Control of DC motor

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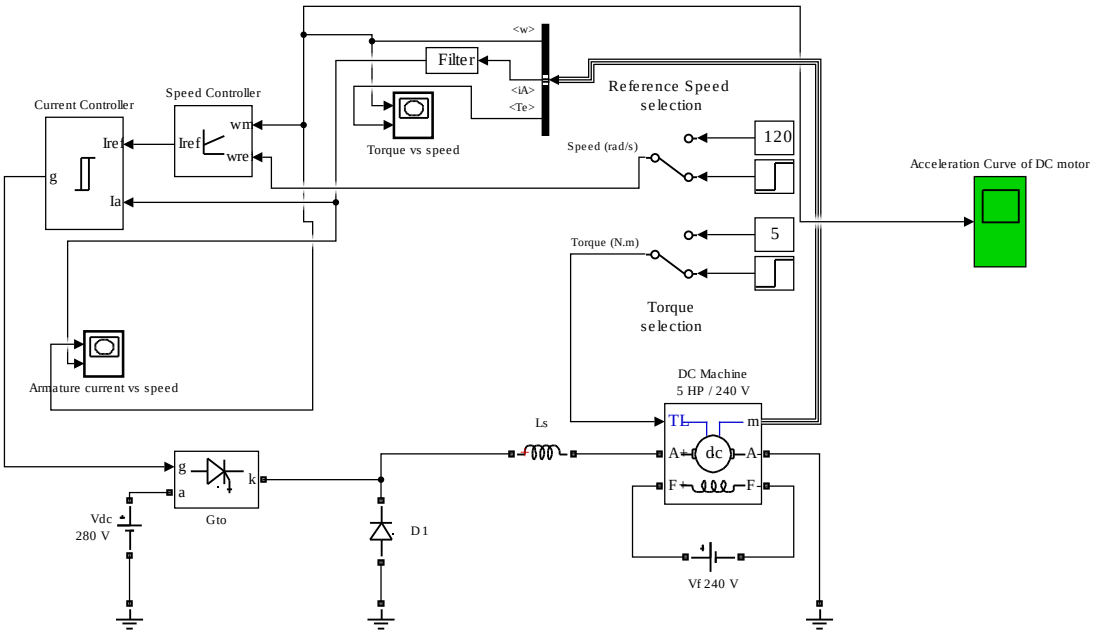
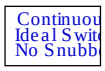
Chapter 1. Rating Characteristics of Motor

Voltage rating: 240V
Current rating: 16.2A
Power rating: 5hp

Chapter 2. Information about Power Source and Control System

a)Power Source. Voltage value of the source should be greater than the emf of the motor to run it in motoring mode.Power source is controller by a chopper which consists of GTO thyristor and free-wheeling diode





Chopper-Fed DC Motor Drive (Continuous)

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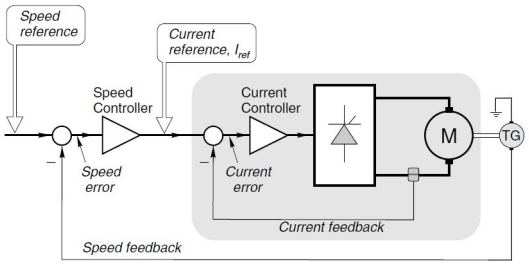
b)Control System. Control system contains two control loops as inner one is current-control loop and



outer one is speed control loop.

Outer Loop. This loop is responsible for speed control. It compares the measured speed value of motor with the desired(reference) speed of the motor. The difference between these values gives an error which contributes as a current reference value for inner loop system. The result of speed control loop should reach stability to be used for reference current.Therefore, an used PI controller for speed controller can provide zero steady-state error. Also, there is a saturation system at the output of the PI controller. This system limits the maximum value of the reference current. Thus, even small amount of error exists at output of the speed controller, since reference cannot exceed limited value, the rest of the system is not affected.

Inner Loop. This loop provides that the measured current value becomes very close to reference current value. As a working principle of control system, when load increases, the speed of motor decreases. Then, the speed error between reference speed and actual(measured) speed of motor increases. This leads to more current to inner loop as reference current. When the current error increases, the torque increases by providing acceleration and reducing the speed error to achieve a balance in the system to make torque of the motor equal to torque of the load.

Chapter 3. Acceleration Curve and Start up Current Graphs

According to acceleration curve, up to t=0.4s, speed tries to reach 120rad/s as rated value. After this time, rated speed is increased to 160rad/s and system arranges itself to provide this value. When t=1.2s, torqoue load is increased from 5Nm to 25Nm. This effect leads to a decrease on the speed.

Figure 3.1. Acceleration Curve of DC motor

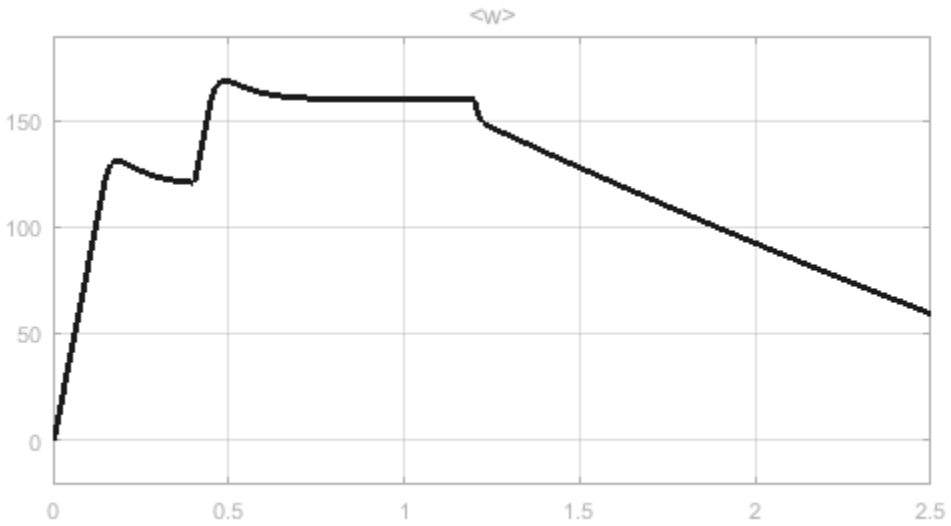


Figure 3.2. Armature current vs speed

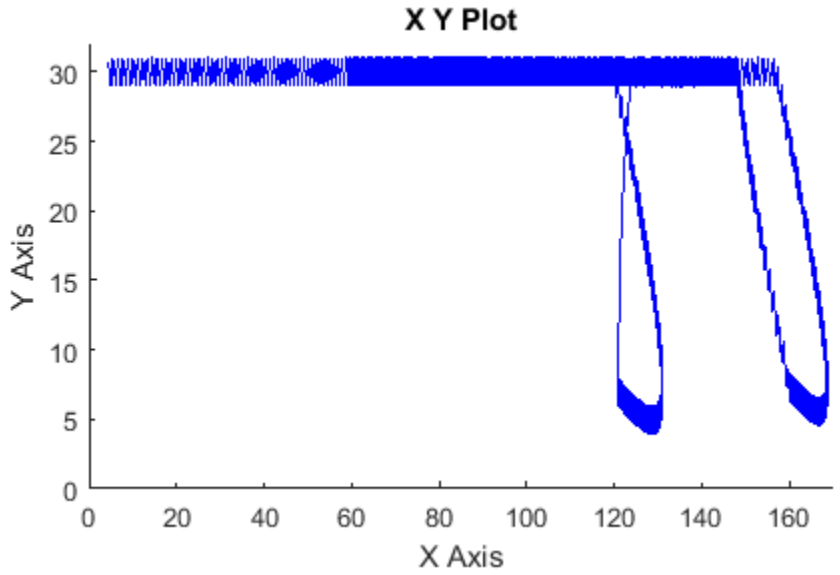
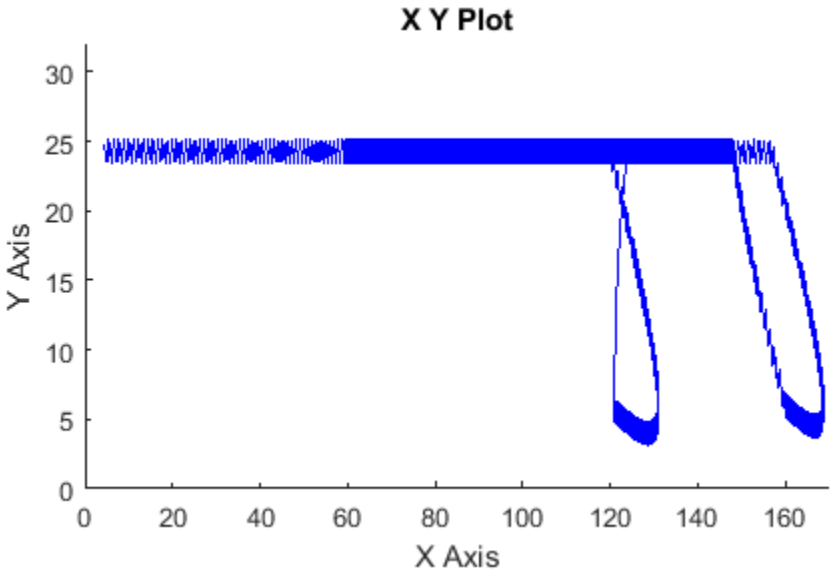


Figure 3.3. Torque vs speed



Chapter 4. Produced Torque During Start up

According to Figure 4.3 the produced torque is approximately 25 Nm for DC motor during start up.

Chapter 5. Bibliography

H. Le-Huy (Universite Laval, Quebec),Chopper-Fed DC Motor Drive (Continuous)