Analog electronics, Fall 2012

Exercise 1, 9.11.2012

1. Laplace transform

Compute $\mathcal{L}[f(t)]$ for:

$$f(t) = e^{-(t-\alpha)} \cos(\omega_0 t + \beta)$$

2. Inverse LT

Compute the inverse transform $f(t)$ of $F(s)$.

$$F(s) = \frac{s^2 + 9}{s^3 + 7s^2 + 14s + 8}$$

3. RC filter

Compute the frequency responce of a RC high-pass filter (amplitude and phase) using the complex impedance. Compute pole and zero locations for the transfer function $H(s)$. What is the -3dB cutoff frequency of the filter?

4. RLC circuit

Closed series circuit consists of a resistor, a capacitor and a inductor. The voltage over the capacitor at $t = 0$ is 5 V. Compute the voltage over the resistor as a function of time using the Laplace transform method. You may use use transform tables to get the inverse transform. $R = 1k\Omega$, $L = 1mH$, $C = 1nF$.

BONUS:

Prove the convolution theorem for Laplace transform