Team HEV

Bill Carson, Siyuan Dai, Anne Krishnan, Matthew Zenz

High Level Design

Our subsystem demonstration task will focus on how we will charge the ultra-capacitor bank from the diesel generator.

We obtained our generator from Professor Bauer and analyzed its specifications for output levels. It is rated at 60 Hz and will produce 20 A at 120V AC. Our ultra-capacitor bank will consist of 6 cells of 6 ultra-capacitor each (making a total of 36 capacitors), and we want to maintain the ultra-capacitor bank between 60V and 80 V DC. Each capacitor will break down if more than 2.7 volts is across it.

Note: For this subsystem demonstration, we are not testing the feedback switch with the controller. The controller will switch off the diesel generator once the voltage across the ultra-capacitor bank reaches a predefined level, likely 75V DC.

Step 1: We will use a bridge rectifier. The rectifier will need to convert the 120V AC output from the Diesel Generator into a DC voltage. We are assuming that the DC output will be around 90-100V.

Step 2: We will design a charging circuitry. We understand that this circuit will need to tolerate high voltage and currents and find a way to safely charge the ultra-capacitors. This goal of this part is to set the output of the charging circuit equal to the voltage across the ultra-capacitor bank. Within this charging circuitry, we will likely need to use a variable transformer to step down the voltage. So the charging circuitry should have a constant voltage input while outputting a current into the ultra-capacitor bank

Step 3: Use the output from the charging circuitry to feed a constant current into the ultra-capacitor bank (This will likely be the bulk of the work for the subsystem demo). This ensures that the voltage output of the charging circuitry will always match the voltage across the ultra-capacitor bank. For our demo, we will monitor the voltage across the ultra-cap bank with a voltmeter, and switch off the diesel generator when the voltage gets to a certain level.

Step 4: (This will be done in the Spring Semester) Once the voltage of the ultra-capacitor bank reaches a certain voltage level (75V DC), we will signal the diesel generator to switch off. This will likely involve a power amplifier.

Diesel Generator

120V AC

20 A

Bridge Rectifier

90V DC

Charging Circuitry

Ultra- Capacitor Bank