Chapter 5 - Impedance Matching and Tuning

One of the most important and fundamental two-port networks that microwave engineers design is a **lossless matching network** (otherwise known as an **impedance transformer**).

HO: Matching Networks

Q: *In microwave circuits, a source and load are connected by a **transmission line**. Can we implement matching networks in transmission line circuits?*

A: **HO: Matching Networks and Transmission Lines**

Q: *These matching networks seem too good to be true—can we **really** design and construct them to provide a **perfect** match?*

A: We can **easily** provide a **near** perfect match at **precisely one frequency**.

But, since lossless matching and transmission lines are made of entirely r**eactive elements** (not to mention the reactive components of source and load impedance), we find that **changing** the frequency will typically "**unmatch**" our circuit!

Thus, a difficult challenge for any microwave design engineer is to design a **wideband** matching network—a matching network that provides an "**adequate**" match over a wide range of frequencies.

Generally speaking, matching network design requires a **trade-off** between these for desirable attributes:

1. Bandwidth
2. Complexity
3. Implementation
4. Adjustability

5.1 – Matching with Lumped Elements

Reading **Assignment**: *pp. 222-228*

Now let's begin to examine how matching networks are **built**!

We begin with the **simplest** solution: An **L-network**, consisting of a **single capacitor** and a **single inductor**.

Q: *Just **two** elements! That seems simple enough. Do we **always** use these L-networks when constructing lossless matching networks?*

A: Nope. L-networks have **two** major drawbacks:

1. They are narrow-band.

2. Capacitors and inductors are difficult to make at microwave frequencies!

Now, let's see how these L-networks actually **work**:

HO: L-Network Analysis