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FINITE ELEMENT ANALYSIS AND VIBRATION TESTING OF THE MYSAT-2 CUBESAT

Abstract

During launch, a CubeSat will experience high quasi-static and dynamic loads. Resultant structural responses could cause fatal structural damage; therefore, it is fundamental to analyze the CubeSat structure before handing it to the launch provider. This is generally done through numerical and experimental procedures. MYSAT-2, a 2U CubeSat currently being developed at Khalifa University, was subjected to an extensive structural analysis. Two types of analysis were performed on the fully detailed model of MYSAT-2; a quasi-static loading analysis and a modal analysis. The commercially available finite element analysis software ABAQUS was utilized. Six different quasi-static loading analysis scenarios that correspond to an equal loading of 13G on the positive and negative directions of the X, Y and Z-axes, were created. Modal analysis was conducted to identify the natural frequencies and the modal shapes of multiple finite element models that correspond to various surface interaction conditions of the frame fasteners. Experimental tests were conducted on the CubeSat and the results were compared with those obtained from the numerical simulations. The testing routine consists of a random vibration run, preceded and followed by sine sweeps. Shifts in the natural frequency before and after the random vibration are to be reported and explained. The vibration test results were found to conform with the finite element analysis results. The obtained results were conveyed to the launch provider, in order to qualify the CubeSat for launch.