سامية محمد مصطفى

شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

سامية محمد مصطفى

شبكة المعلومات الجامعية

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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سامية محمد مصطفى

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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سامية محمد مصطفى

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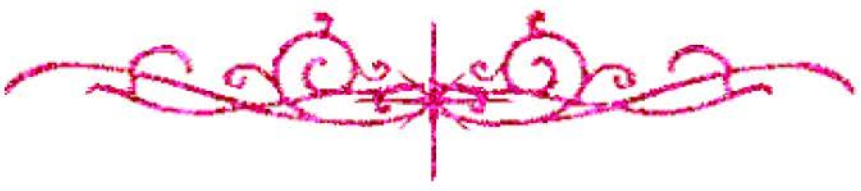
بعض الوثائق الأصلية تالفة



سامية محمد مصطفى

شبكة المعلومات الجامعية

بالرسالة صفحات لم ترد بالأصل

Cairo University
Faculty of Engineering

Configuration, Design, and Analysis of Small Satellite Structure

By

Ahmed Hamdy Gad El Sayed

A thesis Submitted to the
Faculty of Engineering at Cairo University
In partial fulfillment of
Requirements for the Degree of
MASTER OF SCIENCE
In Aerospace Engineering

Supervised by

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Faculty of Engineering, Cairo University,
Giza, Egypt
August 2006

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Prof. Edward A. Sadek	**Member**
Prof. Gen. Mahmoud M. El-Maddah	**Member**
Prof. Hany M. Negm	**Advisor**
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ABSTRACT

This thesis discusses the conceptual design, preliminary design, and detailed design of the primary structure of a low cost, low-earth orbit small satellite intended for earth observation missions. The payload of the satellite under consideration is a very precise optical unit to image the earth's surface having a mass of 45 kg.

Design of the internal and external configuration and estimation of the mass properties of the integrated satellite are considered in this thesis. The iterative process by which the configuration of the small satellite is obtained includes mission definition, launch vehicle selection, description of the requirements, and the major design constrains. The processes used to develop the satellite structural design, choose the suitable material for each structural component, and design the appropriate internal and external structural interfaces are considered.

The ground handling and transportation loads, the launch loads, and the on-orbit loads are considered in both preliminary sizing and detailed structural design of the small satellite structure. A finite element model for the whole satellite is built by ANSYS package to conduct static, modal and dynamic analyses to verify the structural strength and stiffness of the satellite. Fatigue damage is calculated for the detailed satellite structure due to mechanical dynamic vibrations and on-orbit cyclic thermal deformation to verify the required structural reliability of 0.9987. The design criteria require that such a satellite structure should survive all applied loads with no failure during a total service life of 5 years.

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To my parents, my wife,

and

my son Mohammed