SHORT COMMUNICATION

DESIGNING AND OPTIMIZING CLUTCH SYSTEM

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ABSTRACT: Connecting gearbox to motor is done by clutch. In order not to transferee all motor power to gearbox suddenly and then to other parts and not make sudden movement in the car, the power must be transferred gradually and this is done by clutch system. In modern cars clutch system is very important and should have specialties such as: possibility of transferring power safely moving car without vibration and enough durability so its analyzing is very important. In this research different parts of clutch system were designed and made and then they were analyzed and week parts were identified. Then week parts were optimized and finally a suitable and durable design was presented.

KEYWORDS: Design, Optimization, Clutch system, Analysis.

INTRODUCTION

Connecting gearbox to motor is done by clutch. At the beginning of moving a car a lot of power and energy is needed for forces that are facing with the car and this power is provided by motor. In order not to transfer all motor power to gearbox suddenly and then to other parts and not make sudden movement in the car the power must be transferred gradually. Figure 1 shows clutch system and its mechanism (Kharazan, 2012).
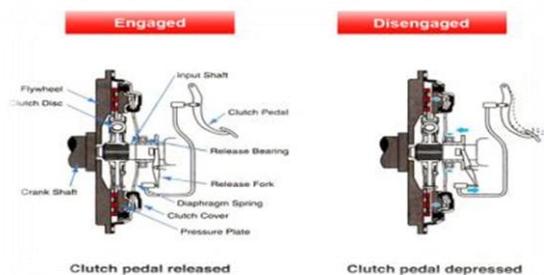

Figure 1: Clutch Set and its Mechanism

Clutch system prevents the car from moving suddenly and moves the car smoothly and safely. Clutch plays the role of cycle change. Clutch protects the car against too much and sudden power. In other words it plays the role of a safety switch. Clutch disk is its moveable part that is put on smooth surface of flywheel. Transferring power is done through friction process and for more friction both sides of disk are covered with a special shoe. Figure 2 shows clutch disk and its shoe (Kharazan, 2012).

Figure 2: Clutch Disk and its Shoe

Clutch system should have the following specialties (Kharazan, 2012; Cveticanin and Maretic, 2000):
1) Possibility of transferring power safely.
2) Moving car without vibration.
3) It should have enough durability while facing with motor cycle changes.
4) It should be light and easy using.
5) In heavy trucks it should be able to transfer high power and it should have enough durability.

The aim of present research is designing and optimizing clutch system for delivering better work in a car for this purpose designing software's have been used.

MATERIALS AND METHODS

In this part for designing clutch system at first different software's have been evaluated then using suitable software the work has been done properly. Solidworks software is a good one for designing especially three- dimensional designing. In this software there are separate parts for modeling, sheeting and analyzing different parts. Also this software has side software's

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such as Geartrax, solid CAM, Cosmos and so on. Besides Solidworks software can be connected to software such as ANSYS (Ha *et al.,* 2006; Koser, 2004).

CATIA software is one of the best ones all over the world that can design, produce analyze by a computer on using CAD/ CAM/ CAE. Modeling spaces of solid model are beside Mechanical design one and are used for different works. CATIA has following spaces (Meriam and Kraige, 1998; Shrinivas and Satish, 2002; Prakash and Vadiraj, 1994).

1. Modeling space of surfaces: this part can make complicated surfaces and files of three- dimensional scans.
2. Machining space: after making a model machinery, operations for making and producing amodel can be possible and each stage is visible.
3. Limited Eleman analyzing space: using this space analyzing pieces and models will be possible
4. Analyzing and designing mechanisms: using catia software after defining connections between different parts of mechanism seeing its movement will be possible and also it can be analyzed.

DELMIA software is the same as CATIA. It helps producer for simulating production process and tools productions. DELMIA is used independently but it has complete compatibility with CATIA software.

Delmia PLM technology lets manufactures optimize their production, months before final production managers engineers and designers can study their designs and can study all of the process is visible in three-dimensional space. Whole process is visible in three dimensional form. Then production direction is presented in the form of film slide and report. JIMULIA software is software for analyzing elements. This software is used widely in industries such as car production air- space, and industries that produce industrial materials (Shigley and Mischke, 2001; Prakash and Aprameyan, 1998; Mourelatos, 2001). So this software is used for modeling and customizing in research sites. STMULIA software has the following usages:

1. Car-industry: motor durability gearbox efficiency transfer system surveying washers transferring hent mental forming mechanism analyzing and assembly.
2. Tire industry: caulking systems sport products motor base systems for removing vibration and thermo

mechanical analyzing of rubber products.

3. Defense industries and air- space:

Simulating huge structures related to space such as solar cells space radars simulating air plane motors thermo mechanically in different situations designing different pieces resistant to explosion.

ANSYS software is an analytical one for modeling designed for solving complicated problems. In this method complicated models are at first divided into smaller parts and then by combining results, the whole answer of model is gotten at each point. Preference of analyzing diverse problems and promoting computer tools has developed use of software's related to it. Predicted tools of ANSYS software has made possible analyzing different structures such as:

Bridge, dam, reservoir and different parts such as: steel fitting and so on. Among them, we can point to statically analyzes, Model time situations numerous choices in the form of power accelerate and are available. So different behavioral models of form able materials are available that can be used.

Among different software for doing the research paying attention to clutch conditions solidworks has been used because it has high capacity for modeling.

RESULTS

In Solidworks software space different parts of clutch system were designed. After modeling different parts of clutch by a software as embling process was done and different parts were assembled figure 3 shows clutch system modeled and figure 5 shows clutch scale. Figure 5 shows all parts of clutch system after assembling. Figure 7 shows a part of clutch system. It should be said that different analyzes have been done after modeling and weak parts have been known. After that weak parts have been optimized. Finally a suitable designed was presented. It should be mentioned that used analyzed for clutch system were stress analysis and fatigue analysis, these analysis were done according to forces that were applied on different parts of clutch system.
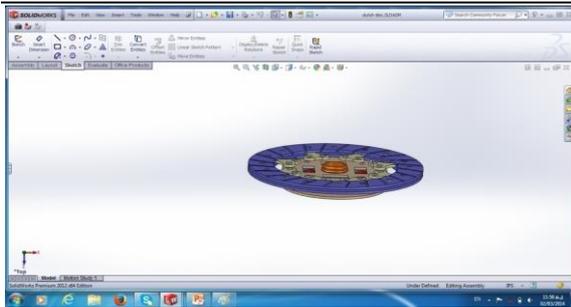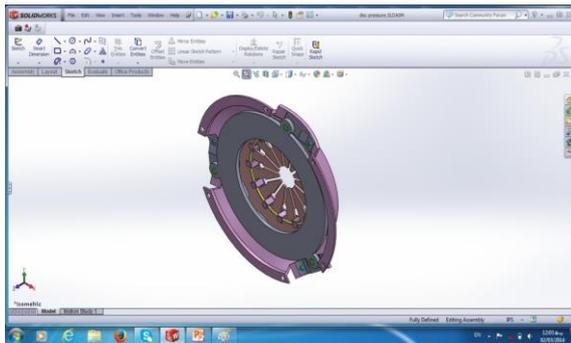
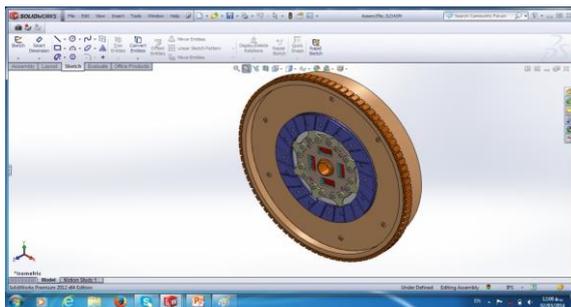**Figure3:** Clutch Disk Modeled Set

Figure 4: Clutch Scale Modeled Set
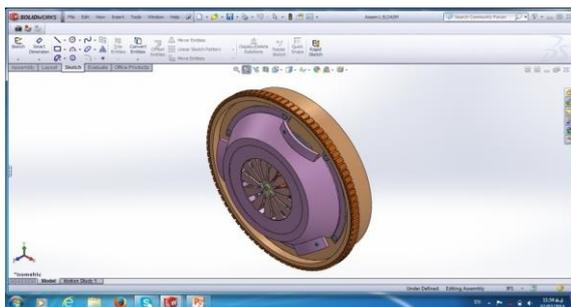

Figure 5: Flywheel Modeled Set

Figure 6: All Parts of Clutch Set Assembled After Modeling

Figure 7: A Section of Clutch Set

CONCLUSION

Clutch system should do Possibility of transferring power safely, Moving car without vibration, making enough durability while facing with motor cycle changes and in heavy trucks it should be able to transfer high power and it should have enough durability. According to above statements this paper reviews designing and optimization of clutch system. So different parts of clutch set were modeled using Solidworks software and then they were assembled and after different analyzes weak parts were identified. After this stage weak parts were optimized and finally suitable design was presented. Also this note should be mentioned that according to our researches and shape of clutch system the best software for doing this project was Solidworks software so our analysis were done in this software.

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