Variable Input Constant Output Voltage Regulator

Functional Requirements List & Performance Specifications

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I. Introduction

The need to create a more efficient form of transportation while also considering the ecosystem has led to the development and use of electric vehicles. The primary goal of the "Variable Input Constant Output Voltage Regulator" (VICOVR) project is to redesign the power electronics developed by a 2012-13 capstone project group to significantly increase output current capacity. A secondary goal will be to design a simple closed loop control system capable of maintaining a constant output voltage over a wide range of input voltages. Although not included in the goals for this senior capstone project, the VICOVR is ultimately intended to provide a controlled DC current to charge the battery bank in an electric vehicle during regenerative braking.

II. Block Diagram

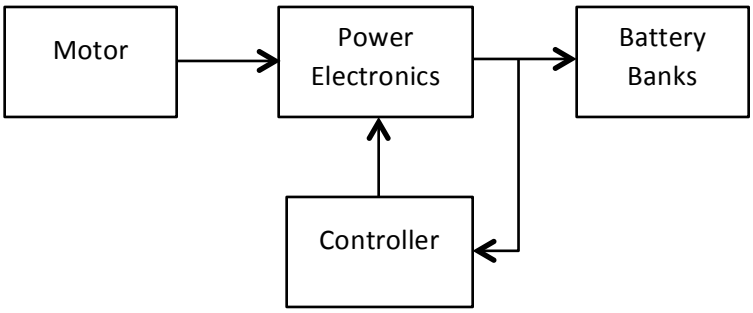

Figure 1: High Level Block Diagram

Figure 1 represents a high-level block diagram of the Variable Input Constant Output Voltage Regulator. The power electronics will convert the widely varying generator (or source) output voltage to a narrow voltage range capable of recharging the battery as the available power decreases with input voltage. The controller will change the duty cycle of a switch in the power electronics depending on the measured output current to maintain a constant output of about 50 ampere.

III. Functional Requirements

A. Motor

- The motor output will vary from 5 to 35 volts.
- Armature current ranging from approximately 20 amps to approximately160 amps.
- Armature Resistance of 0.04 ohms.

B. Power Electronics

The power electronics will convert the varying DC input current from the motor and output up to 48 ampere to the battery banks. Each battery bank has a current maximum of 12 amps. The design is for 48 amps because the energy of the car at 30 mph was calculated and the amount we could recover in a 10 second stop with one battery bank was approximately one fourth of the energy required, which lead to the four-battery bank assumption.

The design current output goals are as follows:

- 5 Amp output at 10 Volts input
- 15 Amp output at 20 Volts input
- 45 Amp output at 30 Volts input

C. Battery Banks

I is assumed there will be four battery banks that contain 3 batteries in each bank. Each battery has a maximum current of 12 amps and 15 volts. The four banks will handle a maximum of 48 ampere and 45 volts.

D. Controller

The controller will measure the current output of the power electronics and adjust the duty cycle of the switch in the power electronics to optimize the current supplied to the batteries.

IV. References

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