RF Circuits and Systems

Impedance Matching

Pere Palà

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In this lab session we will investigate some matching networks and we will find out their advantages and disadvantages.

We will start building a specific load impedance. Next, we will synthesize some matching networks making use of short sections of transmission lines. If you have worked out some of the exercises, you may save some work here.

> Attention: Please do not forget to have some printed Smith Charts available during the session.

1 Load Impedance

We will start building a specific load impedance. Next, we will build some matching networks making use of short sections of transmission lines. If you have worked out some of the exercises, you may save some work here.

> *Previous work* 1. Making use of lumped components (R, L, C) synthesize 4 different networks that exhibit an input impedance of $20 + j80\ \Omega$ at a frequency of 1 GHz.

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> *Previous work* 2. Making use of lumped components (R, L, C) synthesize 4 different networks that exhibit an input impedance of $100 - j80\ \Omega$ at a frequency of 1 GHz.

2 Matching Networks

We will start building a specific load impedance. Next, we will build some matching networks making use of short sections of transmission lines. If you have worked out some of the exercises, you may save some work here.

Previous work 3. Considering that we are working in the vicinity of 1 GHz, design several matching networks (to 50 Ω) for each of the aforementioned loads. Leave the line lengths in terms of the wavelength λ.

3 The Double Stub Matching Network

The double-stub matching technique is another technique that is more flexible in practice than the single-stub technique and the $\lambda/4$ transformer approach.

Have a look at the explanation given in `http://cnx.org/content/m1066/latest/`. Follow the explanation with your own printed copy of a smith chart.

We will start building a specific load impedance. Next, we will build some matching networks making use of short sections of transmission lines. If you have worked out some of the exercises, you may save some work here.

Previous work 4. Design a double stub matching network for a load of $20 + j80$ Ω. The objective is to achieve 50 Ω and the transmission lines exhibit a characteristic impedance $Z_0 = 50$ Ω

4 Qucs

Have a detailed look at the Qucs for RF tutorial that is available in the OCW!

Lab task 1. Using Qucs, evaluate the input impedance of the loads that you have designed in the previous work items 1 and 2. The input impedance should be as expected at 1 GHz and will change (slightly) for 1.05 GHz and 0.95 GHz.

Lab task 2. Simulate some of the matching networks that you have designed. Use microstrip transmission lines for the matching network and experiment with different implementations of the loads.