FINITE ELEMENT ANALYSIS OF UPPER CRANKSHAFT SIX STROKE ENGINE USING CAE SOFTWARE

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion this thesis is satisfactory in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering.

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted in candidate of any other degree.

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DEDICATION

This project is dedicated to both of my beloved parents,
Anidin bin Hj. Muhammad Nor & Zaitun Hj. Norsidek
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ABSTRACT

This dissertation describes the stress distribution of the upper crankshaft for six stroke engine by using finite element analysis. The finite element analysis is performed by using computer aided engineering (CAE) software. The main objectives of this project are to investigate and analyze the stress distribution of upper piston at the real engine condition during combustion process. The dissertation describes the mesh optimization with using finite element analysis technique to predict the higher stress and critical region on the component. The upper crankshaft is implemented in the six stroke engine of 110 cc Modenas motorcycle. Aluminum 356-T7 is selected as an upper crankshaft material. Despite all the stresses experience by the upper crankshaft does not damage the upper crankshaft due to high tensile strength but the upper crankshaft may fail under fatigue loading. Thus, it is important to determine the critical area of concentrated stress for appropriate modification. With using computer aided design (CAD) which is SOLIDWORK, the structural model of an upper crankshaft is developed. Furthermore, the finite element analysis performed with using MSC PATRAN and MSC NASTRAN. The stress analysis results are significant to improve the component design at the early developing stage. The result can also significantly reduce the cost and time to manufactured the component and the most important to satisfy customer needs.

ABSTRAK

Disertasi ini menggambarkan serakan tekanan terhadap crankshaf atas dengan menggunakan keadah analisis elemen terhingga. Kaedah analisis elemen terhingga dilakukan dengan menggunakan perisian kejuruteraan bantuan computer (CAE). Objektif utama projek ini adalah untuk mengkaji dan menganalisis serakan tekanan terhadap crankshaf atas dalam keadaan sebenar enjin semasa proses pembakaran. Disertasi menggambarkan pengoptimuman jala dengan menggunakan teknik analisis elemen terhingga untuk menjangka tekanan yang lebih tinggi dan kawasan kritikal pada komponen. Crankshaf atas digunakan pada enjin motorsikal Modenas enam lejang 110 cc. Aluminum 356-T7 dipilih sebagai bahan crankshaf atas. Meskipun semua tekanan yang dialami oleh crankshaf atas tidak merosakkan crankshaf tetapi crankshaf atas mungkin rosak apabila daya lesu dikenakan. Oleh demikian, sangat penting untuk menentukan kawasan kritikal yang ditumpu oleh tekanan untuk pengubahsuaian yang sesuai dapat dilakukan. Dengan menggunakan perisian lukisan bantuan komputer (CAD) iaitu solidwork, model struktur crankshaf atas dapat dihasilkan. Seterusnya, analisis elemen terhingga dilakukan dengan menggunakan PATRAN MSC dan MSC NASTRAN. Keputusan analisis tekanan amat berguna untuk memperbaiki reka bentuk komponen pada tahap awal penghasilan. Keputusannya juga dapat mengurangkan kos dan masa untuk menghasilkan komponen dan yang paling penting bagi menjamin kepuasan dan memenuhi kehendak pelanggan.

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ρ	Density
k	Thermal conductivity
T	Temperature
E	Modulus of elasticity
σ_{UTS}	Ultimate Tensile strength
P	Pressure
mm	Millimetre
E	Exponent
Pa	Pascal
MPa	Megapascal
GPa	Gigapascal

LIST OF ABBREVIATIONS

Al	Aluminium
CAD	Computer-aided Design
CAE	Computer-aided Engineering
FE	Finite Element
FEM	Finite Element Modeling
FEA	Finite Element Analysis
FVM	Finite Volume Method
FDM	Finite Different Method
2D	Two Dimension
3D	Three Dimension
TET	Tetrahedral
cc	Centimetre Cubic
CPU	Central Processing Unit
MPC	Multi Point Constraints

SAE	Society of Automotive Engineers
ASME	American Society of Magazine Editors
Max	Maximum
Min	Minimum