

EECS 723-Microwave Engineering

Teacher: *"Bart, do you even know your multiplication tables?"*

Bart: *" Well, I know of them".*

Like Bart and his multiplication tables, many electrical engineers know **of** the concepts of microwave engineering.

Concepts such as characteristic impedance, scattering parameters, Smith Charts and the like are familiar, but often we find that a **complete, thorough and unambiguous** understanding of these concepts can be somewhat lacking.

Thus, the goals of this class are for **you** to:

1. Obtain a complete, thorough, and unambiguous understanding of the fundamental concepts on microwave engineering.
2. Apply these concepts to the **design and analysis** of useful microwave devices.

Almost all the devices we study will be both **linear and time-invariant**. Thus, almost all our analysis will have at its root the **mathematics** of linear, time-invariant systems.

Certainly, **all** electrical engineers know of linear systems theory. But, it is helpful to first **review** these concepts to make sure that we all understand **what** this theory is, **why** it works, and **how** it is useful.

First, we must carefully **define** a linear-time invariant system.

HO: THE LINEAR, TIME-INVARIANT SYSTEM

Linear systems theory is useful for microwave engineers because most **microwave devices and systems are linear** (at least approximately).

HO: LINEAR CIRCUIT ELEMENTS

The most powerful tool for analyzing linear systems is its **eigen function**.

HO: THE EIGEN FUNCTION OF LINEAR SYSTEMS

Complex voltages and currents at times cause much **head scratching**; let's make sure we know what these complex values and functions **physically** mean.

HO: A COMPLEX REPRESENTATION OF SINUSOIDAL FUNCTIONS

Signals may **not** have the explicit form of an eigen function, **but** our linear systems theory allows us to (relatively) easily analyze this case as well.

HO: ANALYSIS OF CIRCUITS DRIVEN BY ARBITRARY FUNCTIONS

If our linear system is a linear **circuit**, we can apply **basic circuit analysis** to determine all its **eigen values**!

HO: THE EIGEN SPECTRUM OF LINEAR CIRCUITS