

Effect of sensor location of smart composite plate system on feedback control performance

ABSTRACT

The present study is proposing a deflection control of a fiberglass composite plate system using shape memory alloy (SMA) actuators. The aim of this study is to determine the optimal placement of sensor for the feedback smart composite plate system. Strain measurement on the composite plate was chosen as the input variable for the feedback system. The change in strain on the composite plate was different at all locations on the plate during deflection. Thus, six strain gauges were placed at three positions i.e. tip, mid and root of the plate, at angle 0° and 45° in order to measure the change in strain at these locations and determine which is the best location to produce accurate control of the plate. The performance of the plate using these input variables were compared and analyzed by conducting experiments which required the plate to be deflected using the control system. In order to evaluate the performance of the controller under varying conditions, disturbances were also added to the experiments. The disturbances introduced were similar to those faced by aircraft during flight that is wind flow at varying velocities conducted in the wind tunnel. From the experimental results, it was found that the tip of the plate had the highest change in strain value and the control using input from the strain gauge located there produced the best performance as compared to input from strain gauges located at mid and root of the plate. However, in the presence of airflow, it was found that the best control performance was using feedback from the strain gauge located in the middle of the plate.

Keyword: Smart structure system; Shape memory alloy; Strain feedback control; Composite