ELEC 3724
Experiment Report

Experiment #2

DC Motors

Date Performed: March 04, 2020

Date Submitted: April 14, 2020

Team:

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Objectives:

The objectives for this lab were to examine and verify starting control and speed regulation while utilizing tools to observe these behaviors within a DC shunt motor.

Part A: Preparation, Induction Motor Setup

Per the lab manual, we were not required to record any values for this part (Part A).

Part B: Speed Control by Adjusting Field Current

Field Current [A]	150mA	200mA	250mA	300mA	350mA	400mA
Speed [rpm]	-1226.1	-941.4	-782.4	-685.5	-623	-583.3

Table 46. Speed control by field current.

Part C: Speed Control by Adjusting Terminal Voltage

Armature Voltage V_t [V]	10V	25V	50V	75V
Armature Current I_{out} [A]	.61	.77	.92	1.03
Speed [rpm]	-213	-561	-1138.6	-1740.8

Table 47. Speed control by terminal voltage.

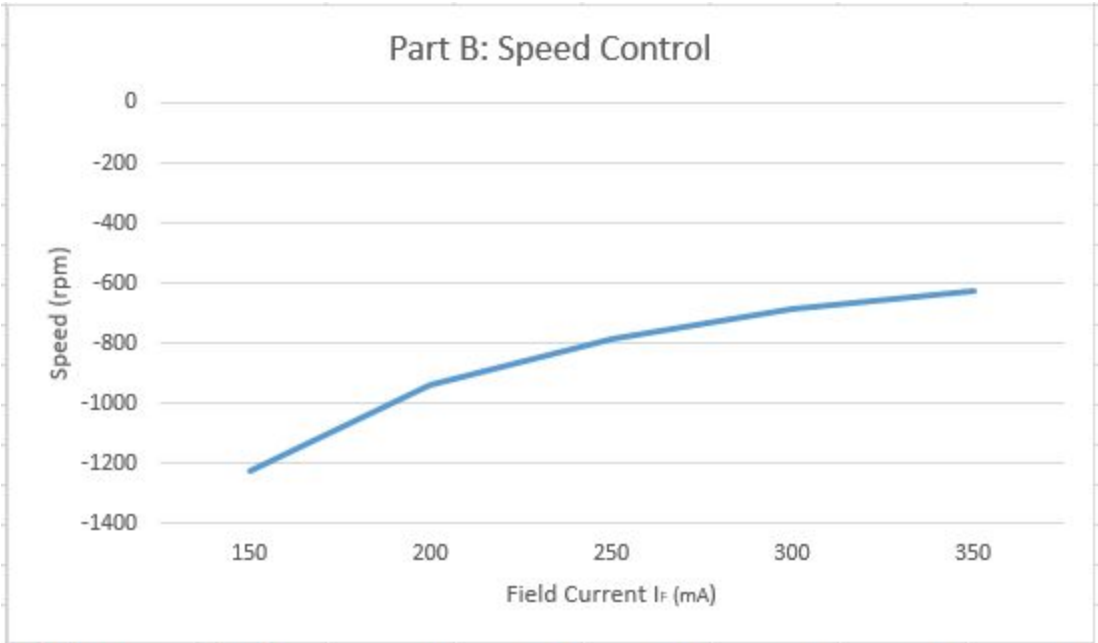
Part D: Speed-Load Characteristic of Self-Excited Shunt DC Motor

AC Output Current [A]	0A	1A	1.5A	2A	2.5A	3A
Armature Voltage [V]	25V	25V	25V	25V	25V	25V
DC Output Current [A]	-1.8	-2A	-2.33	-2.72	-3.12	-3.99
Speed [rpm]	-1252	-1250	-1235.7	-1220.3	-1206.9	-1177.5

Table 48. Load-speed characteristics of shunt DC motor.

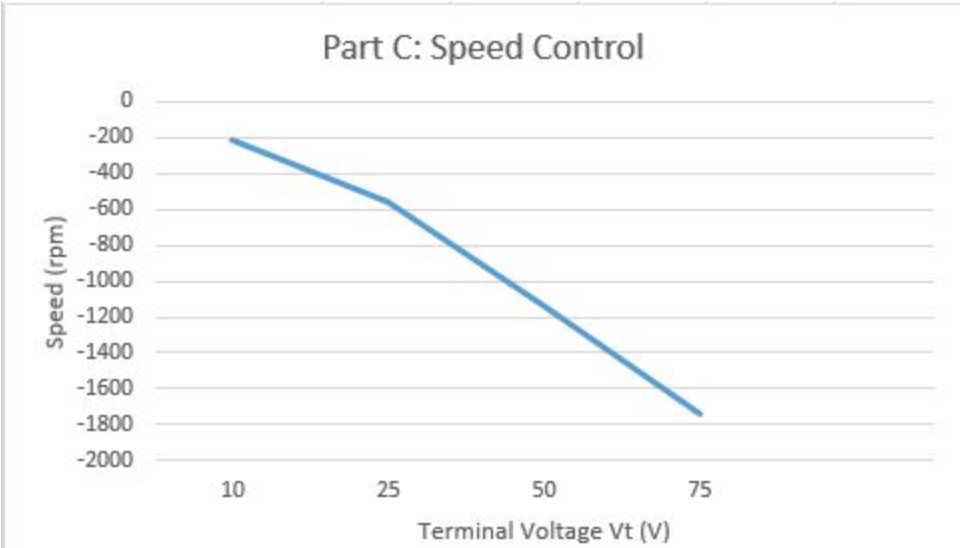
Report Questions:

1. Plot the speed control in part B. Use field current (I_F) as the X-axis and speed (rpm) as the Y-axis.



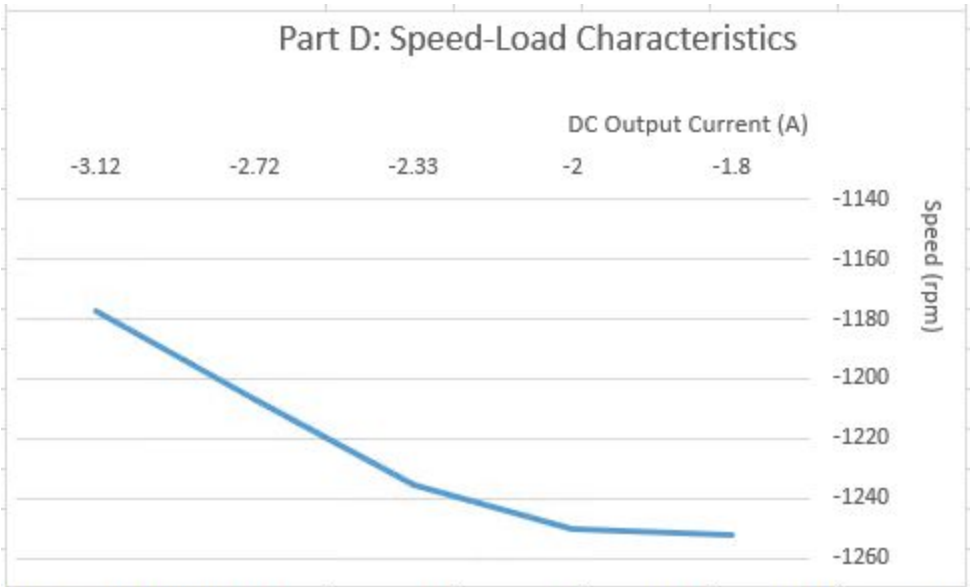
Filed Current I_F (mA)	150	200	250	300	350	400
Speed (rpm)	-1226.1	-941.4	-782.4	-685.5	-623	-583.3

2. Plot the speed control in part C. Use terminal voltage (V_t) as the X-axis and speed (rpm) as the Y-axis.



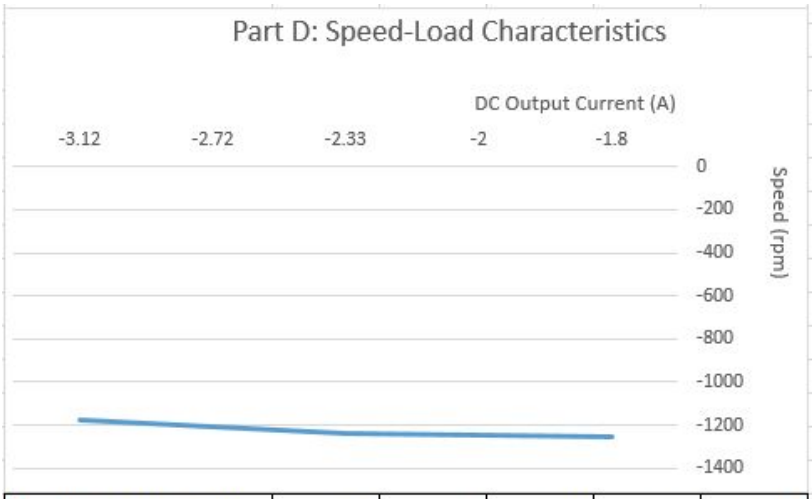
Terminal Voltage Vt (V)	10	25	50	75
Speed (rpm)	-213	-561	-1138.6	-1740.8

3. Plot the speed-load characteristic of part D. Use DC output current as the X-axis and speed (rpm) as the Y-axis.



DC Output Current (A)	-1.8	-2	-2.33	-2.72	-3.12
Speed (rpm)	-1252	-1250	-1235.7	-1206.9	-1177.5

Below is the same graph for Report question (3.) Part D, but zoomed out for clarity:



DC Output Current (A)	-1.8	-2	-2.33	-2.72	-3.12
Speed (rpm)	-1252	-1250	-1235.7	-1206.9	-1177.5

4. Calculate the motor speed regulation for part D.

$$\% \text{ speed regulation} = \frac{S_{no\_load} - S_{full\_load}}{S_{full\_load}} \times 100 \ [\%]$$

where, S_{no_load} = speed at no load

S_{full_load} = speed at full load

% speed regulation = $\frac{(-1252 - (-1177.5))}{-1177.5}(100) = \frac{-1252 + 1177.5}{-1177.5}(100) = 6.327$ %

% speed regulation = 6.33%

Conclusion:

In this lab, I examined a DC shunt motor and it's behavior with regards to speed control, as well as speed regulation. Regarding the behavior for the speed (rpm) in the circuit where we adjusted field current, I noticed that speed became less negative as field current increased. During "part C," of the lab, I noticed speed became greater in magnitude as the armature voltage at the voltage terminal increased. In this instance, the speed (rpm) became more negative, which, again, meant a greater **magnitude** overall. Next, in "part D," in examining the speed-load characteristics, as the DC output current became less negative, speed (in rpm) became more negative, which meant it

increased in **magnitude**. Finally, from the data found in “part D,” the speed regulation percentage was found to be 6.33%.

From this lab we were able to observe the relationship between concepts such as field current, DC output current, and armature terminal voltage in their relationship to speed rpm. The objective to better understand speed control and speed regulation was ,thus, satisfied.