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# EFFECTS OF THE HIGH-TEMPERATURE LOADING ON THE STRUCTURE DYNAMIC BEHAVIOR

**Abstract**

Hypersonic flight vehicles will be subjected to extremely high surface temperatures and large temperature gradients. High-temperature loading will change the effective stiffness of the structure, and will give rise to serious structural problems. In order to get more information about this thermoelastic phenomenon, both laboratory tests and vibration analysis were carried out on several types of beams and plates. These testing samples were heated using a quartz lamp heating system and their vibration responses were measured using a scanning laser vibrometer. The changes in stiffness were determined by measuring the changes of natural frequency of the structure exposed to the thermal loading. The tests were described here. And the results showed that the effective stiffness changes significantly with the change of the temperature. For the free plate, the natural frequency of mode 1 and mode 2 increased significantly with the radiant heating, and the order of the modes was changed since the frequency of mode 3 was reduced. The changes of the mode shape were also described here. Meanwhile, the effects of the several different rates of thermal loading were also analyzed. For the vibration analysis, the structure temperature distribution from the radiation heating system was simulated firstly. And then the thermal stress was calculated. At last, considering the change of the elastic modulus, the pre-stress modal analysis was carried out to get the change of the structure dynamic behavior. This research will improve the understanding of the effects of the thermal loading on the structure modal characteristics.