Hello 1.0 DC Motor

We will get to know the DC motor we used in this experiment more closely. DC motor is controlled by Arduino. Arduino has digital, pwm and analog pins.These are shown in **Figure 1**.

Figure 1: Arduino and Pins

While digital pins take values only 1 and 0, pwm pins take values between 0 and 255. Speed control of the motor is done with pwm pins, and direction control is done with digital pins. **Figure 2** shows the engine. The motor is operated with a 12 Volt adapter. When the motor is given maximum power (12 V), it works with 1030 rpm. Rpm is the number of rotations / revolutions performed within 1 minute on a fixed axis. There are some informations from data sheet of motor in the box below.

12 V1030 RPM, 300 mA3.2 kg·cm (44 oz·in), 5.6 A
[redacted]

Figure 2: The Engine

The laboratory model is shown in **Figure 3**.

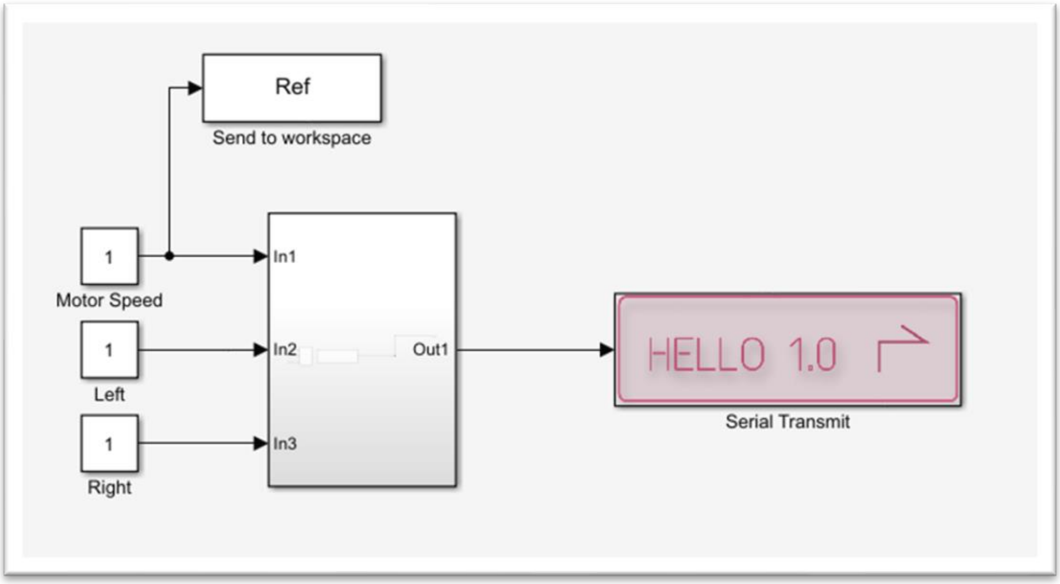


Figure 3: Laboratory Model

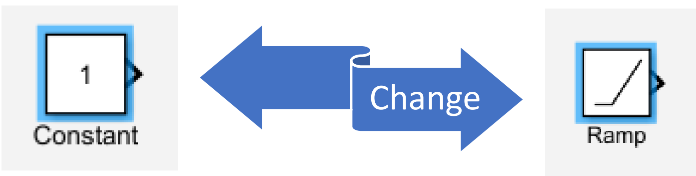
QUESTİONS

1. Set the engine input 255, right input 1, left input 0 and run for 5 seconds. Observe from the graph at what RPM the engine is running and compare it with the datasheet. If there is a difference, interpret the reason. Write down the reason why the motor is rotating and add your graphic. Write down the reason which direction is rotating motor and add its graphic.

2. If the input of the motor is 120 pwm, how many volts of power does it need and at what rpm is it expected to rotate? Show your transactions. Perform the simulation and compare your result.

3. Set the motor's input 255, 1 to both the right input and left input and run for 5 seconds. Explain your observations and reasons.

4. Change the fixed given input of motor with the ramp function. After giving 1 to the left direction input and 0 to the right direction input, operate for 30 seconds. In what direction did your engine spin? What changes did you notice while the engine was turning? Add your graphic and mark the second from which the engine starts to run.



The ramp function is defined as seen in **Figure 4**. Physically, it refers to an entry sign that is gradually time dependent. You are asked to make 10 slope from the settings shown in **Figure 5** by double clicking on the ramp function.

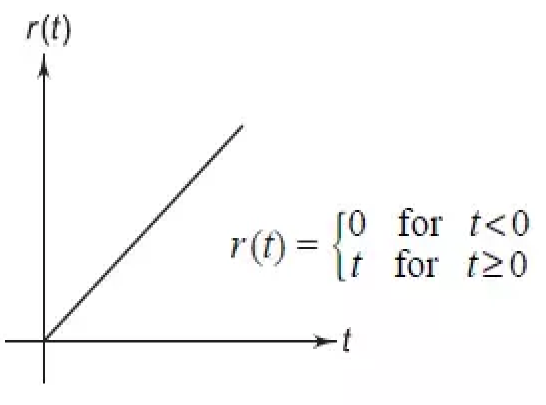


Figure 4: Ramp Function

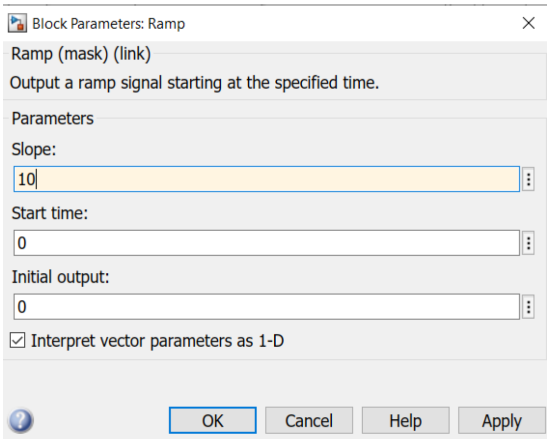


Figure 5: Settings of Ramp

5. The reason why the motor starts up after a certain time is because the motor has a certain dead zone. It shown in **Figure 5**. The engine will not run in this dead zone. Find the opening rpm of the motor according to the previous step. According to this value, find and write how many pwm's the motor opens and after what voltage.

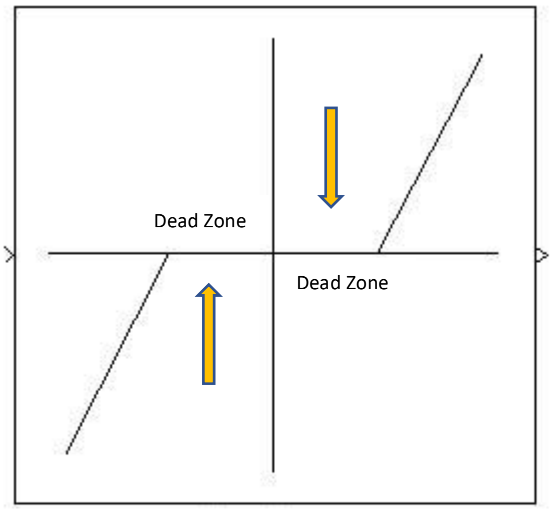
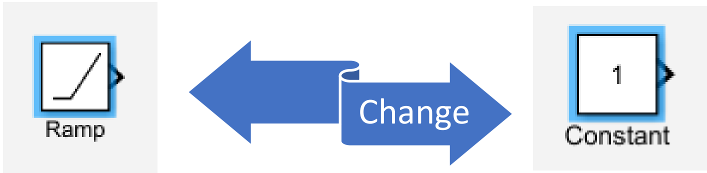


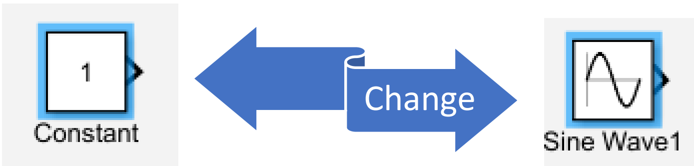
Figure 6: Dead Zone

6. Attach 750 grams of weight to the engine and do the same as the previous step. Has there been a change in the dead zone of the engine? Compare and write what has changed when you add weight to the motor with the previous chart.

7. Replace the ramp function you have given for the input of the motor with a fixed value again and give 1 to the left direction input and 0 to the right direction input. Don't forget to remove the weights. Enter a value for the motor's input smaller than the pwm value you calculated in the dead zone and write down your observations.



8. Replace the speed input of the motor with a sine wave source. The sine is both a trigonometric and periodic function. Its representation is given in **Figure 7**. The amplitude value indicates how much the sine signal will rise and fall.



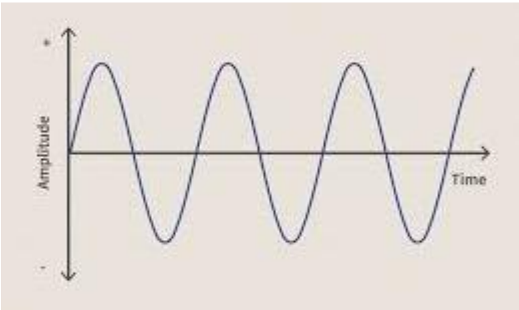


Figure 7: Sine Wave

Enter 300 for the amplitude setting and 5 for the frequency setting from the table shown in **Figure 8**. After setting the left direction to be 1 and the right to be 0, explain your observations with the graphic.

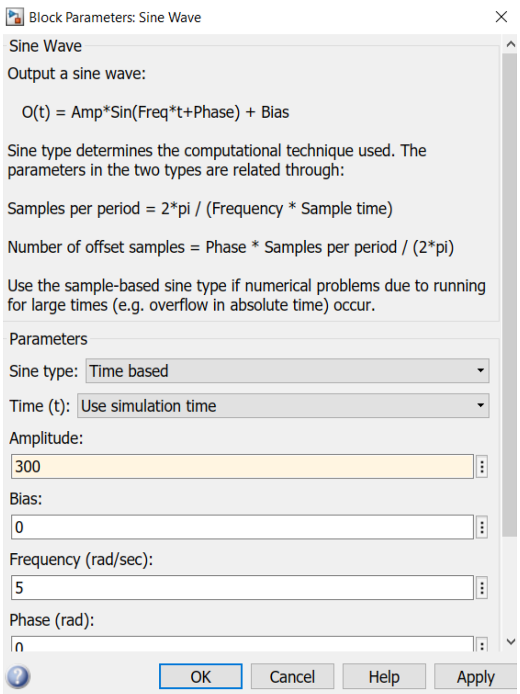


Figure 8: Settings of Sine Wave

9. Replace the amplitude value with 150 and the frequency with 10 and graphically explain what has changed.