Exercises for Lecture Course on Modelling and System Identification (MSI)
Albert-Ludwigs-Universität Freiburg – Winter Term 2015

RLC Band Pass Filter Identification

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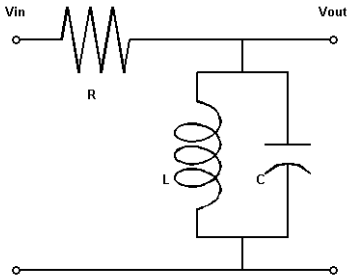
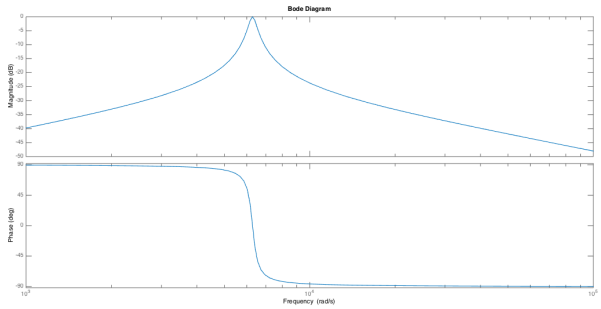
A RLC band pass filter is depicted on Figure 1a. The characteristics of such a filter can be seen on its Bode plot, which is represented on Figure 1b.



(a) Band Pass RLCFilter



(b) Bode plot for Band Pass RLC Filter

The transfer function of the filter is given by:

$$G(s) = \frac{sL}{R + S^2RCL + SL} \tag{1}$$

with $s = jw$:

$$G(w) = \frac{w^2L^2}{R^2(1 - w^2LC)^2 + w^2L^2} \tag{2}$$

With this last equation, the center band pass frequency can be calculated as:

$$w_p = \frac{1}{\sqrt{LC}}[\text{rad/s}] \tag{3}$$

In the particular case of our system: $L = 1$ mH, $C = 25.3\ \mu F$ and $R = 10\ \Omega$, which leads to a pass band frequency $f_b = 1$ kHz.

The system was simulated using a step response as input and using a sampling time of $10\ \mu$s. Moreover, output zero mean Gaussian noise with $\sigma = 0.04$ V was considered. All relevant values of the simulation are attached in one file, and the input-output behavior can be seen on Figure 2.

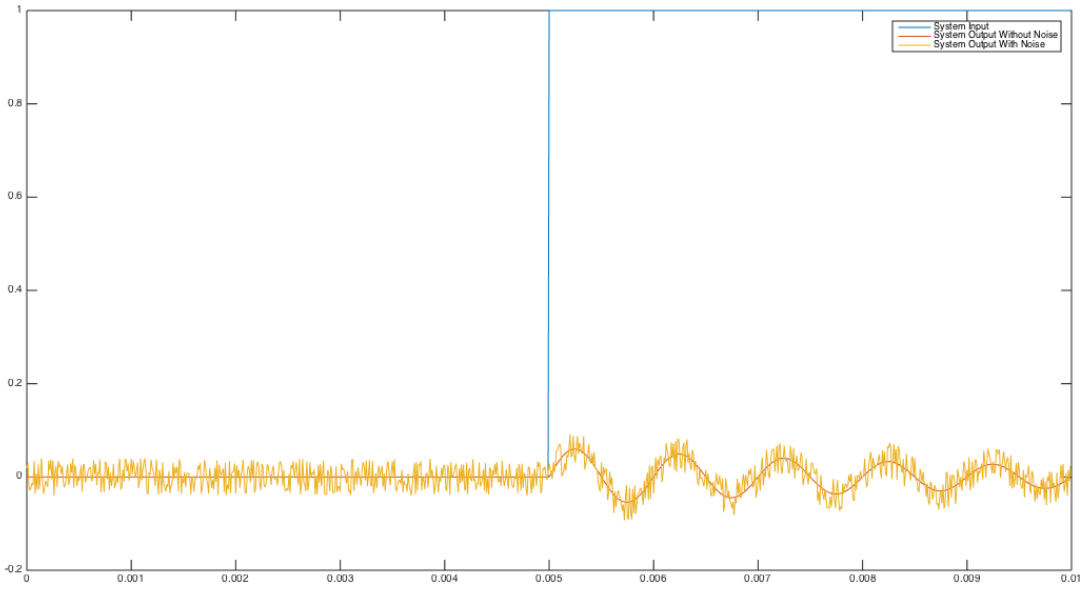


Figure 2: RLC filter simulation to a step response