Electric Motor Control with Regenerative Braking

Functional Requirements

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Introduction

The Electric Motor Control with Regenerative Braking (EMCRB) project will develop a test system to investigate electric vehicular drive systems and regenerative braking. The test system will consist of a three phase permanent magnet synchronous motor, flywheel, and control electronics. Data collected from the test system will be used to develop a model that will establish the efficiency of regenerative braking. An on going Bradley University Mechanical Engineering project will utilize the efficiency data to design an ultra light electric vehicle. A future Bradley University Electrical Engineering project may expand upon the test bench system developed in the EMCRB project.

System Block Diagram

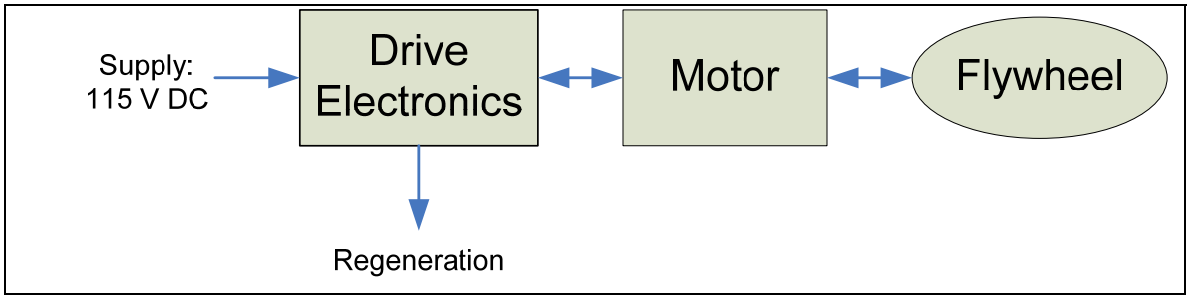

Figure 1: Test Bench Block Diagram

The system motor will initially be powered from a 115 V DC supply and will impart kinetic energy to a flywheel. Once kinetic energy is stored in the flywheel, the motor will be operated as a generator in order to recover electrical energy from the system. The rate and amount of the recovered energy will be used in order to determine the efficiency of the regenerative braking process.

Functional Requirements

The system must drive a flywheel with a three phase permanent magnet synchronous motor and recover energy from the flywheel by operating the motor as a generator. Since efficiency data must be gathered for the system, the drive electronics must also allow instrumentation to measure energy flow into and out of the motor. Furthermore, the flywheel must be large enough to return a measurable amount of energy during regeneration.

Safety Requirements

All system components must be operated within the manufacturer's recommended operating parameters. In particular, the motor and flywheel must be coupled according to the manufacturer's specifications. All high voltage connections must be routed in a secure and well insulated manner. Appropriate safety apparel must be worn whenever the test bench is operating.

Conclusion

The purpose of the EMCRB project is to develop a model for regenerative braking. As such, specific numerical requirements for the test bench components do not exist. Rather, the requirement is to collect operating data from the system.