ECE 303 Lab 5

Drexel University

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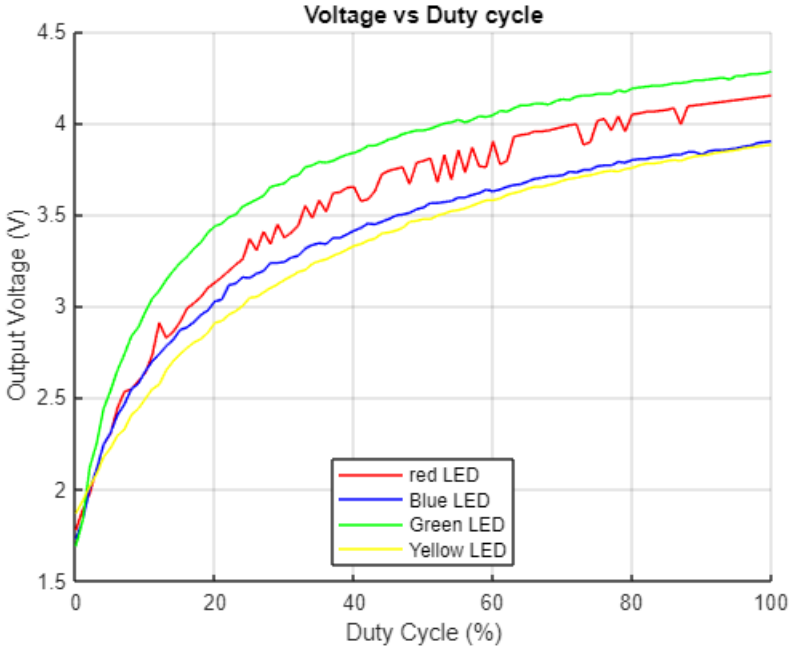
Re: Serial Communications

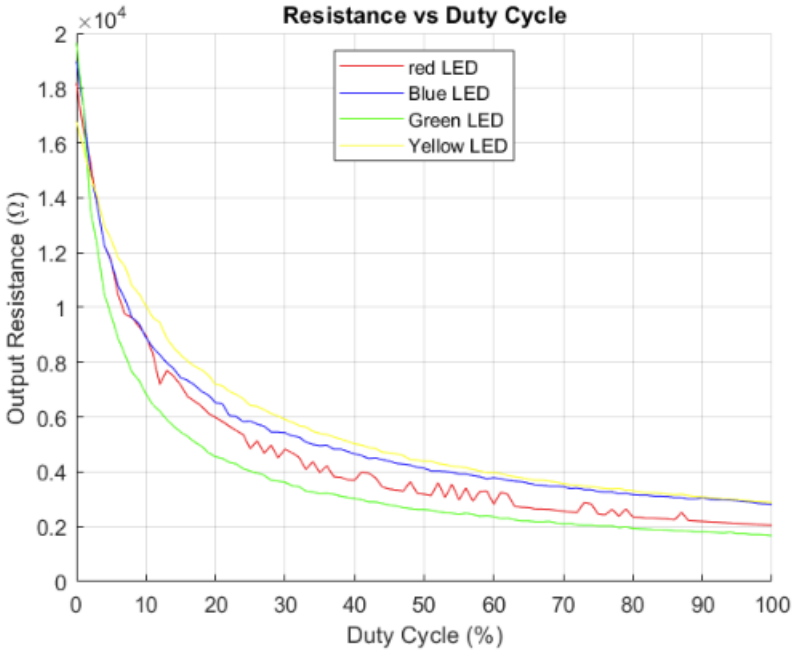
Purpose

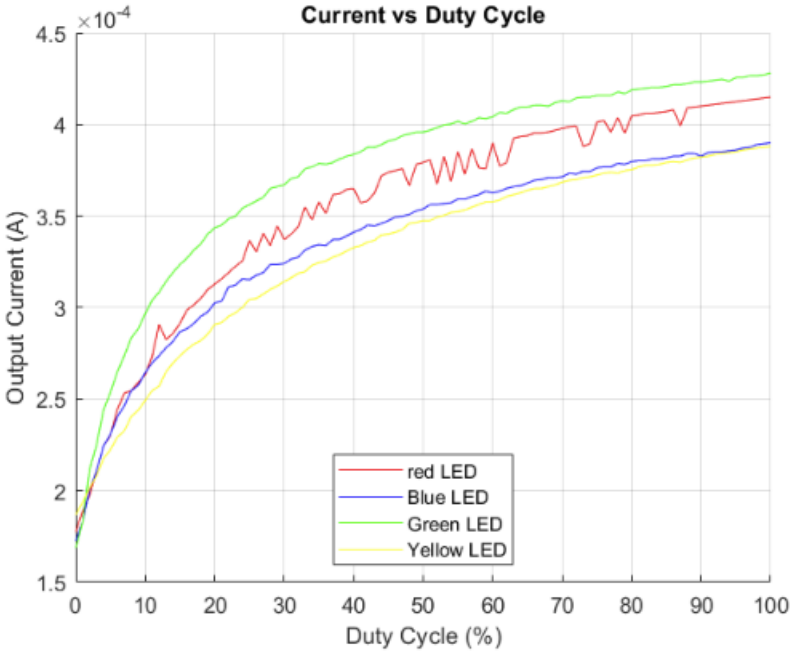
The purpose of this lab was to use MATLAB to measure the LED readings from last week. Using a photoresistor to measure data and transfer between the pc and arudino using a serial port.

Discussion

Like last week's lab, we created graphs to depict the data that we measured, these graphs were Voltage, Resistance and Currant vs Duty Cycle.


Voltage vs Duty cycle
Output Voltage (V)
Duty Cycle (%)
red LED
Blue LED
Green LED
Yellow LED
4.5
4
3.5
3
2.5
2
1.5
0
20
40
60
80
100


Resistance vs Duty Cycle
×10^4
Output Resistance (Ω)
Duty Cycle (%)
red LED
Blue LED
Green LED
Yellow LED
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
10
20
30
40
50
60
70
80
90
100



Recommendation

This was basically the same as last week's lab except it had the inclusion of MATLAB code and instead of manually reading, we took the 5 point average across the LED colors.

```
#include <Arduino.h>

#include "DigitalPin.h"


DigitalPin::DigitalPin(int pin)

{

  pinMode(pin, OUTPUT);

  _pin = pin;
```

```
}

void DigitalPin::set_ICR(){
  if(_pin == 6){
        TCCR4A = (1<<WGM41) | (1<<COM4A1);
        TCCR4B = (1<<WGM43) | (1<<CS40);
        ICR4 = 255;
        OCR4A = 50;
        TCNT4 = 0;
   }

}

void DigitalPin::set_duty_cycle(int num){
  if(_pin == 6){
        OCR4A = (num * 255) / 100;

   }

}
#ifndef DigitalPin_h
#define DigitalPin_h

#include <Arduino.h>
```

```
class DigitalPin

{

public:

  DigitalPin(int pin);


  void set_ICR();

  void set_duty_cycle(int val);

};

#endif
```

```
#include <Arduino.h>
#include <DigitalPin.h>

int photo = A0;
int val1 = 0;
unsigned int val = 0;
unsigned int count = 0;
DigitalPin LED(6);


void setup() {
  LED.set_ICR();
  Serial.begin(9600);

}


void loop() {
if (Serial.available() > 0){


  val=Serial.parseInt();
  LED.set_duty_cycle(count);
```

```
  delay(500);
  val1 = analogRead(photo);
  Serial.println(val1);
  count += 1;
  if (count == 101){
    count = 0;
  }
}
}
```

```
close all;
clear all;
clc;


% Set up communications
arduino = serialport("COM5", 9600, "Timeout", 25);
pause(1);


x = 0:100;
numLEDs = 4; % Number of LEDs
y = zeros(numLEDs, 101);
voltage = zeros(numLEDs, 101);
current = zeros(numLEDs, 101);
resistance = zeros(numLEDs, 101);


photoResistor = 10000;


for led = 1:numLEDs
    for K = 0:100
        flush(arduino);
        write(arduino, 2, 'string');
        pause(0.5);
        a = read(arduino, 4, 'string');
        flush(arduino);
        y(led, K+1) = str2double(a);
        disp([led, K, y(led, K+1)]);
    end

    voltage(led, :) = (y(led, :) / 1023) * 5;
    current(led, :) = voltage(led, :) / photoResistor;
    resistance(led, :) = photoResistor * (5 - voltage(led, :)) ./ voltage(led,
:);
```

```
    disp('Press any key to continue to the next LED...');
    pause;
    close;
end




    figure;
    hold on
    plot(x, voltage(1, :), 'r-', 'MarkerFaceColor', 'red');
    plot(x, voltage(2, :), 'b-', 'MarkerFaceColor', 'blue');
    plot(x, voltage(3, :), 'g-', 'MarkerFaceColor', 'green');
    plot(x, voltage(4, :), 'y-', 'MarkerFaceColor', 'yellow');
    hold off
    grid on;
    xlabel('Duty Cycle (%)');
    ylabel('Output Voltage (V)');
    title(['Voltage vs Duty cycle']);
    legend('red LED', 'Blue LED', 'Green LED', 'Yellow LED');
    legend('Location', 'south');


    % Current
    figure;
    hold on
    plot(x, current(1, :), 'r-', 'MarkerFaceColor', 'red');
    plot(x, current(2, :), 'b-', 'MarkerFaceColor', 'blue');
    plot(x, current(3, :), 'g-', 'MarkerFaceColor', 'green');
    plot(x, current(4, :), 'y-', 'MarkerFaceColor', 'yellow');
    grid on;
    xlabel('Duty Cycle (%)');
    ylabel('Output Current (A)');
    title('Current vs Duty Cycle');
    legend('red LED', 'Blue LED', 'Green LED', 'Yellow LED');
    legend('Location', 'south');


    % REsistance
    figure;
    hold on
    plot(x, resistance(1, :), 'r-', 'MarkerFaceColor', 'red');
    plot(x, resistance(2, :), 'b-', 'MarkerFaceColor', 'blue');
    plot(x, resistance(3, :), 'g-', 'MarkerFaceColor', 'green');
    plot(x, resistance(4, :), 'y-', 'MarkerFaceColor', 'yellow');
    grid on;
```

```
    xlabel('Duty Cycle (%)');
    ylabel('Output Resistance (\Omega)');
    title('Resistance vs Duty Cycle');
    legend('red LED', 'Blue LED', 'Green LED', 'Yellow LED');
    legend('Location', 'north');


delete(arduino);
clear arduino;
```