College of Engineering
School of Aerospace Engineering

AE 6705: Introduction to Mechatronics

LAB2

Professor:
Jonathan Rogers
Gtech AE Professor

Student:
Tomoki Koike
Gtech MS Student

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Debugging Question 1

Solution:
The variable is `dcoFrequency` was set to the value `3E+6` which is equivalent to 3000000. When showing the variable in hexadecimal in the Code Composer Studio we see the value of `0x002DC6C0`. Converting this to decimals we get

$$0x002DC6C0 = 2 * 16^5 + 13 * 16^4 + 12 * 16^3 + 6 * 16^2 + 12 * 16^1 + 0 * 16^0 = 3000000.$$

Hence, the decimal value and hexadecimal values are the same.

Debugging Question 2

Solution:
After pressing `F8` 4 more times after line 51 we get the value of

50.

The figure shows the outcome

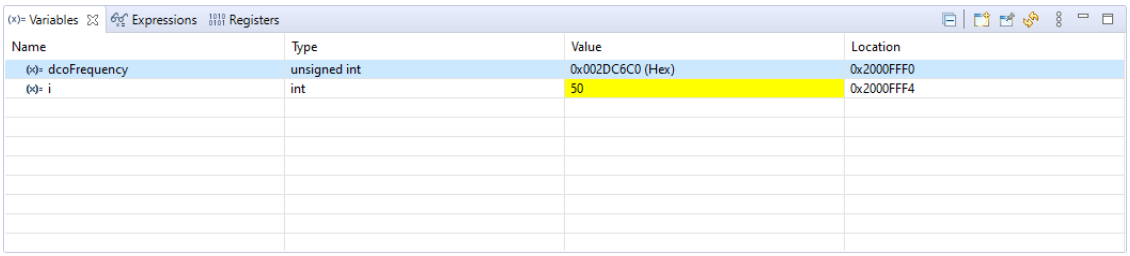

Figure 1: Variable Window of CCS

When showing the variable `i` as a binary value we get `00000000000000000000000000110010`. Which has

32 bits.

This is because, by default, the integer type of `int` sets a 32 bit integer.

Circuit Design Question 1

Solution:
from the DC motor specification we can see that the voltage that must be provided to the motor should be within 10.8V to 26.4V, and therefore 24V would be optimal. Thus, we will implement a voltage regulator which can control the input voltage to the motor in the appropriate range since the power supply is 30VDC. For the motor switching we will employ a MOSFET transistor along with a resistor of $1k\Omega$ and $20k\Omega$. The resulting motor driver circuit looks as follows.

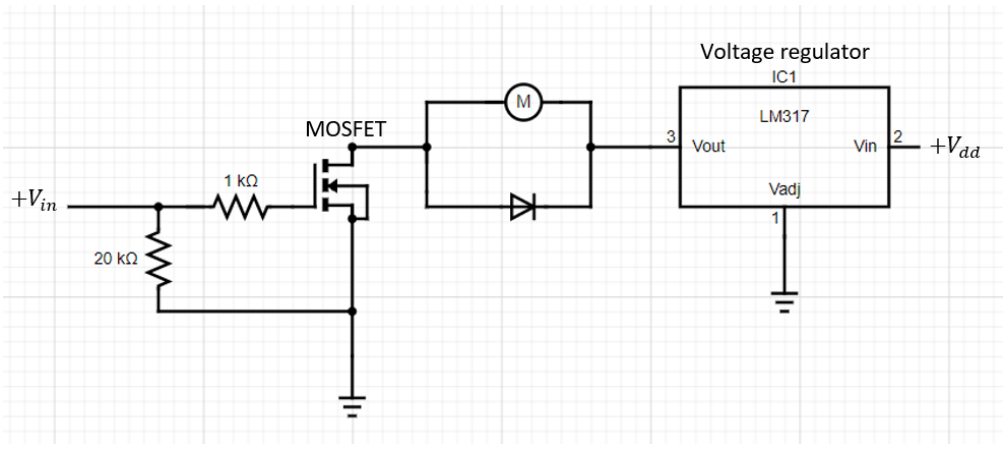

Figure 2: Motor Driver Circuit Diagram

Circuit Design Question 4

Solution:
For this circuit I have chosen CSD17585F5 30-V N-Channel FemtoFET™ MOSFET from Texas Instruments. The datasheet for this MOSFET is attached separately from this report. The important values that we have to consider are

- $V_{GS}(th) = 1.3V$: which is valid since $+V_{in} = 3.3V$.
- $V_{DS} = 30V$: this is also enough for our purpose since the DC motor is expected to run around 24V.
- The price is \$0.080 | 1ku which is reasonable for a simple ON/OFF DC motor.

The part number for the other components are

- 1KΩ resistor: 100EP5121K00 1k
- 20KΩ resistor: 10EP51420K0 20k

- diode: Cafurty 1N4007 DO-41
- voltage regulator: Texas Instruments TPS7A47-Q1