

Active Vibration Control Student Design Competition

Intelligent Sensors and Actuators Symposium at the 2008 Earth and Space Conference



Fig. 1 A portable smart flexible beam with piezoceramic sensor and actuator

Description of the Competition Platform: Shown in Figs. 1, 2, and 3 is a flexible beam with a piezoceramic sensor and a piezoceramic actuator. This experiment was made possible by an NSF award (DUE 0442991). The piezoceramic sensor will sense the vibration of the beam, and the piezoceramic actuator will generate control action to counteract the beam vibration if the controller is properly designed. A PC with a dSPACE data acquisition and real time control system, along with Matlab/Simulink, will be provided. Detailed information of this system will be provided online at a later time.

Control Design Objective: The control design objective is to design a controller to suppress the induced vibration of the flexible beam in the presence of disturbance, such as sensor noise, and uncertainty, such as changing mass or stiffness, by using the piezoceramic actuator and the piezoceramic sensor.

Competition Procedure: Day 1: each team will be given a fixed amount of time for system identification. Day 2: each team will be given a fixed amount of time for control design verification. Day 3: the actual competition – each team’s controller will be run under three cases to suppress induced vibration: 1) no sensor noise and no uncertainty, 2) with sensor noise, and 3) with both sensor noise and uncertainties, such as added mass or changed stiffness with the help shape memory alloy wire actuators.

A comprehensive evaluation matrix will be used to rank each controller’s performance. A committee of professors and researchers specialized in vibration control or smart structures will be formed and oversee this student competition.

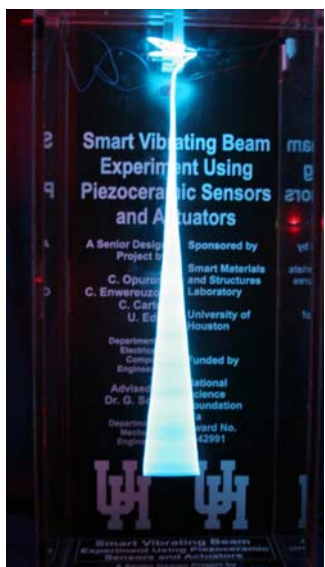


Fig. 2 Vibration at 1st modal frequencies

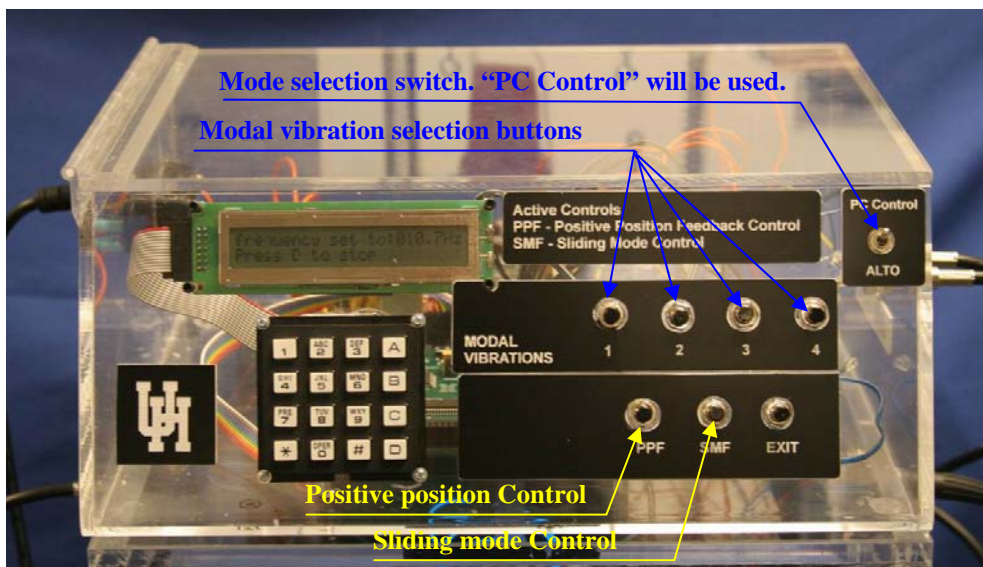


Fig. 3 User Interface of the flexible beam experiment, which can be autonomous or controlled by an external system