Lab 2: Filtering

EEE4514

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# Filtering

## Overview

The purpose of this lab is to create a system where the high frequency components of a signal will be filtered out creating a very smooth output curve as a result.

## Theory and Methods

The filter we are using for this lab is a simple first order system: 50/(s + 50). This lab will use the basics of setting up the Quarc Servo while sending and receiving signals to the servo motor. The general for of this formula is represented as ω /(s + ω) where ω is the cutoff frequency.

## Results

The low pass filter proves to work correctly as can be shown from the encoder speed graph bellow. The results seem very close the expected results with a few minor spikes that are mostly likely do the mechanical differences and measurement tolerances.

## Questions

1. What was the value of your gain?
   1. Our gain was set to 1 as there was now need to increase this value with the current signal generator.
2. Explain the why the encoder-based measurement is noisy.
   1. This has to do with the measurement tool of the device not having a completely continuous method of finding the current velocity of the device. The tool somewhat jumps as the sensor sees the plate rotate to a new slot. This will appear as nose as the next slit comes in front of the sensor.
3. Build and run the QUARC controller. Show the filtered encoder-based speed response and the motor voltage. Has it improved?
   1. Yes the filtering dramatically improved the noise. There is still a small amount that is still present but the filter really reduced this.
4. What is the cutoff frequency of the low-pass filter 50/(s + 50)? Give you answer in both rad/s and Hz.
   1. 50 Hz or about 314 Rad/s.
5. Vary the cutoff frequency, ωf , between 10 to 200 rad/s (or 1.6 to 32 Hz). What effect does it have on the filtered response? Consider the benefit and the trade-off of lowering and increasing this parameter.

## Conclusions

From this lab we have learned that buy using a filter one can significantly reduce the noise inside of a system to allow for a much more steady output.