Accepted Manuscript

Regular paper

High-Selectivity Single-Ended and Balanced Bandpass Filters Using Ring Resonators and Coupled Lines Loaded with Multiple Stubs

Kai Da Xu, Zekai Luo, Yanhui Liu, Qing Huo Liu

PII: S1434-8411(18)30682-4
DOI: https://doi.org/10.1016/j.aeue.2018.09.021
Reference: AEUE 52500

To appear in: *International Journal of Electronics and Communications*

Received Date: 21 March 2018
Revised Date: 11 August 2018
Accepted Date: 19 September 2018

Please cite this article as: K. Da Xu, Z. Luo, Y. Liu, Q. Huo Liu, High-Selectivity Single-Ended and Balanced Bandpass Filters Using Ring Resonators and Coupled Lines Loaded with Multiple Stubs, *International Journal of Electronics and Communications* (2018), doi: https://doi.org/10.1016/j.aeue.2018.09.021

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

High-Selectivity Single-Ended and Balanced Bandpass Filters Using Ring Resonators and Coupled Lines Loaded with Multiple Stubs

Kai Da Xu*, Zekai Luo, Yanhui Liu, and Qing Huo Liu

***Abstract*—High-selectivity single-ended and balanced bandpass filters (BPFs) using dual-mode ring resonators and coupled lines loaded with multiple stubs are proposed in this paper. With the help of the loaded short-circuited and open-circuited stubs, six deep transmission zeros (TZs) from 0 to $2f_0$ (f_0: center frequency of the passband) can be realized in both of single-ended and balanced BPFs to improve the stopband suppressions. The functions of the loaded short/open stubs and calculated analysis of TZs' positions have been presented. For further demonstration, two examples of single-ended BPF and balanced BPF with high common-mode suppression are designed and fabricated, whose center frequencies are both at 2.1 GHz. Their measured 3-dB fractional bandwidths are 23.7% and 24.7% (differential-mode), respectively. The simulated results and measurements of these two filters are in good agreement.**

***Keywords*—Balanced bandpass filters, high-selectivity filters, ring resonators, parallel-coupled lines, transmission poles, transmission zeros.**

I. Introduction

High-performance components and circuits are extensively desirable in the modern radio-frequency and microwave wireless communication systems. These components mainly include active circuits such as power amplifiers [1] and passive circuits such as power dividers [2] and bandpass filters (BPFs) [3]-[5]. The design of the BPFs is indispensable to meet the specific demands of consumer electronics and industrial applications. Recently, many planar BPFs with low insertion losses in the passbands and high out-of-band rejections have been reported using signal-interference techniques [6]-[7], stub loaded techniques [8]-[9], substrate integrated waveguide [10] and so on.

Additionally, balanced BPFs have more advantages of noise immunity and low electromagnetic interference in wireless communication systems compared with their single-ended counterparts [11]. Numerous planar balanced BPFs with differential-mode (DM) filtering characteristic and common-mode (CM) suppression have been proposed in [12]-[21]. In [12], a fourth-order differential BPF using four folded stepped-impedance resonators is presented with extended upper stopband. Moreover, balanced filters with different configurations are introduced by using multilayer structure [13], ring resonators [14], coupled line scheme [15], stub loaded structures [16][17], and combined structures of coupled lines and stubs [18]-[20].

In this paper, a new high-selectivity single-ended BPF using dual-mode ring resonator and coupled lines loaded with open and short stubs is proposed based on the ring resonator filter in [22]. With this simple modification, the filter performance is improved, where four transmission poles (TPs) and six transmission zeros (TZs) can be realized. The analytical and accurate design equations for TPs and TZs are deduced using the transmission line theory. Then, based on the single-ended BPF structure, a balanced BPF circuit with high-selectivity DM filtering characteristic and high CM suppression is presented. The detailed analysis procedure, numerical calculation, and experimental measurements are demonstrated.

II. The Proposed Single-Ended BPF

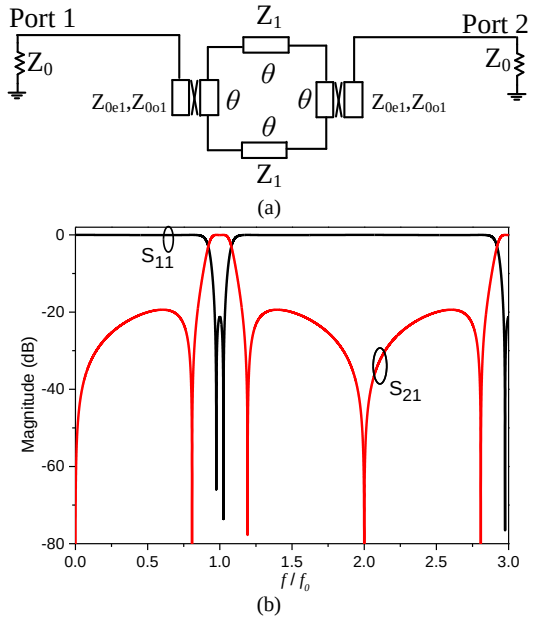

Fig. 1. (a) Ideal circuit of bandpass filter using a conventional dual-mode ring resonator, and (b) its S-parameter simulated results.

This work was supported in part by the National Natural Science Foundation of China under Grant 61601390 and in part by the Shenzhen Science and Technology Innovation Project under Grant JCYJ20170306141249935.

*K. D. Xu, Z. Luo, and Y. Liu are with the Department of Electronic Science, Xiamen University, Xiamen 361005, and also with the Shenzhen Research Institute of Xiamen University, Shenzhen 518057, China. (*e-mail: kaidaxu@xmu.edu.cn)

Q. H. Liu is with the Department of Electrical and Computer Engineering, Duke University, Durham, NC 27708, USA.

Download English Version:

https://daneshyari.com/en/article/11028118

Download Persian Version:

https://daneshyari.com/article/11028118

Daneshyari.com