HIGHER TECHNICAL INSTITUTE

MECHANICAL ENGINEERING DEPARTMENT

DIPLOMA PROJECT

IMPROVEMENTS OF VIBRATING STRUCTURES USING FINITE ELEMENT ANALYSIS

By

NEOPTOLEMOU MICHAEL (M/766)

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Student: Neoptolemou Michael (3ME2)

Supervisor: Dr. A. Stassis

External Examiner: G. Kampouris

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Dedicated to my missing uncle

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Michael Neoptolemou

Project Report

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SUMMARY

The finite element method is a computational technique based on numerical procedure which produces 3D modeling of structures allowing engineers to analyze stress factors within the structure when a variety of forces, vibrations and conditions are applied to the structure as a whole or any particular element of this structure.

Several experiments were performed on a software called Algor to test a car chassis for the stresses applied on it during the engine running. Simulations and photos have been taken and an improvement procedure was followed to develop the mathematical model under structural modifications.

The results obtained with a finite element analysis, in my opinion can be very accurate when a proper finite element model is used. The engineer who wishes to develop a finite element code, must understand the finite element theory, first. The engineer, however, who wants only to use a finite element code, can work by simply having: rudimentary understanding of the fundamental concepts of the finite element method and training of the computer program that will be used.

INTRODUCTION

The finite element analysis, is a powerful procedure for solving the mathematical problems of engineering and physics. Its applications ranges from the analysis of a structural framework of an aircraft or an automobile to that of a fluid flowing through a duct, over a weir, or through the earth.

Actually, the FEA is a numerical procedure for solving the differential equations of physics and engineers. In structural problems, the method produces a set of linear equilibrium equations by minimizing of the FEA with a minimization procedure quickly led to its eye in other engineering areas. The method was applied to problems governed by Laplace or the Poisson equations because are closely related to the minimization of a functional.

What makes a finite element model finite is that you take the part you want to analyze and break it down into a finite number of chunks, called elements. Elements are connected to each other at their boundaries by points called nodes and contain a mathematical description of the material properties of the part. The nodes and elements connected together form a mesh, which looks like the part being modeled. There are two types of elements called h and p. An h-element mesh is refined by adding more h-elements, while a p-element mesh is refined by increasing the order of the displacement polynomial in the p-elements.

The applications of this method began with the conduction heat transfer analysis, then the fluid mechanics followed and finally the method was applicable to any system which was including differential equations.

The finite element method was developed because of the need for a more accurate analysis of aircraft frames and the national commitment to space exploration. The digital computer provided a rapid means of performing the many calculations involved.

As is been reported the FEA can be applied in a large variety of other things. The mechanical engineering is one of the many things. In our days, where the hi-technology is dominating the world, every single product which is produced is tested. As the technology is developed the demands of the customers are increased. No excuses can take place in our days. The people are very predicative in breakdown situations. So, every company all over the world has software. In our case with Algor's capabilities we can test even a coffee-machine.