ABSTRACT

ACTIVE VIBRATION CONTROL OF A SMART BEAM: A SPATIAL APPROACH

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This study presented the design and implementation of a spatial H_∞ controller to suppress the free and forced vibrations of a cantilevered smart beam. The smart beam consists of a passive aluminum beam with surface bonded PZT (Lead-Zirconate-Titanate) patches. In this study, the PZT patches were used as the actuators and a laser displacement sensor was used as the sensor.

In the first part of the study, the modeling of the smart beam by the assumed-modes method was conducted. The model correction technique was applied to include the effect of out-of-range modes on the dynamics of the system. Later, spatial system identification work was performed in order to clarify the spatial characteristics of the smart beam.

In the second part of the study, a spatial H_∞ controller was designed for suppressing the first two flexural vibrations of the smart beam. The efficiency of the controller was verified both by simulations and experimental implementation.

As a final step, the comparison of the spatial and pointwise H_∞ controllers was employed. A pointwise H_∞ controller was designed and experimentally implemented. The efficiency of the both controllers was compared by simulations.

Keywords: Assumed-Modes Method, Model Correction, Spatial System Identification, Spatial H_∞ Controller Design.