RECENT INNOVATION IN DESIGN AND ANALYSIS OF MULTI-BANDPASS FILTERS USING OPEN LOOP RESONATOR

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Abstract: As the ongoing popularity of the communication industry is being made rapidly, the necessity of optimized-performing filters is rapidly increasing. These filters applied in RF sections require minimum size, optimized output, easy design and minimum attenuation in pass band and high rejection at reject band. Microwave band reject filters do a crucial job in new multi-communication applications. Open-loop resonators are efficiently and suitably used in band pass filters and band reject filters. Now a days, multi-standard wireless propagation model requires multi-band performing transceivers. Besides the multi-band function, higher output and minimum size are required significance for band pass filters. Open multi stubs are structured enabling transmission zeros which signifies differentiating pass bands. Stepped-impedance resonators (SIRs) are applied for designing dual-band pass filters by minutely comparing impedance proportion and electrical length of SIRs. In this paper, multi-band band pass filter is being proposed using multi-reject band resonator. The relevant concept and new designs of filters are being introduced with relevant facts using HFSS software.

New Design Description:

I. (Design of a single armed resonator having an opposite armed pair structure)

In this design, a single armed resonator is designed with an opposite arm pair. The required filter is designed by using Ansoft HFSS software and is implemented on the substrate with relative dielectric constant of 3.38 and thickness of 0.813 mm.

Filter characterization

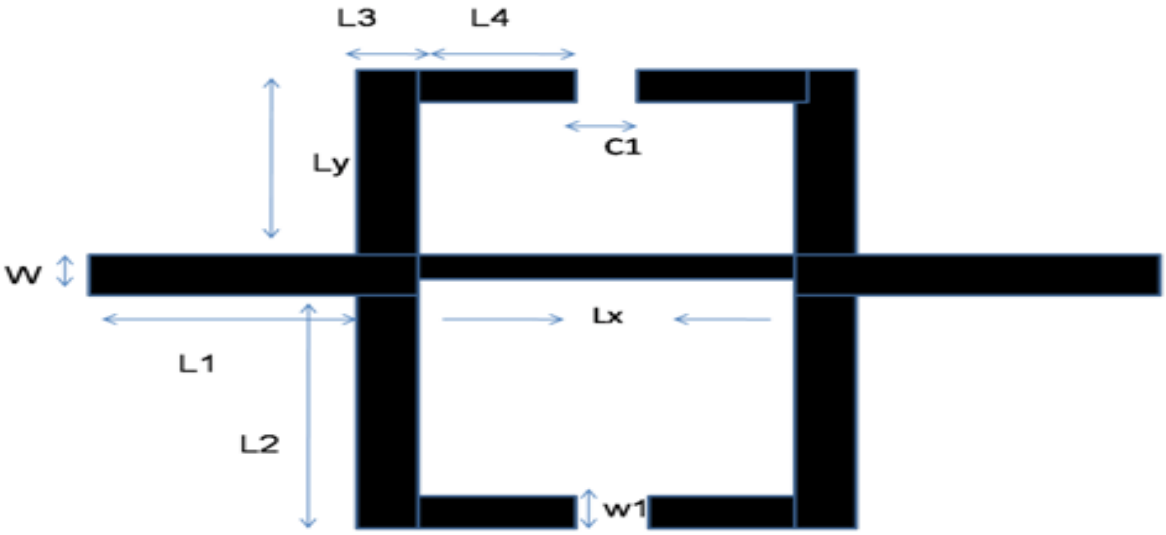


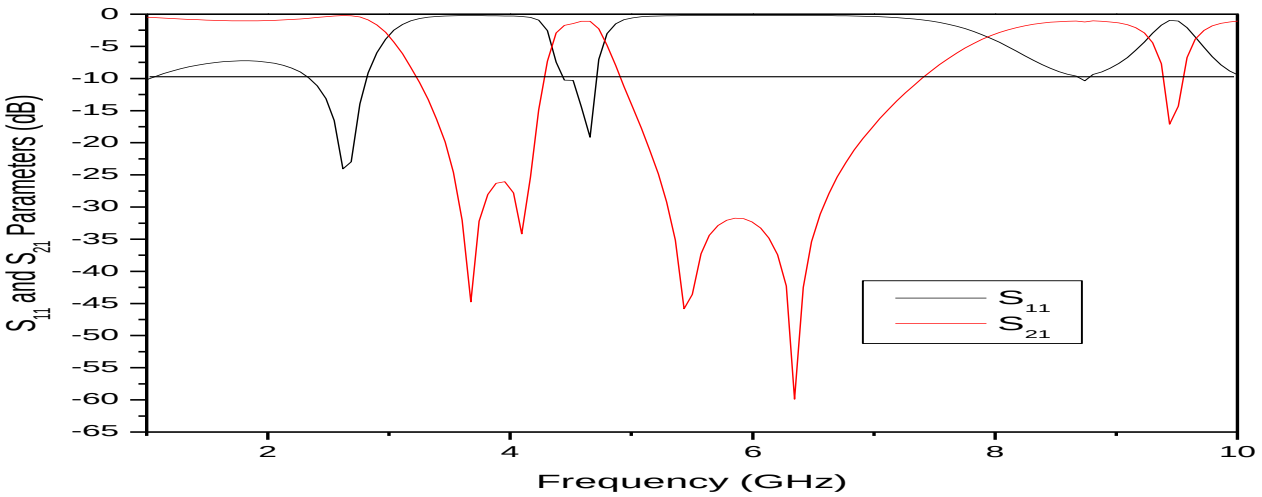
Figure 1 (a) Geometry of a single armed resonator having an extra opposite arm pair

In addition to the original single arm pair resonator, an opposite arm pair is designed. The required dimensions of the filter are as follows: L1= 8 mm, L2= 9.3 mm, L3=1mm, L4=2.52 mm, Lx=6mm, Ly=6.7 mm, w = 1.92 mm, w1=1 mm, c1= 0.96 mm. Designs of the proposed multi-band pass filters are designed on Neltec NH9338 (tm) substrate.

Simulated Results

An opposite armed pair performance is designed, and measured. It is applied on a substrate with relative permittivity of 3.38 and thickness of 0.813. Some exceptions between simulated and measured results may be due to unexpected tolerances in fabrication, material parameters and soldering.

Optimized Results



A single transmission band is resulted for a single arm pair with another opposite armed pair resonator.

II. (Design of a different double armed resonator structure)

In this design, a different double armed pair resonator is designed. The required filter is designed by Ansoft HFSS software and is implemented on the substrate with relative dielectric constant of 3.38 and a thickness of 0.813 mm.

Filter characterization

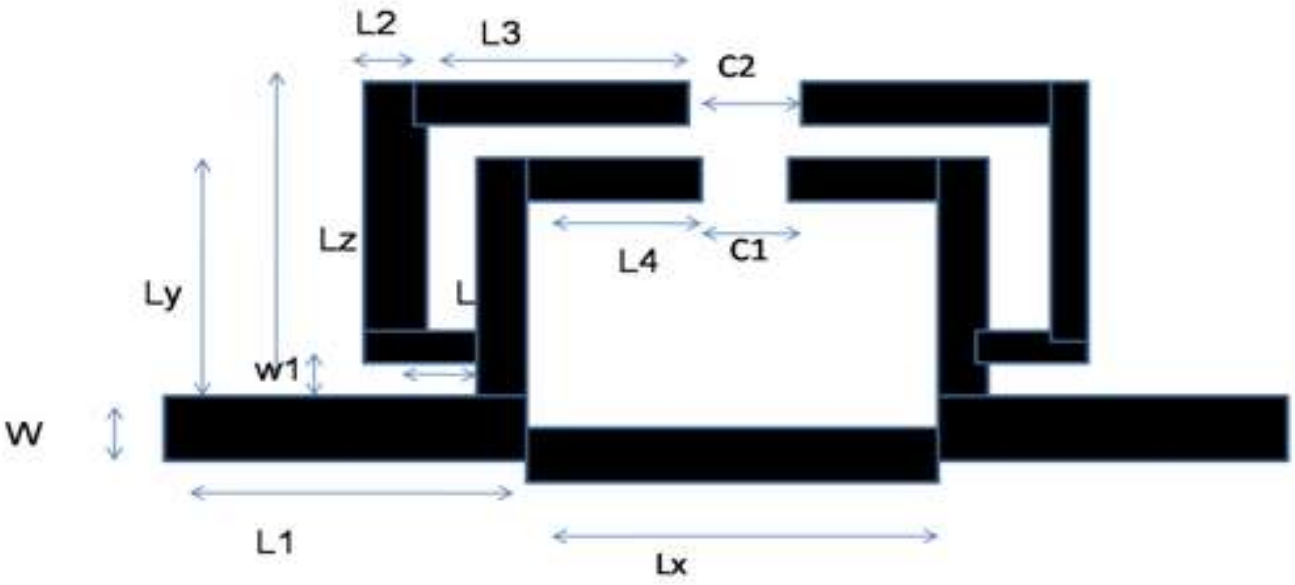


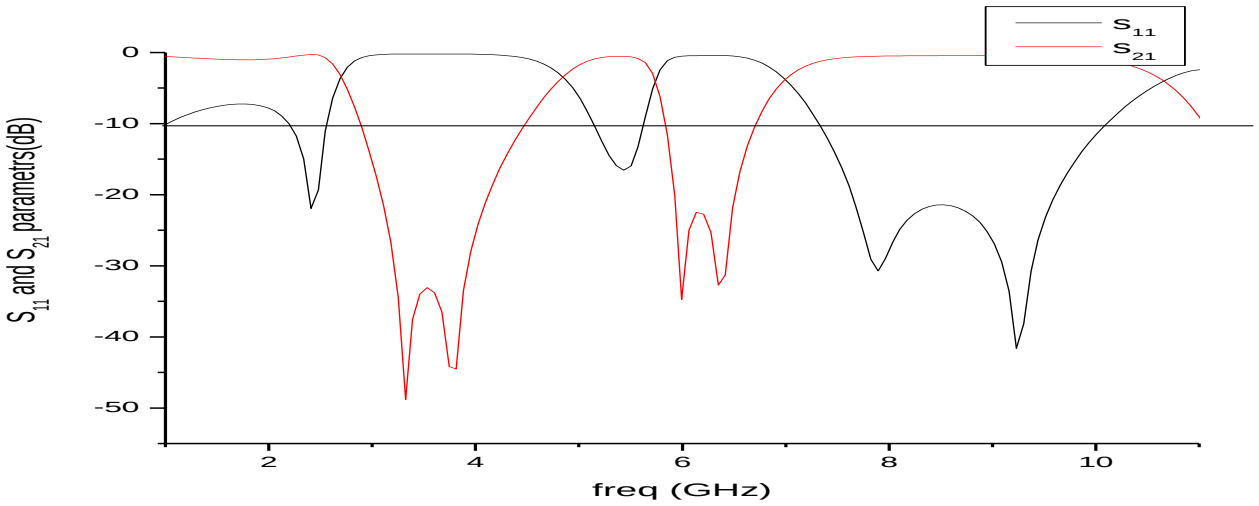
Figure 1 (b) Geometry of a different double armed resonator

The dimensions of the filter are as follows: L1= 8 mm, L2=1mm, L3=4.32mm, L4=2.52 mm, Lx=6mm, Ly=5.78 mm, Lz =6.58mm, L=0.8mm, w = 1.92 mm, w1=1 mm, c1= 0.96 mm, c2=1.36mm. Designs of the multi-band pass filters are designed on Neltec NH9338 (tm) substrate.

Simulated Results

A different double armed pair performance is designed and measured. It is applied on substrate with relative permittivity of 3.38 and thickness of 0.813. Some exceptions between expected and measured results may be caused by unexpected tolerances in fabrication, material parameters and soldering.

Optimized Results



Two transmission bands are resulted for a double arm pair resonator.

III. (Design of a different triple armed resonator structure)

In this section, a different triple armed pair resonator is designed. The required filter is designed using Ansoft HFSS software and is implemented on the substrate with relative dielectric constant of 3.38 and a thickness of 0.813 mm.

Filter characterization

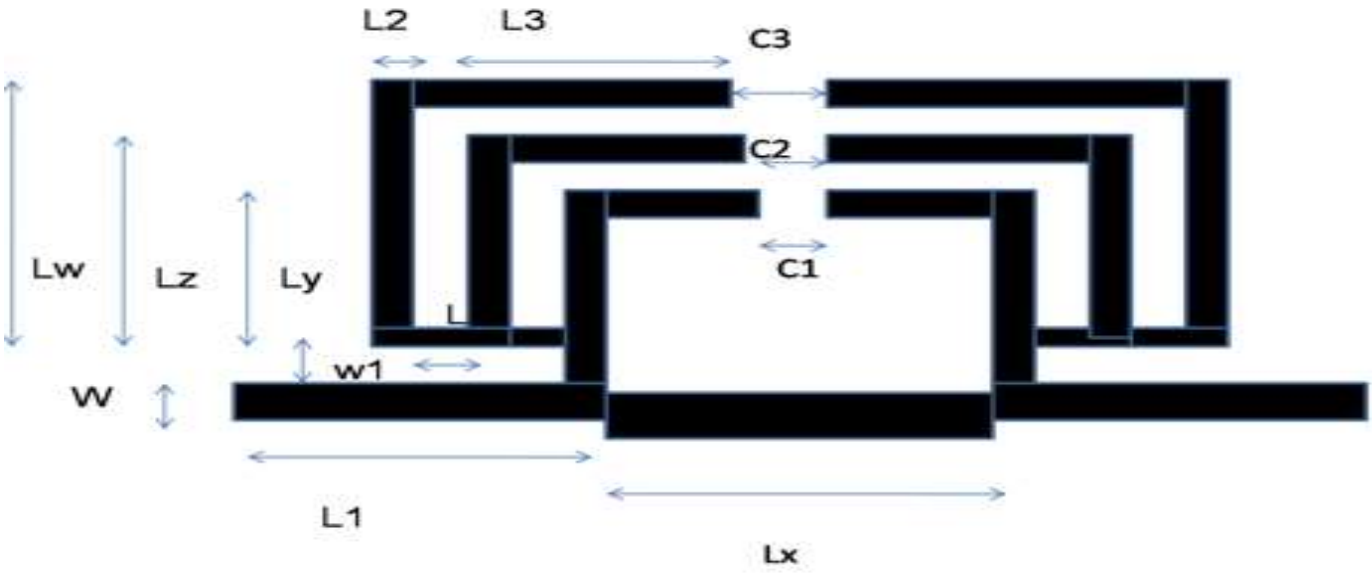


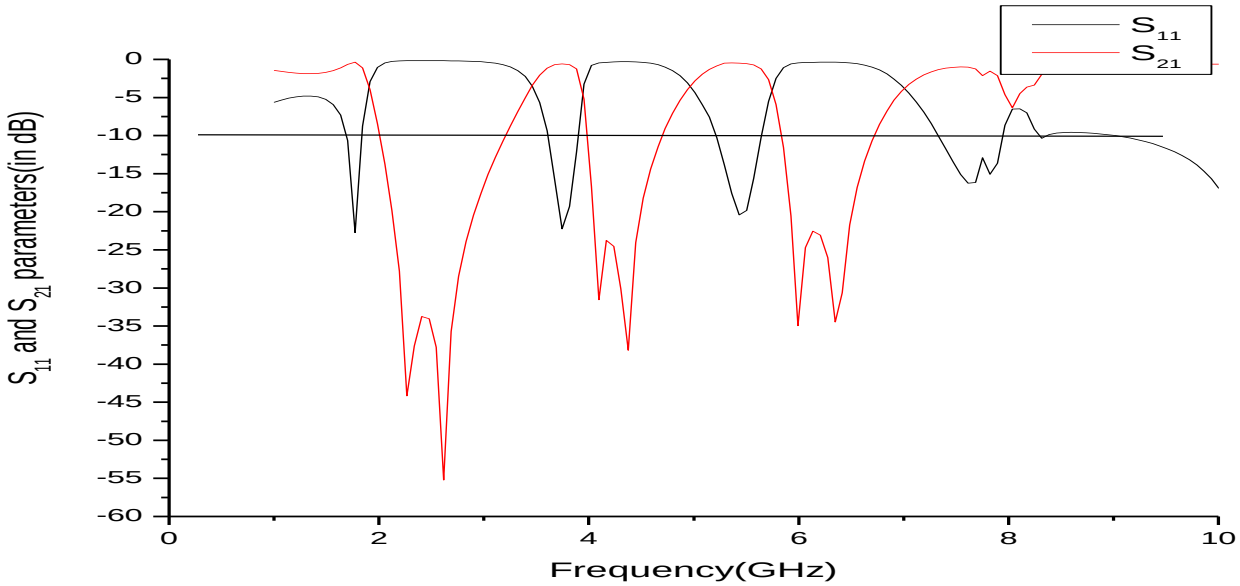
Figure 1 (c) Geometry of a different three armed resonator

The dimensions of the filter are as follows: L1= 8 mm, L2=1mm, L3=6.12mm, Lw=8.38 mm, Lx=6mm, Ly=5.78 mm, Lz =6.58mm, L=0.8mm, w = 1.92 mm, w1=1 mm, c1= 0.96 mm, c2=1.36mm, c3=1.76mm. Samples of the multi-band pass filters are structured on Neltec NH9338 (tm) substrate.

Simulated Results

A different triple armed pair performance is designed and measured. It is applied on substrate with relative permittivity of 3.38 and thickness of 0.813. Some exceptions between expected and measured results may be caused by unexpected tolerances in fabrication, material parameters and soldering.

Optimized Results



Three transmission bands are resulted for a different triple arm pair resonator.

Conclusion

New types of multi-band pass filters have been designed. Three distinct filter geometries have been applied to verify and examining the probability of adding the number of transmission bands by adding the amount of resonator arm pairs. Designing those three structures in a different way resulted in "N arm pairs creating N band pass transmission bands".

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