥有尺寸小、重量轻和性价比高等优点，从而为滤波器的小型化和低成本提供一种新的思路。

本文首先阐述了滤波器的研究背景，其包括滤波器的发展历史与研究方向。然后，第二章详细介绍了滤波器的性能指标和主要类型，从而使我们能进一步了解射频滤波器。第三章主要讲述了微带线的基础理论和半波长谐振器的两种结构。本文的第四章，在微带线谐振器基本理论的基础上，采用微带线结构设计了一款基于半波长开口环谐振器的带阻滤波器。通过引入交叉耦合，在阻带附近产生了三个传输极点，从而提高了阻带的频率选择性，并改善了带阻滤波器的性能。最后，使用 HFSS 软件对该设计进行建模和仿真，文中给出了仿真结果。通过对仿真结果进行分析和对尺寸进行优化，最终设计出符合要求的带阻滤波器。

**关键词：**开口环谐振器，带阻滤波器，微带线，HFSS

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## ABSTRACT

With the coming popularization of 5G, as an important component of communication system, the performance of the filter can improve the performance of the whole communication system. Therefore, how to reduce the size, improve the performance and reduce the cost of filters has become the focus of experts and scholars all over the world. In this paper, a microstrip line band-stop filter based on open loop resonator is designed. Because of the microstrip structure, it has the advantages of small size, light weight and high performance-price ratio, thus providing a new idea for the miniaturization and low cost of the filter.

Firstly, this paper introduces the research background of filters, including the development history and research direction of filters. Then, in chapter 2, the performance index and main types of RF filters are introduced in detail, so that we can know more about RF filters. In the third chapter, the basic theory of microstrip line and the structure of half-wavelength resonator are introduced. In the fourth chapter, based on the basic theory of microstrip resonator, a band-stop filter based on half-wavelength open-loop resonator is designed by using microstrip structure. By introducing cross-coupling, three transmission poles are generated near the stopband, which improves the frequency selectivity of stopband and the performance of the stopband filter. Finally, the design is modeled and simulated with HFSS software, and the simulation results are given. Through the analysis of the simulation results and optimization of the size, a band-stop filter is finally designed.

**Keywords:** Open ring resonator, Band-stop filter, Microstrip line, HFSS

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