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REVIEW ARTICLE

CRANKSHAFT FAILURE ANALYSIS OF A DIESEL MOTOR VEHICLE

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ABSTRACT

The aim of the study is to design and optimization of crankshaft for a single cylinder four stroke over head valve (OHV) spark ignition engine. This paper used reverse engineering techniques, in order to obtain of an existing physical model. A three-dimensional crankshaft has been created with the help of SOLIDWORKS and, it is imported to ANSYS environment for the coupled steady-state thermal structural analysis. The material used for crankshaft is AISI 1040, AISI 1045, AISI 4140 and AISI 4615. The objective of this paper focuses the light weight crankshaft design through coupled steady-state thermal structural analysis, and to optimize the crankshaft design within the design domain using parametric optimization. The results obtained from finite element analysis and parametric optimization concluded, the modified design is safe along the selected materials for AISI 1045 and shows the maximum von-mises stresses 184.21 MPa, factor of safety (n) is 2.4428 and it is reduced weight of the crankshaft was 63 grams which is 4.04 % less as compared to existing crankshaft model without compromising the strength to weight ratio.

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INTRODUCTION

Modern power train is right now being come up against a collection of conflicts with reference to emissions, fuel consumptions, and noise as well as vibration level. This has forced to establish approaches that assure appreciable fuel economy, depressed exhaust emissions and high specific power that enhance the mechanical performance of the engine through the development of light weight engine parts. The stress analysis of crank through would contribute a worthwhile conceptual justification for the weight reduction and improvement of engine design. Based on these analysis result, concept have been developed which reduce the weight concept of the crankshaft to a possible extent, without affecting the performance of the engine. In the present work one crank throw model was used to calculate the static strength of the crankshaft. These analysis used multi-body simulation tools for accurately predicting the operating loads acting on the engine components. The three dimension model of the crankshaft system, obtained from SOLIDWORKS software is analyzed in ADAMS/VIEW to assess the motion and load acting on the crankshaft. Finite element model of the crankshaft from HYPERMESH is exported to ANSYS for static analysis through which the deformation and stress distribution on the crankpin is to be determined. The present analysis was conducted on a single cylinder crank throw of a four stroke cycle engine.

However, as the ground work of study and the analysis are the same for multi cylinder engines, the methods used could be altered and implemented for crankshafts from alternative varieties of the engines. The geometrical changes in the size of crankshaft are considered as a potential source for reducing the weight and cost of the crankshaft. Opportunities for the reduction of the weight of the crankshaft were studied and a light weight crankshaft is reported in this paper.

Engine specification

This paper attention is on crankshaft; the geometry and the requirements of the crankshaft solely depend upon the engine. The specification of the engine and material chemical composition is used for the following Table 1.

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Table 1. Specification of the engine

Engine type	4 stroke, Single cylinder, Air cooled engine
Bore x Stroke	68 X 45 mm
Displacement	163 cm^3
Rated Output	2.83 KW @ 3,600 rpm
Maximum Torque	10.3 Nm @ 2,500 rpm
Compression Ratio	9.0: 1
Weight	15.1 Kg

Conclusions

It is observed that by conducting the coupled steady-state thermal structural analysis shows total heat flux, total deformation, von mises stresses, shear stress and factor of safety as per the given loading conditions. After carrying out the coupled field analysis the stresses in loading conditions were studied and then areas where excess material can be removed were decided.

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