FINITE ELEMENT ANALYSIS OF A LIGHTWEIGHT BOX STRUCTURE

MOHD AMIR BIN BOHARI

(2000205598)

A thesis submitted in partial fulfillment of the requirement for the award of
Bachelor Engineering (Hons) (Mechanical)

Faculty of Mechanical Engineering

Universiti Teknologi Mara (UiTM)

MAY 2003

"I declared that this thesis is the result of my own work except the ideas and summaries which I have clarified their sources. This thesis has not been accepted for any degree and not concurrently submitted in candidature of any degree."

Signed : .....

Date : 16/05/2003

Mohd Amir Bin Bohari

UiTM No. :2000205598

ABSTRACT

A lightweight box with dimension of *1200mm x 400mm x 120mm consisting* of 4 ribs, 8 stringers and 2 spar webs was designed and fabricated. The structural behaviors were studied in terms of stress and deflection by theoretical and Finite Element Analysis (FEA). FEA analysis was carried out based on 116 Elements consisting of 60 Shell41 type (for skin and ribs), 8 shell28 (for spar webs), and 48 link8 type (for stringer and spar flank). The structural integrity was tested by measuring the strain of 4 strain and rosette gauges at 5 different locations. The stress values from the theoretical and FEA are in good agreement. Experimental results showed good agreement with the predicted values at locations 1, 3 and 5. However the experimental stresses at location 2 and 4 are deviated by 43 and 84% respectively from the predicted values. Such high deviations indicate a local effect, since location 2 is closed to the rivet and 4 are on the stringer. Meanwhile, location 1 and 3 are on the skin and 5 was the rosette at the web. The experimental deflection values at all loads are significantly deviated from the predicted values. Therefore the theoretical approach has got to be modified by taking several factors such as the effect of the rivet on the geometry and fabrication imperfection into consideration. The experimental values are higher than the predicted values.

TABLE OF CONTENTS

CONTENTS