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ESTIMATION OF DYNAMIC STRESSES IN CONNECTING LEADS OF SMC ON PCB FOR LAUNCH LOADS

Abstract

The electronic assemblies in spacecraft are subjected to quite high vibration loads during the launch phase. The success of the spacecraft mission entirely depends on the safety of these electronics during the ascend phase which ensures their proper functioning in on-orbit conditions. In order to provide high reliable and cost effective electronic packages, system designers should have better understanding of the loads coming on to the Printed Circuit Board (PCB) and the Surface Mounted Components (SMC) mounted on it.

In the present work an effort has been made to study the magnitude of dynamic stresses acting on connecting leads of RWR 80 resistors that are placed at structurally critical locations on the PCB, using Finite Element software and performing experiment in the laboratory.

The effect of different boundary conditions on the fundamental frequency of the PCB has been studied, in a passive mode. The stresses generated, due to the harmonic loading (similar to launch load conditions), on the connecting leads of the resistor has been evaluated separately at an amplitude of 2g, 5g, 10g, 15g and 20g within a frequency range of 5-2000 Hz. For obtaining the stresses due to random loading the launch loads have been simulated, and applied on the PCB.

The effect of varying temperature (at 25, 40, 55 and 70 degrees Centigrade) on the fundamental frequency and the stresses generated on the connecting leads of the resistor has also been studied, in an active mode.

The magnitude of the stresses generated on the connector leads, in both active and passive mode, has been plotted. The effect on the transmissibility in both the conditions are studied. The effect of the varying temperature on the transmissibility is discussed in detail.

It has been observed that the early "infant mortality" failure of electronics in spacecraft, that follows the Bath-Tub curve pattern, can be reduced to a greater extent if such stress estimation studies are carried out. Based on the results obtained through this study, the reliable placement of the sensitive SMC's on the PCB can be proposed in an optimised manner so as to have a safe and reliable spacecraft mission.