2022

EGR 550 Mechatronics

PROJECT – 5 | TIME-RESPONSE ANALYSIS OF A DC MOTOR & PI CONTROL OF A DC MOTOR

MANOHAR AKULA | ASU ID: 1223335191

EGR 550 PROJECT 5

Name : Manohag Akula

ID : 1223335191

Objective :

To complete activity 6a and activity 6b and implement PI control

Description of Solution

The hardware is setup by making connections as shown in Fig 1.

The software is implemented in Simulink as shown in Fig2. Initially, the black box model of the system is determined. Based on the black box model PI controller is implemented. The following parameters are considered for our motor :

Gear ratio = 1/150

$T_s = 0.02$

Filter constant = 0.1

The black box model obtained ;

$$P'(s) = 500/(0.14s+1)$$

$$Kp = 0.0005$$

$$Ki = 0.0218$$

The PI controller is tuned & improved for integrator windup and disturbances.

Results and Discussion :

Hardware Setup:

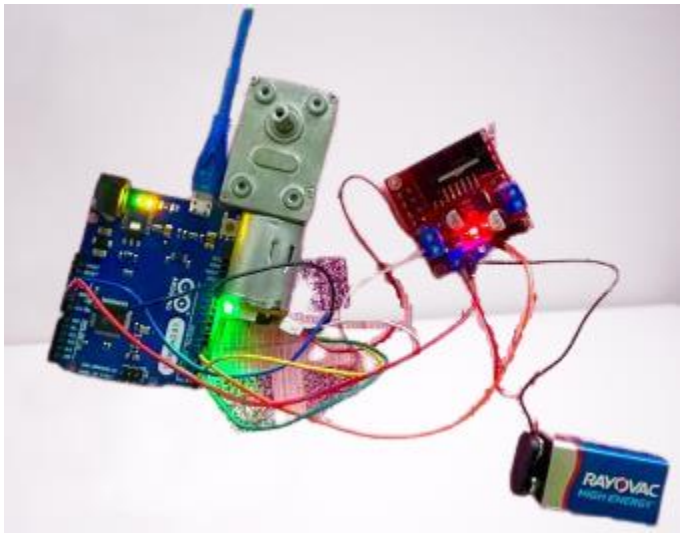
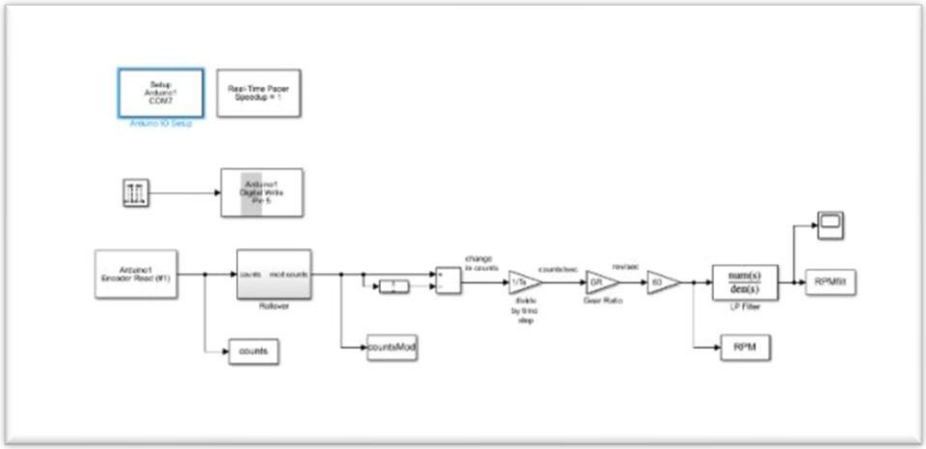


Fig -1: Hardware setup of Arduino

Simulink Code:



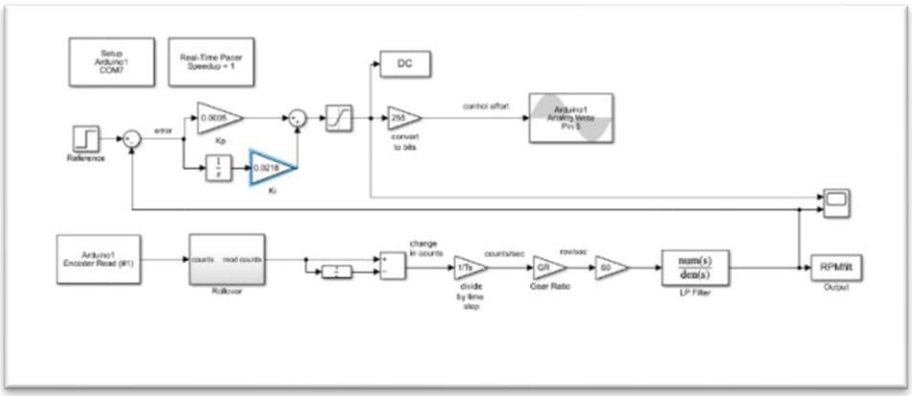


Fig -2: Simulink Code and Simulink Blocks

Results and Discussion:

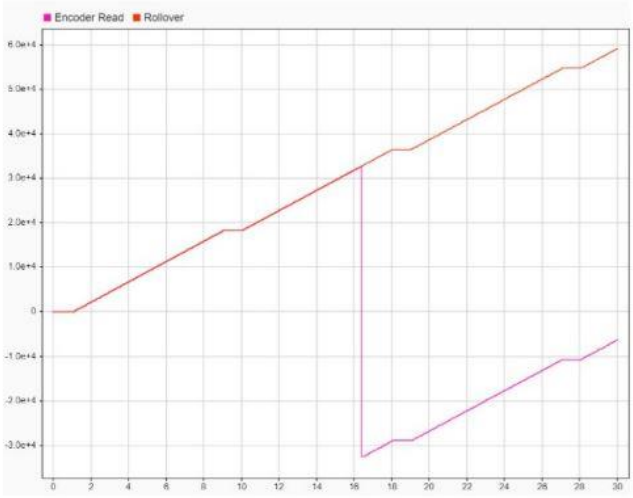


Fig -3: Encoder count corrected for rollover

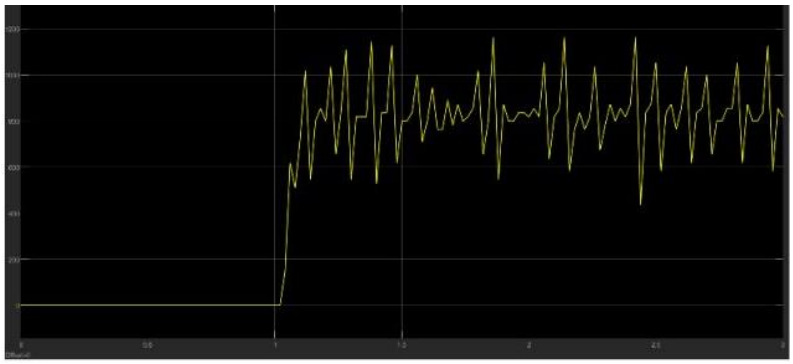


Fig-4: Response of Motor Speed to step input

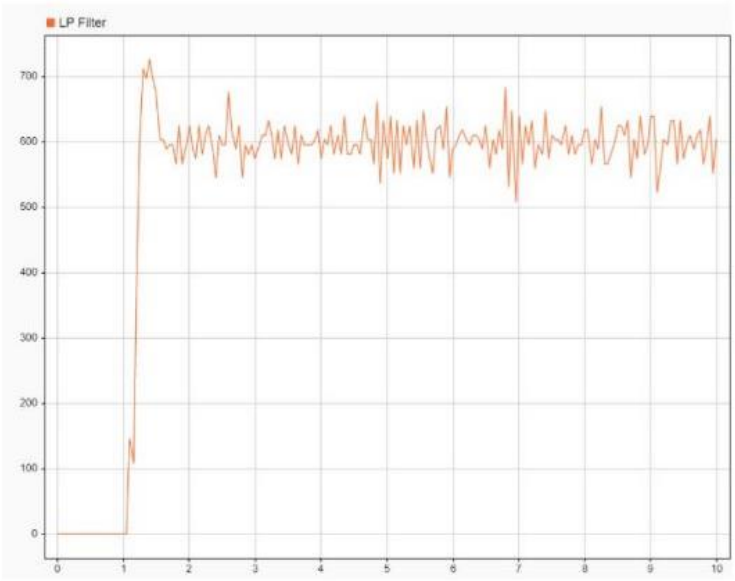


Fig -5: Response of Motor Speed Under PI control (kp = 0.005, Ki = 0.0054)

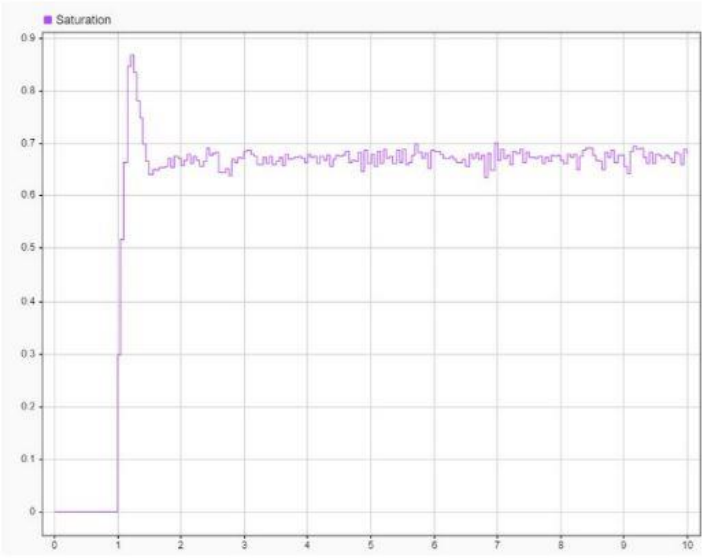


Fig -6: Control Effort Under PI control

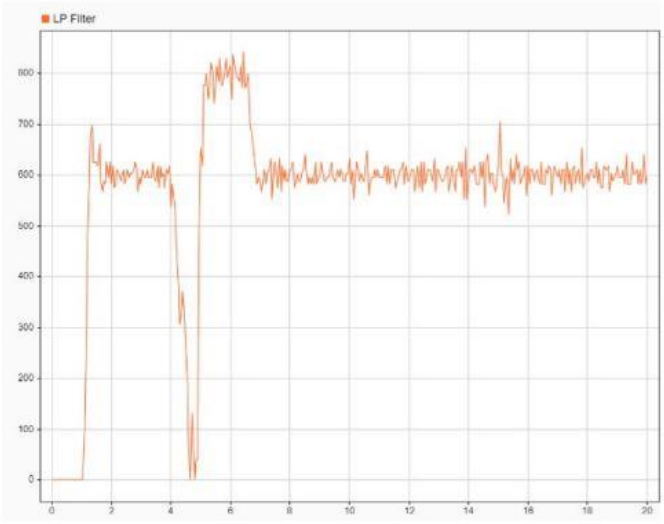
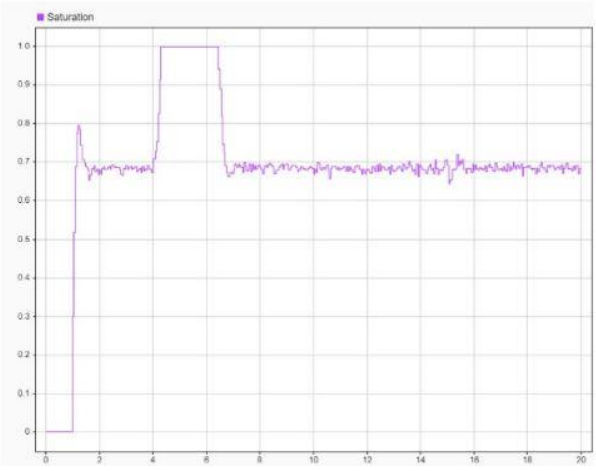


Fig -7: Motor Speed Response Under PI control with the distributors



.

Fig -8: Control Effort Under PI Control with disturbances

References:

[1] https://ctms.engin.umich.edu/CTMS/index.php?aux=Activities_DCmotorA

[2] https://ctms.engin.umich.edu/CTMS/index.php?aux=Activities_DCmotorB