ECE 491 Lab 8

Velocity Sensing and Control – Hall Effect

1. Introduction:

The purpose of this lab is to develop the velocity control system using sensing of the speed of the wheels relative to the motor chassis. Although, ideally, we would want to do this using quadrature encoder, due to lack of Hamamatsu sensors we had to revert to Hall Effect magnetic sensors. You should read up on Hall Effect sensors here: https://en.wikipedia.org/wiki/Hall_effect. However, you are welcome to use any other form of sensing to achieve velocity control, it is up to you.

2. Objective:

Your objective is to develop velocity sensor scheme that will allow you to accurately record the velocity of your car. The suggested way is to use Hall Effect sensors and a magnet, but you can use whatever you'd like. See the suggested Fig. 1 below for Hall Effect.

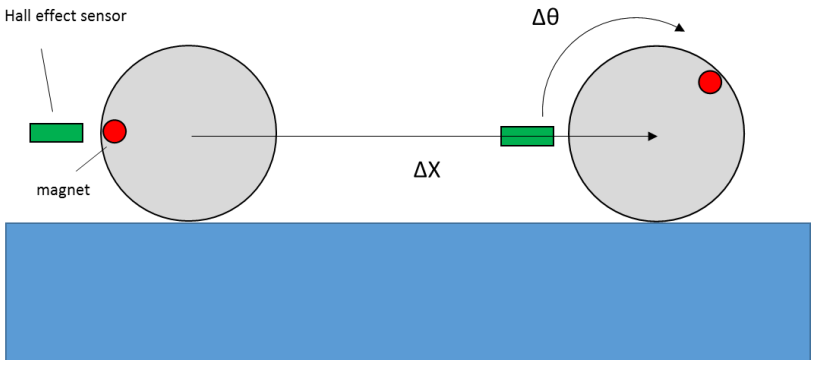

Figure 1: Suggested approach to velocity sensing using Hall Effect.

You can use the Melexis US1881LUA-AAA-000-SP sensor, see attached datasheet. However, since we have not used this sensor previously, you have to do some testing to make sure it works as prescribed.

Figure 2: Timing Parameters

1 Group name _____ Date _____ The lab will consists of three components (if you are using other than hall effect to do this, check with TA regarding checkoffs):

1. Test the Hall Effect sensor with NeFeB magnets supplied in class. Record the signal levels and the distance between the magnet and the sensor when the sensor switches completely on. The magnet will be mounted on the wheel, while sensor is mounted on the chassis. Draw a drawing how this will be done. Use one of the methods we described in class to convert the pulse trai n you are getting from the Hall Effect to velocity. Remember, you get only one pulse per revolution with Hall Effect.
2. Connect the Hall Effect sensor to the FRDM board, and mount the sensor and magnets on wheel base. Remember to convert the output signal of the Hall Effect to input levels of the board! Set velocity of the wheel base to some value using PWM, and show that you can read the velocity using the Hall Effect setup.
3. Demonstrate close-loop velocity control by driving your car straight.

Checkout 1:

Demonstrate the functionality of the sensor using power supplies and oscilloscope or multimeter. Show drawings and calculations to TA.

Checkout 2:

Demonstrate the ability to read velocity of a rotating wheel by driving that wheel at two set speeds, and showing that your code accurately records the velocity of the wheel spinning (chassis elevated). Note that the velocity does not have to be scaled, enough to show relative velocity.

Checkout 3:

Drive the car in straight line to demonstrate close-loop velocity control. Use the proportional control law we discussed in class.

2 Group name _____ Date _____