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Design of Stubs Loaded SIR Filters by Reflection Coefficient Analysis

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Abstract: In this paper, a new method for designing stubs loaded SIR filter is presented. We can calculate the reflection coefficient of stubs loaded resonator directly by converting the admittance to input terminal. This method replaces the transmission matrix and even-mode and odd-mode analysis. Then, genetic algorithm (GA) is applied to search the corresponding electrical parameters, which provides a more effective and intuitive way to design filters. Then, an ultra-wideband bandpass filter using short-stub loaded SIR is realized, which exhibits a good frequency selectivity from 3.1 GHz to 10.4 GHz. In addition, by applying this method, a dual-passband filter with short and open stubs is achieved. It contains two wide bands at 2 GHz and 5.8 GHz, which concerns the frequencies of GPS and WLAN. Meanwhile, the sizes of these filters are further minimized by bend structure. Finally, the filters are manufactured. As a result, the measured results are in good agreement with the calculated ones. These filters exhibit great frequency-selection characteristics: flat passbands and extremely sharp rejections around the passband. So, based on the verifications of the manufactured filters, this method can be widely used in microwave filter design field.

Keywords: Stepped-impedance resonator (SIR), reflection coefficient, short and open stubs.

1. Introduction

With the rapid developments of modern wireless and mobile communication system, microstrip filters play an important role in microwave front ends. In recent years, stepped impedance resonators are widely used in designing filters. In [1-2], bandpass filters with high performance are proposed based on SIR. These two filters achieve a sharp rejection and spurious suppression. In [3-5], wideband bandpass and bandstop filters using stepped impedance resonators have been realized. In [6-7], short and open stubs are used to design a wideband filter. Furthermore, the stubs loaded SIR can provide a wider passband. Thus, many microstrip UWB bandpass filters are designed in this way in [8-13]. In addition, in [14-16], the stepped impedance resonator (SIR) is widely used to design a dual-passband filter. Meanwhile, in [17-20], more research about designing filters using stubs loaded SIR has been proposed. However, in these methods, when we use the SIR, we need to derive the transmission matrix of it. Then the resonant frequency can be obtained when the input admittance equals zero. After we add