Lab 2 - Torque Mode

Last modified by Mark Reynolds (/xwiki/bin/view/XWiki/MarkReynolds) on 2025/07/22 11:50

Purpose

We will conduct an experiment to understand the dynamics of acting as a speed controller. The Lab 2 prepared demo implements a Sensorless FOC algorithm to drive a PMSM (ACT) motor. This control setup includes only the torque control loop, omitting the speed controller. You can experiment with controlling the motor to achieve the desired speed under different torque mode settings. Each torque level simulates a different power level of the "engine," providing insights into the challenges of speed control.

Procedure

1 Program the HW and Connect With the Communicator

> The first part of the lab is the same as Lab 1. Please refer to Lab 1 if you require further guidance or clarification during the process.

1.1 Clear Lab 1: Close **X2C®**. Close **Scilab®**. Close the **project** within **MPLAB® X IDE**.

1.2 Open **mc_foc_sl_fip_float_dsPIC33A_mclv48v300w.X** in MPLAB X IDE.

1.3 Open Scilab.

1.4 Navigate in Scilab to the model directory: C:\....
\mc_foc_sl_fip_float_dsPIC33A_mclv48v300w\project\x2cmodel\
Execute the initProject.sce script.

1.5 From the model, start the Communicator.

1.6 Transform the model.

1.7 Generate the code and verify that the code generated successfully (X2C.c).

1.8 From MPLAB X IDE, compile and program.

1.9 From X2C Communicator, connect to the HW.

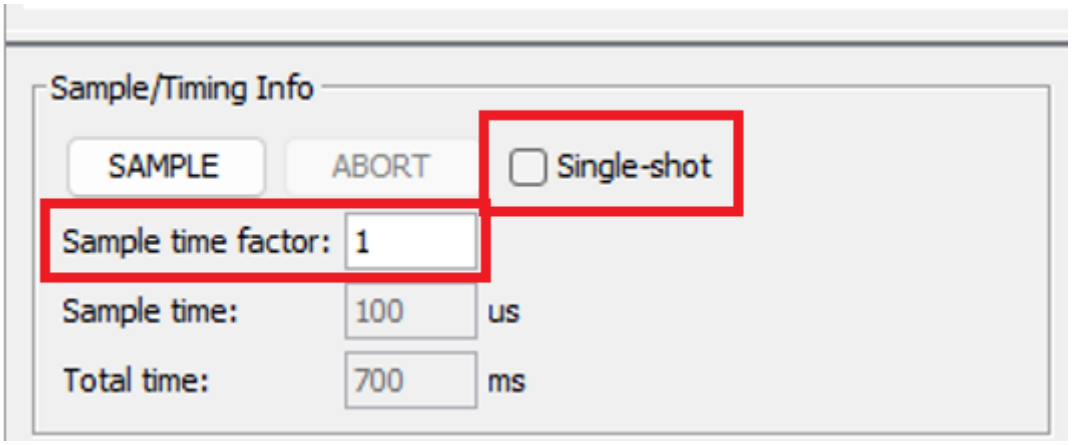
1.10 Open the **Scope** window.

1.11 Press **SW** on the board to start the motor to spin.

> Visit the troubleshoot section if the motor does not spin.

2 Act as Speed Controller With Potentiometer

With the potentiometer, the torque can be set. The goal is to try to reach constant speed by changing the POT settings manually.



2.1 Set the scope to free running.

> Single-shot mode captures one Scope window, then a manual start of sampling is needed. For this task, we recommend auto sampling mode.

> The sample time factor is acting as a prescaler of sampling. If a prescaler is enabled (>1), then not every sample is saved to the buffer. This way the window can show a longer time frame. However, it decreases the resolution. For this lab, the goal is to fill the buffer and plot it as fast as possible to provide frequent feedback of the actual speed.

2.2 Set one channel to show the **Output:Estimated_Speed** block.

2.3 Apply gain of **4500** to the scope channel. This will scale the signal representation to RPM.

2.4 Start sampling with the scope.

2.5 With potentiometer, set torque to keep speed at 1500 RPM.

2.6 Make a note of how easy/fast the speed can be reached and balanced by the POT

settings.

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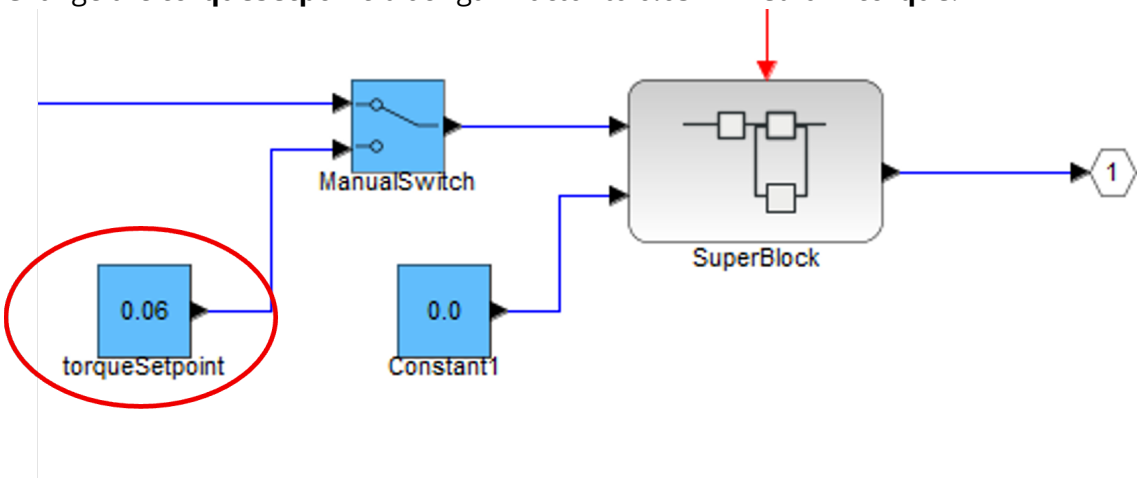
3 Act as Speed Controller With Potentiometer

The objective is to adjust the maximum torque and observe its impact on the system's behavior. Evaluate whether maintaining the desired speed becomes easier or more challenging under these new conditions.

3.1 Navigate back to the model.

3.2 Change the **torqueSetpoint** block gain factor to **0.05--> Medium torque**.



3.3 Try to reach 1500 RPM again.

3.4 Make a note of how easy/fast the speed can be reached and balanced by the POT settings.

3.5 Now, there is a changing environment. The load of the motor is changing. Apply some load with your fingers.

> Exercise caution when handling the shaft. Increased torque can pose a greater risk and friction may cause burns to your fingers.

3.6 Set the **torqueSetLimit** to **0.1**. Experiment with varying loads and document the ease of maintaining 1500 RPM.

Next

Lab 3 - Speed Control Mode (/xwiki/wiki/masters/view/masters-2025-lab-manuals/25085/lab3/)

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