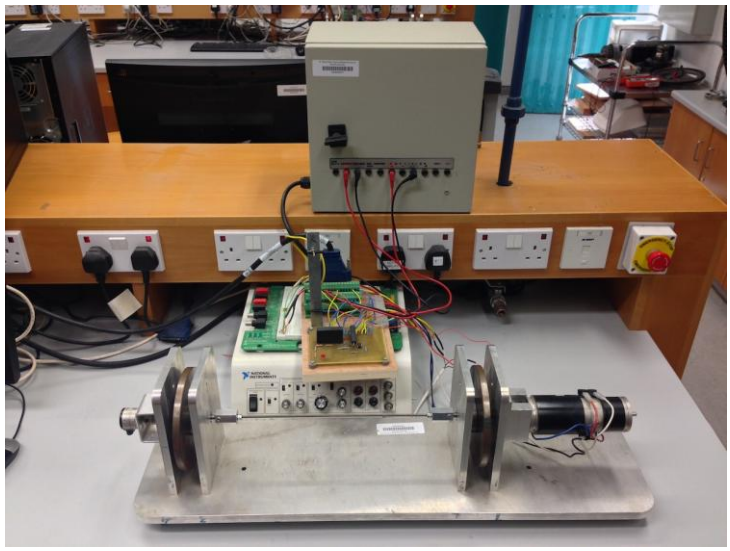
MME 325 - Introduction to Modeling and Analysis of Dynamic Systems

Electromechanical System Modeling Laboratory

The purpose of this experiment is to develop and analyze a model of an electromechanical system. The model will be developed based on first principles and the parameters identified from a series of experiments. The physical system consists of a DC motor connected to flywheel 1, which is then connected to flywheel 2 through a very flexible shaft. Two pairs of roller bearings support the two hi-inertia flywheels. The system is also equipped with a tachometer and optical encoder for measuring the angular velocity of the motor and flywheel 2, respectively. The setup also includes a power supply and a system for control/measurement through LabVIEW.



In practice this model will be used for the design of a control law of the system. Typically, we want to control either the position (angle) or angular velocity of flywheel 2 in order to satisfy some engineering specifications of the device that this system is part of. For example, the device could be a production line mechanism that is used for accurately positioning a microprocessor. The performance of the control system is highly dependent on the model, and therefore, special care must be given to the accuracy of the system model. This is achieved by including the necessary physical phenomena in the model and accurately measuring the parameters.

The model development procedure of the complete system will be divided into steps in order to simplify the estimation of the parameters. First the motor will be disconnected from the first flywheel and studied independently in order to estimate its electrical and mechanical parameters. Then the motor will be connected back to the rest of the system and estimate the mechanical parameters of the flywheels, bearings, and flexible shaft.

After the model is developed and its parameters identified, the system will be excited with a sinusoidal voltage input. By varying the frequency of the input, the experimental frequency response will be generated and compared with the theoretical that is based on the developed model.