EE462 Spring 2016
Project 0

DC Motor Drive and Analysis

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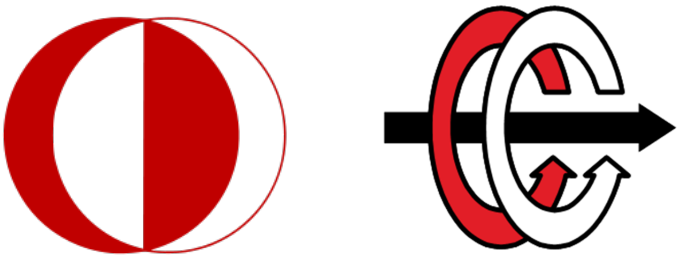

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1 Brief Explanation

These report will try to explain and give information about DC Motor drive and analysis . The wanted specific details are,

- A short info about the motor (voltage, current, power ratings etc.)
- Short info about the power source and control system
- Graphs showing acceleration curve from stationary to rated speed
- Start-up current graphs
- Produced torque during start-up

2 Results

In that project,Firstly I used Chopper-Fed DC Motor Drive Example,and after thinking about Project-0 ,I decided,I will use H-bridge topology due to it is Project 0 and I can test which drive I want.

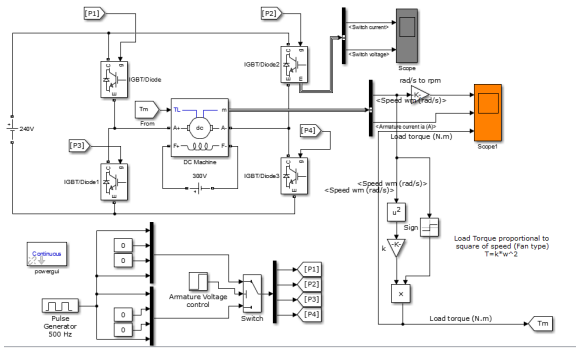

Figure 1: Simulink Diagram of H-Bridge Controlled DC Motor

DC Motor Properties

I looked motor properties from Simulink DC Motor block,and properties are,

-240V
-Nominal 15A(Maximum 30A)
-$\approx 240 * 15 = 3.6kW$
-300V field voltage
-5 HP

-While looking and testing different motor selection, I realised that when I decreased the voltage of the field, field current was weakening .So,

- Induced Voltage(Ea) $\downarrow \rightarrow RotorCurrent(Ia) \uparrow \rightarrow MotorTorque(Tm) \uparrow$

Finally,when motor torque increased our acceleration will increase,so our speed will increase . Then our induced voltage will increase and hopefully our system will be again in steady-state .[2]

-About HP calculation,
HP = (Speed(Rpm) * Torque)/5252
T = 15 Nm or

HP = (Voltage*Current*Efficiency)/746
I = 15.5 A (If we assume efficiency is 100

Power Source and Control Explanation

The system consist of ,
-Power Source Part
-Motor Drive Part
-Control Part(To obtain closed-loop control),

240 V DC power supply used to feed the motor,and to control the DC motor I used H-Bridge topology. H-Bridge topology has four switching element and sometimes called as "Full Bridge". In contrast to MatLab SimScape Power System ($power_H bridge) example I used IGBT switches instead of BJT.

As a machine I used Wound winding DC machine,and it is torque loaded. The torque value calculated via,

Torque = k * ($speed^2$)

Graphs

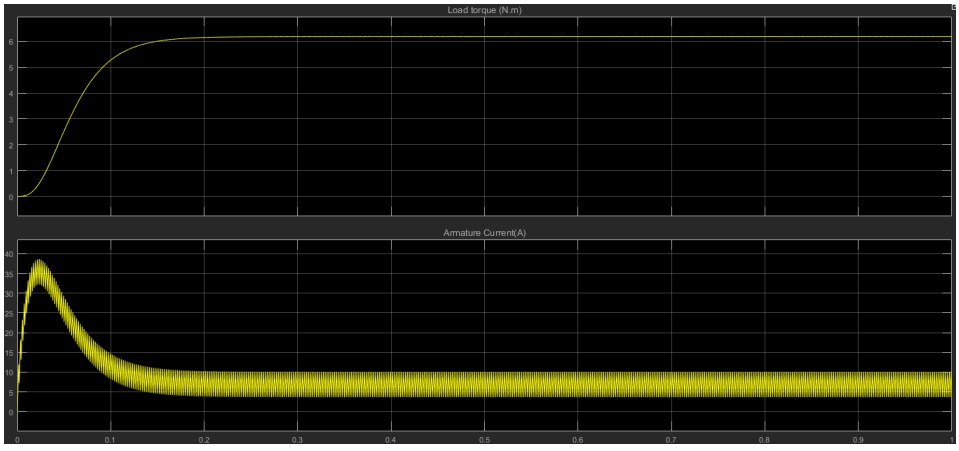

Figure 2: Torque and Current Graphs of DC Motor Drive

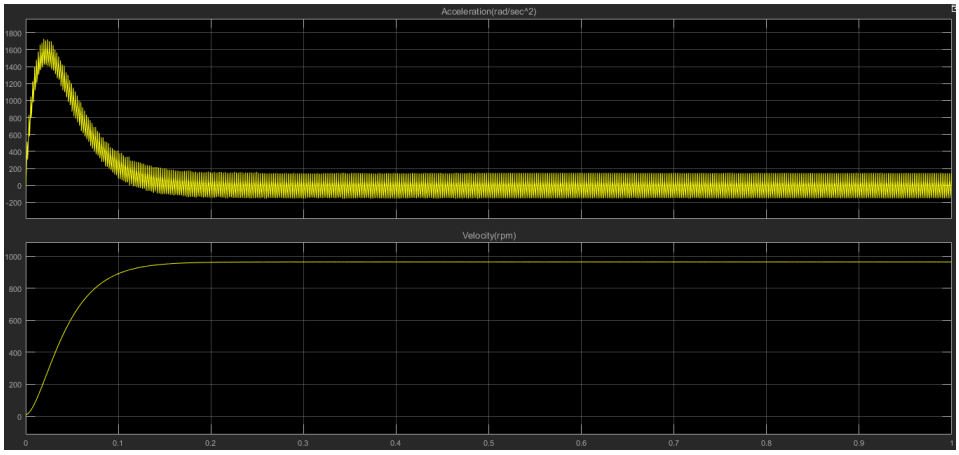

Figure 3: Acceleration and Velocity Graphs of DC Motor Drive

References

[1] Gilbert Sybille *Hydro-Quebec Transmission Company*. SimScape Power Systems Examples, MathWorks

[2] https://www.quora.com/Why-do-we-decrease-the-field-current-in-a-DC-shunt-motor-by-to-increase-the-speed-and-mechanical-output-power *Quora*. (Loren Rademacher answer..)

[3] http://electrical-engineering-portal.com/5-most-common-motor-load-types *Portal*. (Edward answer..)