# 以微帶線環型共振腔
# 設計具有微小化寬截止頻帶帶通濾波器

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## 摘要

本論文提出兩種微小型帶通濾波器的設計。第一種濾波器的設計是在方環型諧振腔的四邊中心加上電容性負載的箭頭型殘段，這些電容性負載所造成的慢波效應，使得諧振腔的基頻($f_0$)可以降到比傳統均勻阻抗環型諧振腔的基頻還低的頻率點，達到縮小諧振腔總面積為傳統環型電路的 50%以下的目的。第二種結構則是引入步階阻抗的結構在環型諧振腔中，形成週期性步階阻抗環型諧振腔。利用週期性步階阻抗諧振腔的共振特性，並適當的安排諧振腔的結構參數，可降低諧振腔基頻，進而縮小諧振腔面積為傳統環型電路的 40% 以下。同時，步階阻抗環型諧振腔亦具有將諧波(虛假響應)頻率拉高的特性，因此得以加寬上截止頻帶，達到 3.7 倍中心頻以上。本論文亦實作數個電路，以資驗證。量測結果顯示與模擬結果相當一致。

# Design of Microstrip Ring Resonator Bandpass Filters with a Miniaturized Area and Desirable Upper Stopband Characteristics

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## Abstract

An optimal ring resonator and a new square loop resonator are proposed for designing miniaturized dual-mode bandpass filters. In the first resonator, the center of each side of the loop resonator is tapped with a capacitive arrow-shape open stub. The whole resonator encloses four coupled compact miniaturized hairpin resonators. The slow-wave effect caused by the capacitively load can reduce the fundamental frequency of the loop resonator. As a result, this miniaturized loop resonator can be used to synthesis a miniaturized dual-mode bandpass filter. In the second resonator, the fundamental frequencies and higher order resonant harmonics of ring resonators with different numbers of impedance steps

are analyzed against the length and impedance ratios of the hi-*Z* and low-*Z* segments. It is found that the optimal numbers of impedance steps and length can be obtained for a given hi-*Z* to low-*Z* impedance ratio to minimize the filter size and maximize the upper rejection bandwidth. Both the proposed bandpass filters not only have good spurious-free performances, but also achieve more than 50% size reductions, as compared with a conventional dual-mode ring bandpass filter. The measured results show a good match with the simulated responses.

# Acknowledgement

# 致謝

能順利的完成論文首要感謝指導老師，郭仁財教授。經過郭老師兩年的辛勤指導，使我對微波工程的領域有更深一層了解，以及學習到做研究的方法與態度。此外，感謝口試委員:徐敬文教授、鍾世忠教授和謝榮展教授，對學生論文提出指導並且提供寶貴建議。

感謝從小到大都一直不斷給我鼓勵和支持的爸媽還有妹妹，你們的愛一直是我在心情低落時，令我復原的原動力。感謝兩年來一起在實驗室為同一目標奮鬥的成員： 程式高手大學長符穎、分享寶貴經驗談的國生學長與慶陸學長、供我心靈食糧的孟駿學長、新好男人竣南學長以及供我搭便車的逸群學長。最後感謝自強、小胖、啟興的相互勉勵，還有文書處理高手萬信學長的技術指導。特別感謝實驗室一群可愛的學弟： 陪我玩吉他的富傑、陪我打彈珠的孟桓、報我好電影看的得佑以及五四三懂一堆的森豪。謝謝大家。

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