

REDESIGN AND OPTIMIZATION OF KEYSEAT

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REDESIGN, OPTIMIZATION AND VALIDATION OF KEYSEAT

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ABSTRACT

Function of keyseat is to lock between main component and sub component like shaft and gear in transmission. Keyseat as one part of moving machine's component need a precision calculation in design, as that reason this project studied about analysis and optimization of design from two dimension model to solid modeling model. Objectives of this project are to redesign a keyseat from the original design, optimize the parameter values and to validate the value using calculation and simulation concept. The original design was taken from anonymous design, and a new keyseat design was made under reflection from the literature reviews. This project have four phases; the first phase is redesigned the original design that add two keyseat into two location, second phase is analyzed the new design with mathematical analysis to identify the optimization of this new design, third phase is built solid modeling by using Computer-Aided Design (CAD) and then simulated by Computer-Aided Manufacturing (CAM), the last phase was made real manufacturing by using CNC machine that drive with G-code that generated from CAM program. Methodology that was used is analysis variable method; variables which affect the value of the objective function, in the manufacturing problem, the variables might include the amounts of different resources used or the time spent on each activity. As the conclusion, redesign and optimization of keyseat is usable in all of shaft in machining part to minimize the failure and minimize the decrease a torque.

ABSTRAK

Fungsi lurah kunci ialah pengunci antara komponen utama dan sub komponen seperti shaft dan roda bergigi pada transmisi. Lurah kunci adalah sebahagian komponen yang bergerak pada komponen mesin yang memerlukan pengiraan yang tepat dalam rekabentuk, oleh sebab itu projek ini mengkaji permasalahan analisa dan pengoptimuman pada rekabentuk daripada model dua dimensi kepada permodelan pejal. Matlamat projek ini adalah merebentuk semula lurah kunci dari bentuk asal, mengoptimumkan nilai parameter dan mengesahkan nilai dengan menggunakan pengiraan dan konsep simulasi. Bentuk asal diambil dari bentuk yang tidak diketahui, dan bentuk lurah kunci yang baru dihasilkan berdasarkan refleksi dari kajian literatur. Projek ini mempunyai empat fasa; fasa pertama ialah merebentuk semula daripada bentuk asal yang ditambah dengan dua buah lurah kunci kepada dua lokasi yang berbeza, fasa kedua pula ialah menganalisa bentuk baru dengan analisa pengiraan untuk mengenalpasti pengoptimuman pada bentuk baru ini, manakala fasa ketiga pula membina model pejal dengan menggunakan CAD dan kemudian ditiru semula oleh CAM, dan fasa terakhir ialah menghasilkan pembuatan yang sebenar dengan menggunakan CNC mesin yang dipandu dengan G-code yang dihasilkan dari program CAM. Metodologi yang digunakan ialah kaedah analisa pembolehubah; dimana pembolehubah-pembolehubah ini mempengaruhi nilai pada fungsi objektif tersebut, pada permasalahan pembuatan, pembolehubah-pembolehubah ini mungkin termasuk penggunaan jumlah rujukan yang berbeza atau masa yang digunakan untuk setiap aktiviti. Sebagai kesimpulan, merebentuk semula dan pengoptimuman pada lurah kunci boleh digunakan pada semua shaft dalam bahagian mesin untuk mengurangkan kerosakan dan penurunan kuasa.

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LIST OF SYMBOLS

D / d	-	Diameter
L	-	Length of key
h	-	Thickness of key
b	-	Width of key
A_c	-	Area resisting crushing
A_s	-	Area resisting shear
F_c	-	Allowable average crushing stress
F_s	-	Allowable average shear stress
P	-	Tangential pressure
M_1	-	Torque
T_{xy}	-	Average stress
σ_x	-	Average bearing

CHAPTER 1

PROJECT OVERVIEW

1.1 Introduction

Function of keyseat is to lock between main component and sub component like shaft and gear in transmission. Keyseat as one part of moving machine's component need a precision calculation in design, as the move machine component, keyseat is moving with a main component and distribute the torque, that is the reason why keyseat need precise design and accurate calculation to decrease wear, noise and deflation of torque. Without this condition keyseat can make main component failure and reduce the torque that distributed.

In this era, machine design` is more complicated and more complex and detail, like sizing, scale, system drawing (America or Europe) and material contour for each detail design. Designer generally using three types of software design, such as: Computer-Aided Design (CAD), Computer-Aided Engineering (CAE), and Computer-Aided Manufacturing (CAM). Software design that usually used like AutoCAD and Mechanical Desktop are registered trademarks of Autodesk, SolidWork and CATIA are registered trademarks of Dassault Systemes, and MasterCAM are registered trademarks of CNC Software, Inc.

Machine design deals with the creation of machinery that works safely, reliably and well and designer have to know about mechanics, thermodynamics, heat transfers, material manufacturing processes, effects of vibration, etc. The ultimate

goal in machine design is to size and shape the parts and choose appropriate material and manufacturing processes so that the resulting machine can be expected to perform its intended function without failure.



Figure 1.1: Broken Keyway

<http://www.phattransmissions.com/200SXWiki/index.php?pagename=Main.MainshaftCounterDrive>)

Machining design also have simulation process to simulate a real manufacturing that refer to what happens when a digital computer runs a state transition table that describes the state transitions, inputs and outputs of a subject discrete-state machine. For simulation processes, designer using CAM software design.

The last process is machining process; machining operations can be divided into those that remove metal from an item, and those that form metal in an item. There is many machining operation like Drill, Lathe, Mill, etc, according to machining processes need. At this time, machining process already uses Computer Numerical Control (CNC)

1.2 Background of Problem

To design part of machine is complicated and have to considerate with concept generation, product planning, advance engineering, product engineering, process engineering and pilot running. US concept that usually used in Asia took 26 months to advance engineering schedule and for Europe and Japan concept used 14 and 15 months to advance engineering schedule.

If advance engineering schedule time can be reduce, the designing process can shorter and can concentrate to another process to increase the quality of product and decrease production cost.

Keyseat is a small thing in machine component however keyseat need precision design and correct calculation to design a keyseat because keyseat is moving part of machine and used to lock and to continue torque from main machine component to sub main component.

1.3 Problem Statement

Design a keyseat with accurate calculation and analysis is complicate and has many considerations, for this reason a program that use to make keyseat in machine design with mathematic calculation, solid modelling and Simulation is needed

According for statement above, this thesis studying as title “**Redesign, Optimization and Validation of Keyseat**”, relate of anonymous design

1.4 Project Objectives

This study was undertaken to achieve the following objectives:

1. Redesign the keyseat
2. To optimize parameter values
3. To validate the value using mathematical calculation and simulation

1.5 Scope of Study

This study was undertaken to achieve the following scope:

1. The design took from anonymous design and keyseat design make under reflection from literature review.
2. Redesign, simulation and real manufacturing of the product
3. Software modeling is using SolidWork, simulation software is using MasterCAM and real manufacturing is using CNC machine.
4. Keyseat parameter base on British Standard, BS 4235:Part 1:1972 (1986)

1.6 Paper Overview

Chapter 1 illustrate an introduction and brief overview of the project including the problem background, problem statement, objectives, and scope.

Chapter 2 explain the literature review; explain about keyseat, formula for mathematic analysis, design and real machining process.

Chapter 3 covers the methodology of the process that will be use in redesign process in chapter four for optimization of keyseat.

Chapter 4 discusses the design and optimization result of keyseat design.

Chapter 5 discuss the validation and result for keyseat after redesign

Chapter 6 the conclusion of the project based on the five previous chapters that have been discussed.