Fatigue and harmonic analysis of a diesel engine Crankshaft using ANSYS

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Abstract. The performance and reliability of an internal combustion engine depend on the robustness of the engine crankshaft as it is one of its important moving component. An internal combustion engine is affected by the vibration activities of a crankshaft. This vibration performance is hard to determine due to the complex nature of the crankshaft. In the past, the stress in a crankshaft is calculated using the methods of beam and frame model. To avoid failure of an engine crankshaft, calculation of the crankshaft strength becomes an importance component. In this paper, fatigue, failure and harmonic response analysis of an internal combustion engine by Finite Element method (FEM) using ANSYS workbench were carried out. The analysis is carried out in ANSYS static structural, mechanical solver on a structural steel material. Result from the transient analysis indicates presence of stress at the crankpin journals and with the appearance of deformation at its crank nose. The failure analysis safety factor is high in the Gerber theory being a structural steel material. Increase in the order number also increases the harmonic response frequencies.

Keywords: Crankshaft, FEM, ANSYS, harmonic, stress, deformation, fatigue.

1 Introduction

A crankshaft is used to provide rotary motion when subjected to a number of continuous loads and stress from other attached parts and combustion of gases which causes it to experience torsional, stress and bending vibrations. The idea behind the principle of a crankshaft is changing the input of devices (pumps, compressors, generators) from a sudden displacement to rotary form [1]. The large force experience by the crankshaft from gas combustion depends on the crank radius, connecting rod, pistons, pins, piston rings etc. As a result, it must have enough strength to handle the force of the power stroke without deforming. To avoid extreme bending of an engine crankshaft, it should be stronger than the power stroke downward force [2]. The crankshaft is hammered by the power impulse whenever the engine is running generating torsional vibration. This hitting of the crankshaft needs to be managed to avoid breaking. The longer the crankshaft of an engine, the higher harmonics will reach the tor-

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