Miniature Active Dynamometer

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Abstract

TI’s Kilby Labs are high-risk innovation centers that focus on the development of highly creative and state of the art product ideas. Within the Dallas lab, the TI motor lab tests motors from a variety of companies. An integral part of their testing involves:

• Simulating loading that each motor may experience
• Recording the motor’s performance and efficiency
• Tuning their electronics, control boards, and algorithms for optimal integration with the motors

The dynamometer (dyno) is an essential piece of test equipment for these tasks. In order to test motors with load torques in both directions and at low speeds, we developed an active dyno that can simulate loads and vary those loads during operation. This provides TI with a test bed to better simulate the actual load environment experienced by the motor.

Objectives

• Design and build a prototype active dynamometer that can taken apart and reassembled easily
• Provide control code to operate dyno and change load torque dynamically
• Design and provide a protective shield to prevent injury in the event of a breakdown malfunction
• Cost of entire build must be less than $5000

Approach

While TI provided our general approach, several factors required consideration during design.

• The torque transducer needed to accommodate the torque range of the system.
• Couplings and mounts needed minimize interference while securing all the parts together.
• All components were required to be available for future purchase if TI decided to build additional dynos.

The layout of the dyno required the driving motor, MUT, and torque transducer to be lined up as straight as possible to minimize error resulting from misalignment which would have translated some of the axial force into normal force. To help minimize the misalignment, the mounts were designed with slots to allow for adjustment when placed on the breadboard. To accommodate future MUTs that may require new mounts, a custom base was made that would allow new mounts to attach to it without the need to machine a new slotted base each time.

Dynamometer Layout

Program Loops

Upon completion of this project, we will have an operational active dynamometer for TI’s labs to assist in tuning and optimizing their electronics and algorithms. The dyno includes software to control current, speed, or torque and is under the given budget. The success of the project will allow for motor tests to be controlled or altered during operation to increase the scope of tests using the dynamometer.

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