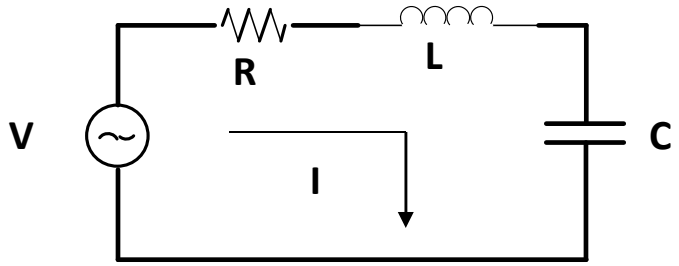
Lecture 7
Impedance matching & power transfer

Reference:
"bible" of RF circuit design:
Thomas H. Lee "The design of CMOS Radio-Frequency Integrated Circuits"

What is "Radio Frequency" ?
Any signal with frequency content 20 kHz to ~ 100 GHz

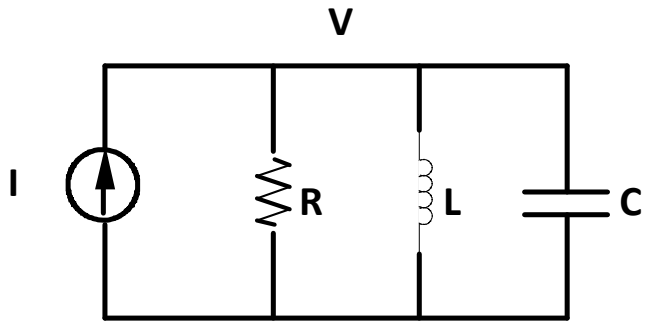
Consider what happens when we introduce L and C into a circuit

Series



$$V = I\left[R + jwL + \frac{1}{jwC}\right]$$

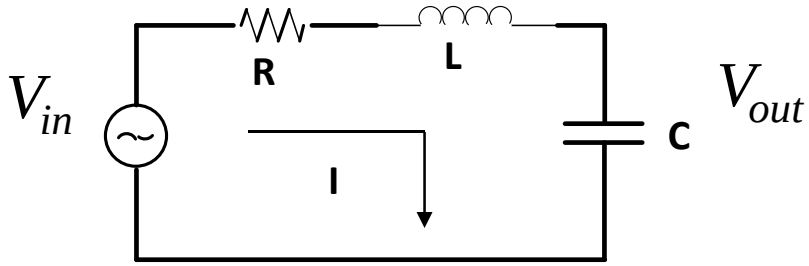
Parallel



$$I = V\left[\frac{1}{R} + jwC + \frac{1}{jwL}\right]$$

The resonant circuit 'picks' out a frequency

Series



V_{in} V_{out}

$$V = I\left[R + jwL + \frac{1}{jwC}\right]$$

Can show:

$$\frac{V_{\text{out}}}{V_{\text{in}}} = \frac{\omega L}{\sqrt{(\omega L)^2 + R^2\left(1-\omega^2 LC\right)^2}}$$

For $\omega_0 = 1/\sqrt{LC}$: $V_{out}/V_{in} = 1$ *else* < 1

A square wave is really a sum of sines (from Fourier analysis)

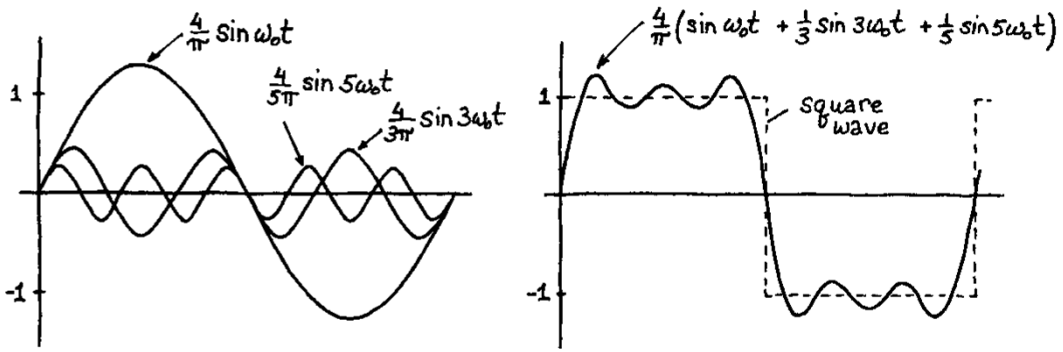
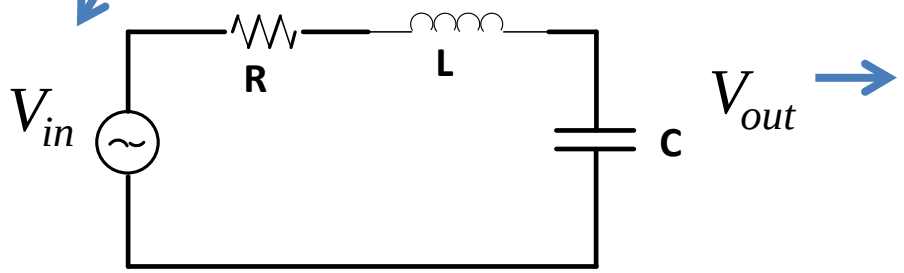


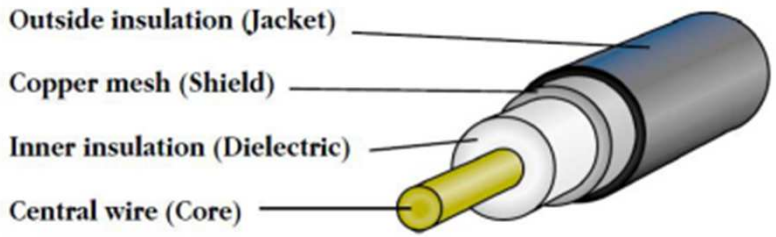
Figure L3.2: Fourier series for square wave

When the square wave is applied as V_{in}

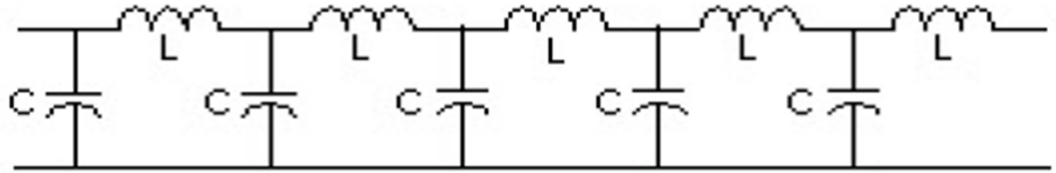


Frequencies near ω_0 will pass through, others will be attenuated

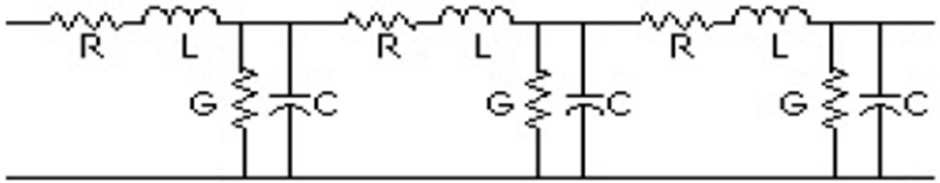
A coaxial cable is modelled as a series LC network



Lossless transmission model



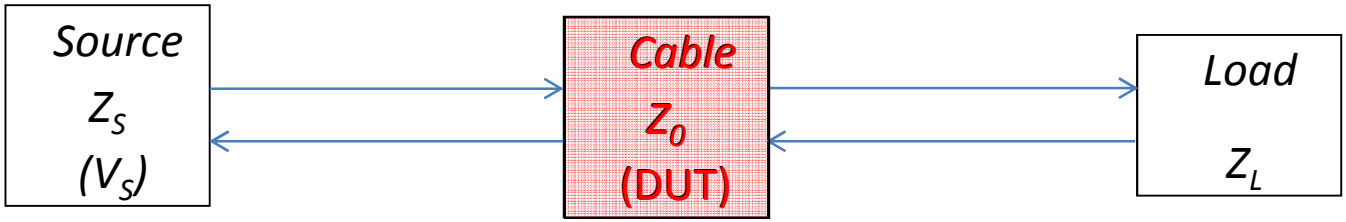
Lossy transmission model



See http://goo.gl/l3p7s7 for a detailed analysis of a how a cable 'works'

Preparation for Lab 7

Study Cables



Device Under Test