**METR3100 Sensors and Actuators**

Actuators Practical Aligned Assignment


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# Executive Summary

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## 2.1 Equipment

### *2.1.1 Practical Equipment*

The equipment used in the practical were:

- AC motor
- Brake
- Cooling fan
- ABB drives
- PC with *drivewindows*; and
- DSP7000

### *2.1.2 Safety Equipment*

The safety equipment used in the practical were:

- Enclosed shoes; and
- Hearing protection

## 2.2 Procedure

The procedure followed for this practical was:

1. The ABB motor drives were turned on.
2. *Drivewindows* was started on the PC connected to the ABB motor drive.
3. Remote control was taken over the motor.
4. The control mode of the motor was switched to scalar.
5. The frequency of the motor was set to 50 Hz.
6. The cooling fan was started for the brake.

7. The DSP7000 was started and set to open loop mode.
8. The brake was turned on.
9. The torque and speed displayed on the DSP7000 and the torque, speed, and motor current on *drivewindows* and the information panel on the ABB drive were noted.
10. The brake percentage was increased incrementally and the torque, speed, and motor current were noted for all brake percentages examined.

# 3. Results

# 4. Analysis and Discussion

## 4.1 Experimental Data Analysis

## 4.2 Design Problem

The scenario shown in Figure (insert number here) involves the ABB model AC motor pulling a mass up a given incline of $12.5°$. The motor shaft is attached to a flywheel of radius $R = 100mm$ and inertia $J = 5kgm^2$ The force opposing the torque of the motor is modelled primarily by the viscous friction model given by:

$$F_f = \gamma m \cos\theta \dot{x}$$

Where $\gamma$ is a friction constant $= 0.1$, $m$ is the mass of the block, $\theta$ is the the angle of inclination of the block from horizontal and $\dot{x}$ is the speed the block is being pulled up the ramp. In this system, there is also a load component due to gravity.
By taking the sum of the torques about the motor axis, we get the following relationship.

$$\Sigma T_{axis} = J\dot{\omega}$$
$$T_{load} - F_f R - F_{gravity} R = J\dot{\omega}$$
$$T_{load} = J\dot{\omega} + F_f R + F_{gravity} R$$

It should be noted that for fixed speed operation, $\dot{\omega} = 0$. Having expressions for $F_f$ and $F_{gravity}$.

# 5. Conclusions

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