

Report 02

Lag factor & Noise applied on DC Motor

MCT 621
Motion Control and Servo Systems
Fall 2021

Submitted By/
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Introduction

In this report the lag effect of signals is discussed on motors and their PID controller with different cases of having higher lag than the Pre-tuned controller or lower or the same lag as the PID tuned for. The other part of the Report is discussing the noise effect with different sampling times on the motor.

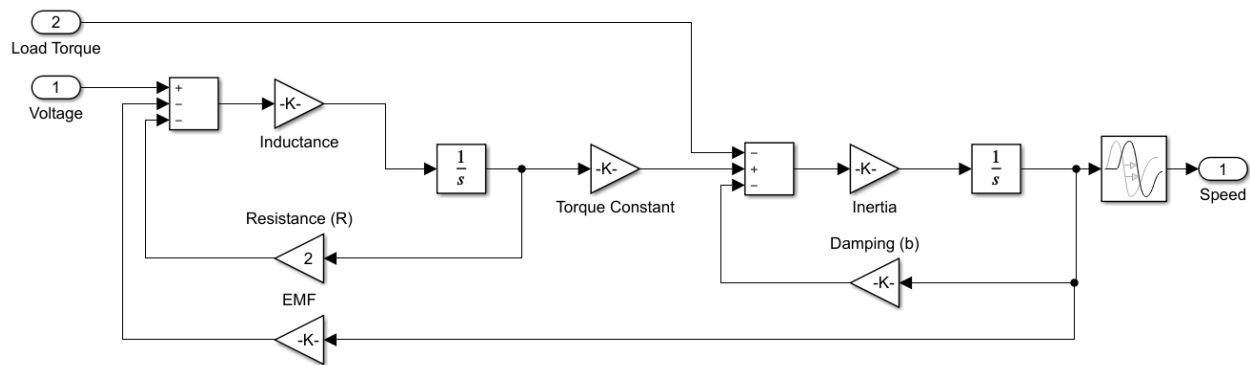
1. Lag Term

Lag results is measured against controller for

1. Pre tuned controller
2. Tuned controller faster than lag
3. Tuned controller slower than lag

Motor Simulink Block Diagram

lag term is added before the output for motor



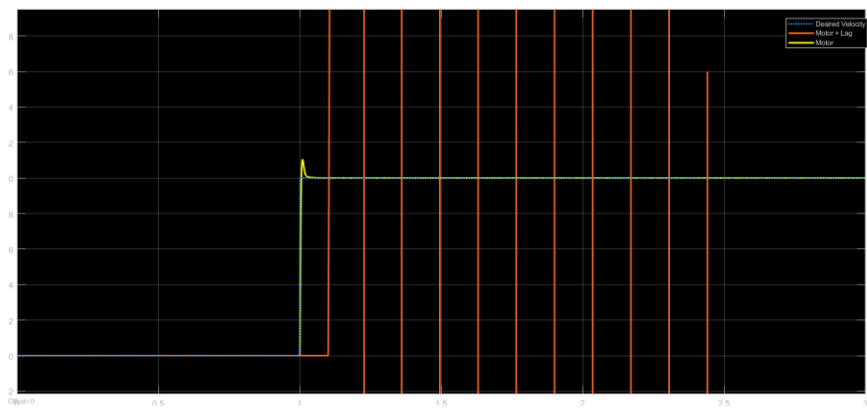
1- Angular Velocity

a) Pre tuned controller

PID parameters

Parameter	Symbol	Value
Proportional	P	5.44852411653308
Integrator	I	298.860623425214
Derivative	D	0.0155623191528944

Filtered derivative 3918.19472839947



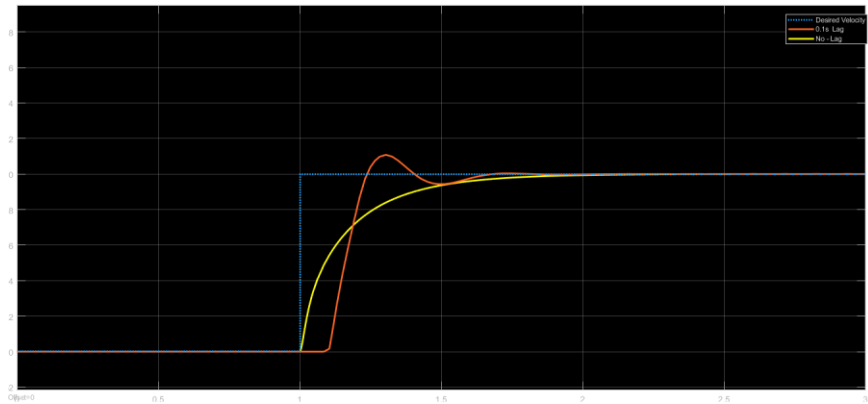
b) Tuned controller faster than lag

PID parameters for 0.1 s lag

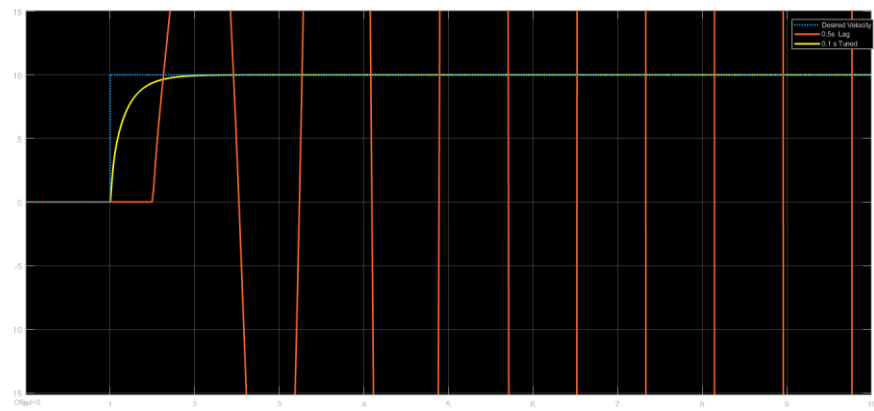
Parameter	Symbol	Value
Proportional	P	0.136705612158136
Integrator	I	1.99708162581554
Derivative	D	-0.00342604783089772

Filtered derivative 8.28752680701693

Controller tuned for 0.1s lag, and Lag = 0.1s

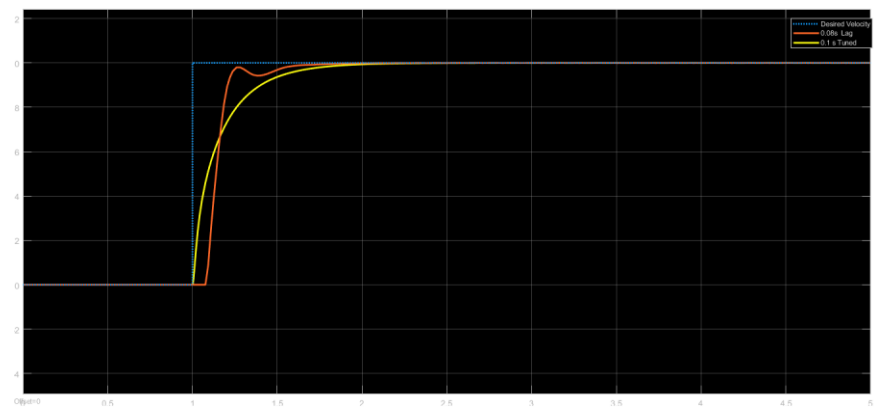


Controller tuned for 0.1s lag , and Lag = 0.5s



c) Tuned controller Slower than lag

Controller tuned for 0.1s lag , and Lag = 0.5s



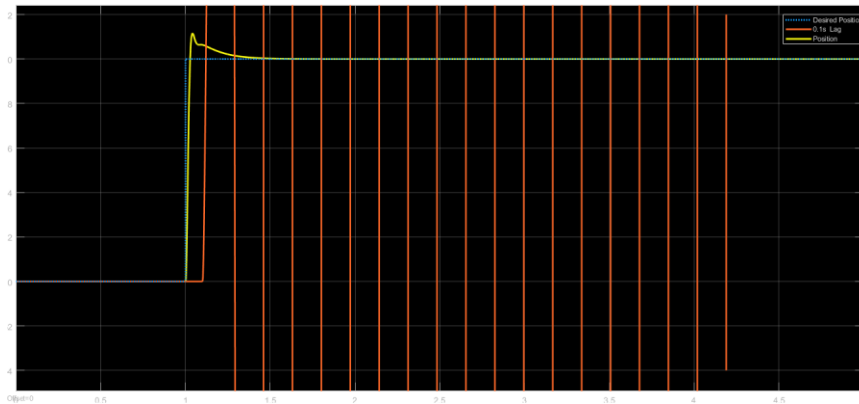
2- Angular Position

a) Pre tuned controller

PID parameters

Parameter	Symbol	Value
Proportional	P	24.7932465228751
Integrator	I	152.003674204515
Derivative	D	0.597968838684143

Filtered derivative 712.994231146963



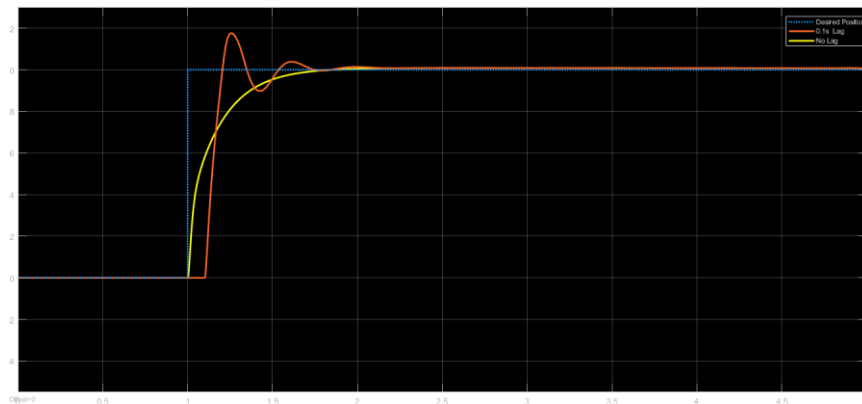
b) Tuned controller faster than lag

PID parameters for 0.1 s lag

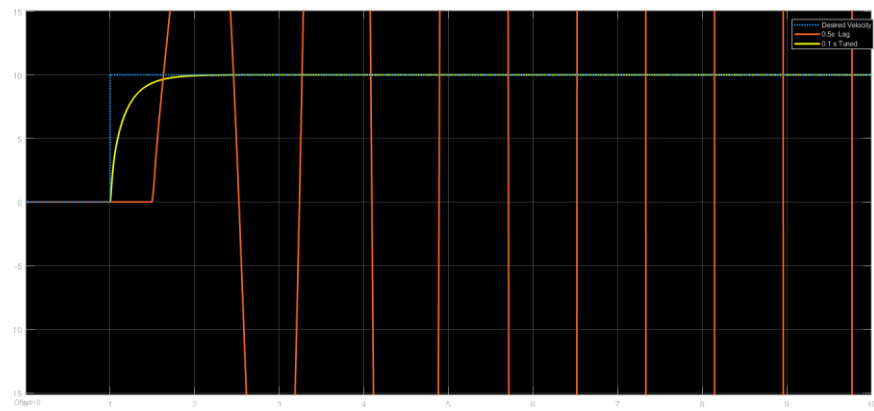
Parameter	Symbol	Value
Proportional	P	2.2248272630171
Integrator	I	0.151353544616416
Derivative	D	0.160573072580033

Filtered derivative 892.907378170991

Controller tuned for 0.1s lag , and Lag = 0.1s

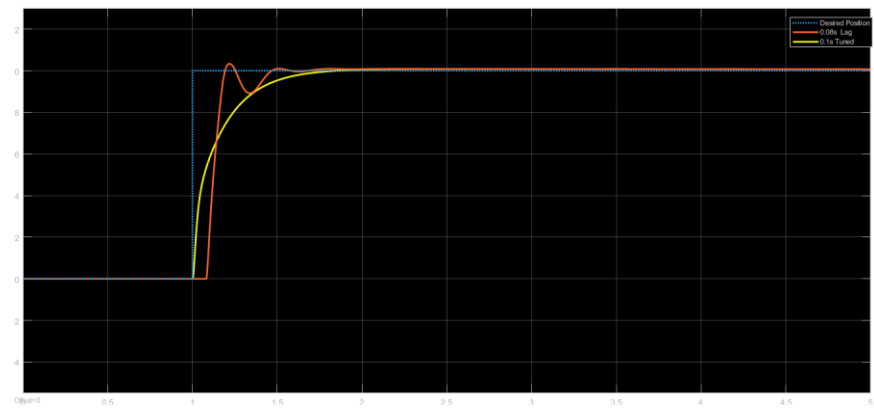


Controller tuned for 0.1s lag , and Lag = 0.5s



c) Tuned controller Slower than lag

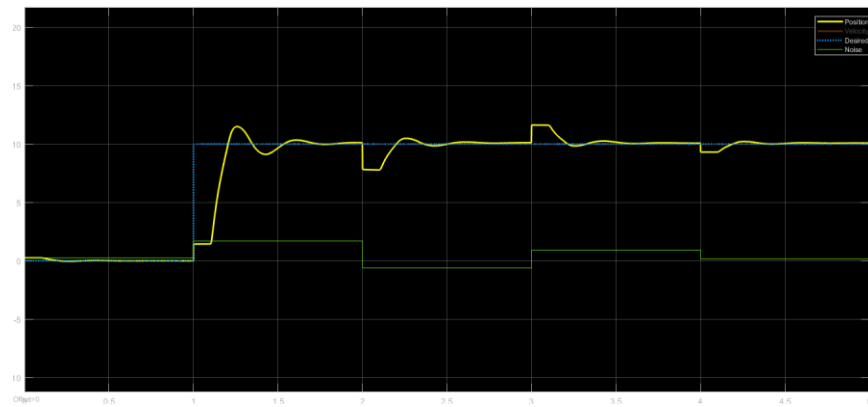
Controller tuned for 0.1s lag , and Lag = 0.5s



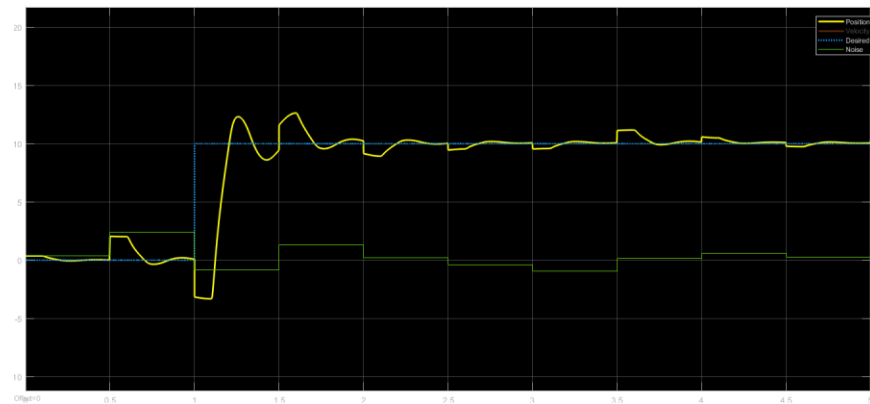
Noise

Random noise is applied on both velocity and position of tuned PID controller for 0.1 s lag. With 0.1 s lag applied

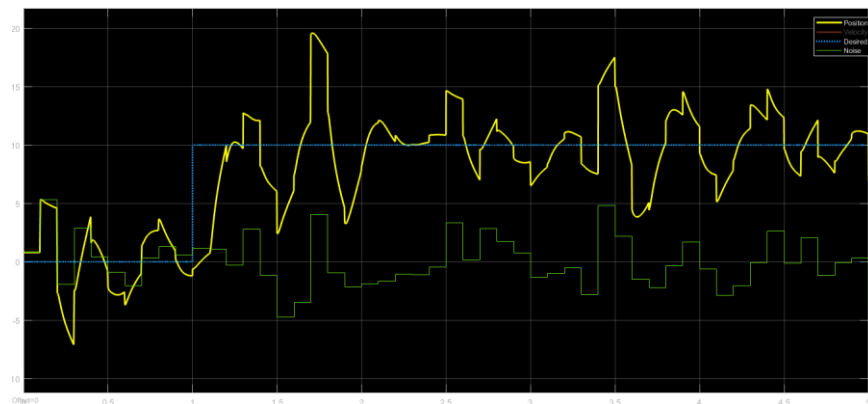
Position with 1s sampling noise



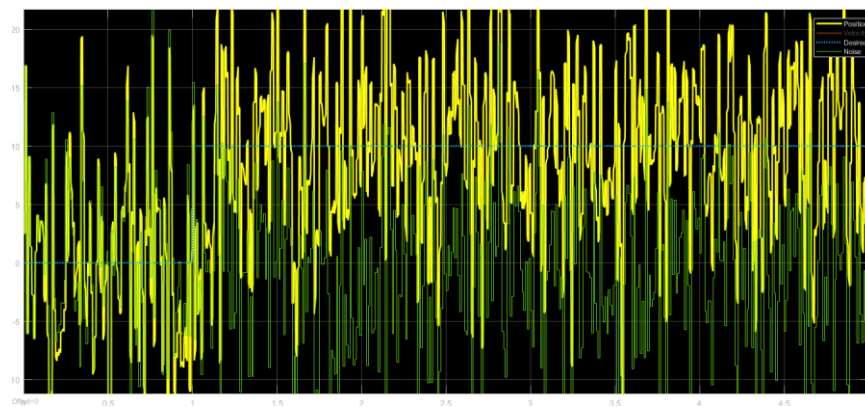
Position with 0.5s sampling noise



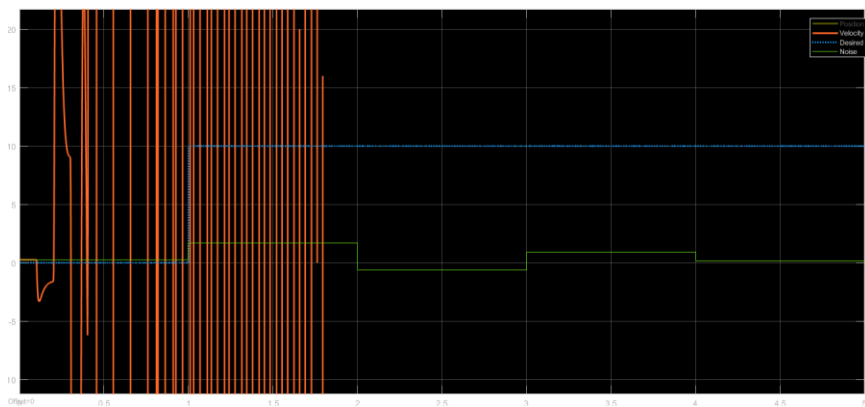
Position with 0.1s sampling noise



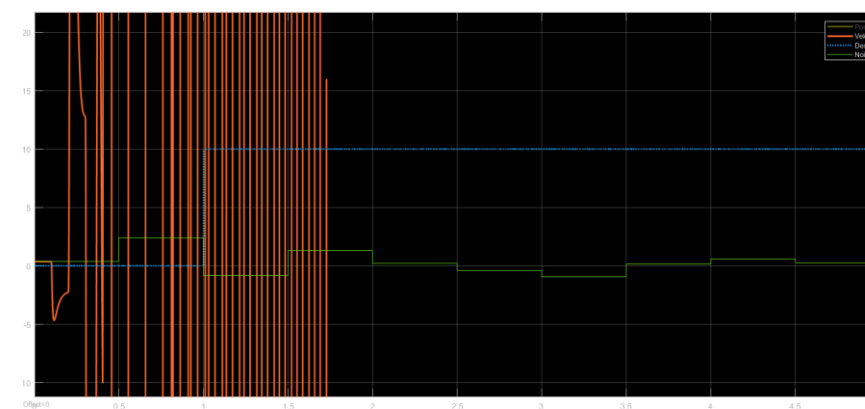
Position with 0.01s sampling noise



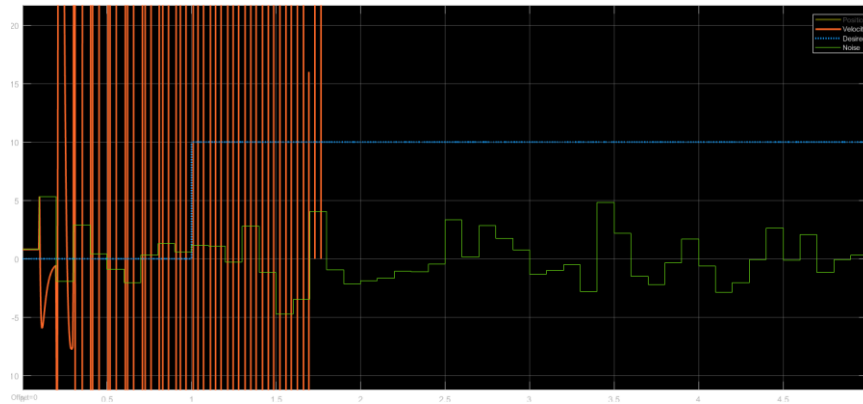
Velocity with 1s sampling noise



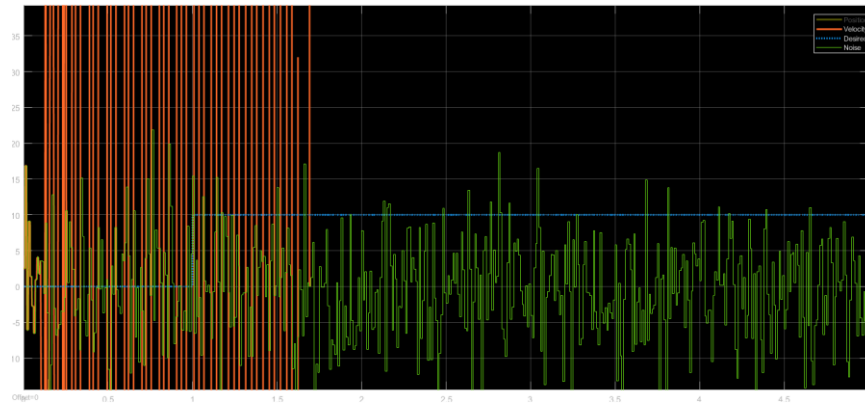
Velocity with 0.5s sampling noise



Velocity with 0.1s sampling noise



Velocity with 0.01s sampling noise



Conclusion

When the Controller is Tuned for a delay larger than the noise frequency, the controller can withstand this noise and return stable,

If the noise frequency is greater than the lag in which the controller is tuned to, so the system becomes unstable