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ANALYSIS OF INFLUENCES OF EXTERNAL COMPONENTS DURING VIBRATION TESTING OF CUBESATS

Abstract

During a satellite launch physical forces in form of acoustic waves and vibrations are impacting the spacecraft. The environmental test campaign replicates these launch conditions on a vibration table. Accurate measurement results give an important determination of the spacecraft components survival or if structural enhancements have to be applied. Especially in CubeSat missions cheap and easily available materials like aluminium or wood are the first choice for construction of mechanical ground support equipment (MGSE).

In this paper the effects of MGSE and other components to the vibration test results are analysed. Shaker adapters for PCBs have their own resonances and are thus affecting the test results. On this account, influences on the test outcomes by using shaker plates of various materials are shown. Besides, vibration sensors are directly applied to the devices under test (DUTs). This additional mass influences the outcomes of the test. Vibration tests with different sensor masses are therefore compared against each other to evaluate this impact. Additionally, different DUT weights are used to identify the influence of the weight relation between DUT and sensor. Evaluation of vibration test campaigns shows that the MGSE and sensor placement can have significant results on the test results, especially with respect to the resonance frequency. Additionally, it was observed that the MGSE in use showed noticeable decrease in its structural integrity which leads to the conclusion that construction of MGSE components requires significant margins in terms of mechanical stability.