Paper ID: 64266
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IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Advancements in Materials Applications and Rapid Prototyping (5)

Author: Mr. Pedro Neto
University of Beira Interior, Portugal, pedro.matos.neto@ubi.pt

Mr. Rose Avelino Teixeira
University of Beira Interior, Portugal, rose.teixeira@ubi.pt
Mr. Marcos Rosa
University of Beira Interior, Portugal, marcos.rosa@ubi.pt
Prof. Pedro Gamboa
Centre for Mechanical and Aerospace Science and Technologies (C-MAST), Portugal, pgamboa@ubi.pt

NANOSATELLITE ADDITIVE MANUFACTURED STRUCTURE - DESIGN AND ANALYSIS

Abstract

Nanosatellite structures typically consist of series of standard individually machined components bolted or riveted together. However, despite the increased cost of additive manufacturing, the usage of a custom structure tailored for the internal components ensures a high structural efficiency and lower structural weight. The objective of this paper is to document the process of designing and sizing, from scratch, an additive manufactured structure for a CubeSat capable of withstanding the static launch loads and thermal loads from the high temperature gradients present in orbit. Modal analyses were also performed to ensure the natural frequencies are above the threshold for a safe launch. In a first approach, a 3U structure with a novel component attachment method was designed and sized for a certain set of internal components and loads. In a second phase, this 3U structure was scaled down to a 1U configuration with a standard component attachment method. The 1U structure was manufactured and, despite significant deformations being observed in slender elements, the overall geometry and dimensional accuracy was maintained. Overall, the usage of additive manufacturing was found to result in weight savings while maintaining mechanical performance. In addition, new design possibilities can be explored through the usage of this manufacturing technology.