Lab 6: Separately Excited DC Motor
Performed: March 4, 2013
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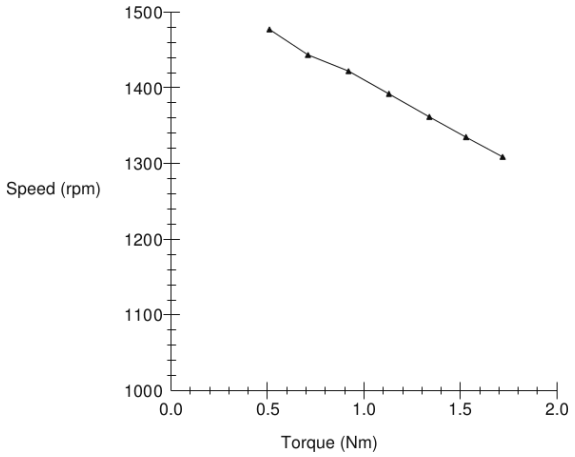
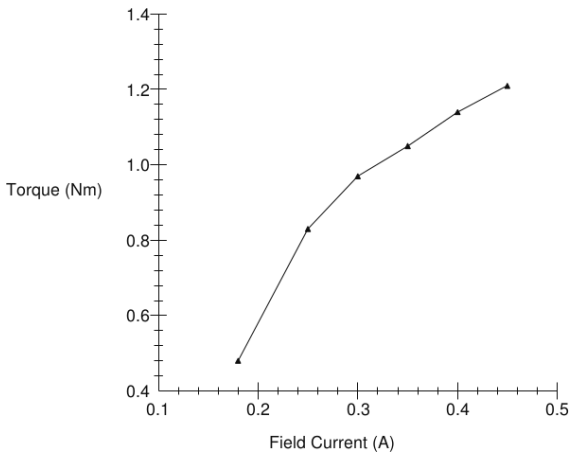
Abstract

In this experiment, the operating characteristics of a separately excited DC motor were analyzed. This report highlights two parts: the investigation of the relationship between motor torque and armature current, and the investigation of DC motor saturation effects. The procedure to determine the motor torque and armature current relationship consisted of increasing the dynanometer load torque while keeping the voltage supply constant at 116.5-V. A set of data containing the load torque and the armature current were recorded and analyzed. The procedure to determine the DC motor saturation effects consisted of using the field control rheostat to increase the field current while keeping the armature current constant at 1.5-A. A set of data containing the output torque and field current were recorded and analyzed.

Results



(a) **DC Motor Speed vs. Torque**



(b) **DC Motor Torque vs. Field Current**

Conclusions

In Figure 1a, the linear relationship between DC motor speed n_m and torque τ is exemplified. The DC motor was initially operating at approximately 1500-rpm. As the load torque was increased, the DC motor experienced a decrease in speed. The armature current was also increasing while the load torque was increasing, and thus the internal generated voltage E_A was decreased.

In Figure 1b, the DC motor saturation effects are shown. This plot is similar to a DC motor magnetization curve, where the field current is plotted against the internal voltage. Here, the field current was plotted against the output torque. Since the torque in any real machine depends on the flux in the machine, and the internal voltage E_A is directly proportional to the flux produced, the y-axis in Figure 1b can be represented by torque and not E_A as in a DC machine magnetization curve. This plot shows that initially a large increase in field current correlates to a sharp increase in output torque. Initially the dynanometer load torque was set to its max value. Thus as the DC motor output torque nears this max dynanometer load torque, further increases in field current produce less and less increases in output torque.