

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures I - Development and Verification (Space Vehicles and Components) (1)

Author: Mr. Amr Elhussein
University of Khartoum, Sudan, iamrelamin@gmail.com

Mr. Mohammed Abbasher
University of Khartoum, Sudan, mohammed.abasher@gmail.com

TOPOLOGY OPTIMIZATION OF UOKSAT3

Abstract

In this paper, we present an optimized design for University of Khartoum Space Research Center UOKSat3 structure. The design was obtained by performing topology optimization of the CubeSat using finite element software package (ANSYS 18.2) to serve as a foundation for using 3D printing technologies for manufacturing the CubeSat structures on the quest for reducing the cost and mass of the structure along with maintaining its strength during the launch environments. First, the static and modal analysis were conducted after studying the load conditions in horizontal and vertical arrangements, Von Mises stress and natural frequencies were calculated, and the topology optimization tool was used to reduce the overall mass. Furthermore, the resulted model was modified using computer-aided design modeler (Space Claim and Solidworks 18) to meet manufacturing limitations and possible manufacturing techniques were discussed. Eventually different plastic materials were tested to investigate its survivability during launching. It was found that the values of the maximum stress and natural frequencies are below the used materials limits and the UoKsat 3 will survive the launching loads without yielding or failures. Moreover, the topology optimization method used can save up to 50 percent of the mass compared to conventional satellite structures.