Modification In Variable Gear Ratios Along With Fuel Saving Technology

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Abstract: In this current Research explores the impacts of modifying the tooth profile on the vibration of multiple gear sets. The nonlinear analytical model takes into account the dynamic load distribution between the individual gear teeth and the impact of variable mesh stiffness, profile changes and loss of frictional contact. Compared to nonlinear gear dynamics, the model proposed in this research provides better agreement than two current models. The noise mechanism can therefore be precisely uncovered to noise source, transmission path, and response. The Benchmark contact mechanics in gear mechanisms had compared with various loads, changes to the profile and circumstances of bearing stiffness. This model depicts the complete and partial loss of contact. Based on the suggested model, perturbation analysis discovers approximate frequency response alternatives in the event of no complete contact loss due to optimization. In this work, to increase the speed as well as the torque of the motorcycle by modifying the gear ratios of the gear train. The motorcycle decided to undergo the modification of the gear ratios is Hero Honda Passion. The sprockets provided by the manufacturer consist of 14 teeth and 44 teeth as the driver and the driven sprocket respectively. In this modification two more sprockets having 56 teeth and 32 teeth would be added along with the existing driven sprocket. The sprocket having 32 teeth is provided to increase the speed of the vehicle and the other consisting of 56 teeth is provided to increase the torque of the vehicle. This modification would help the bike attain a higher torque at off-road terrain and also higher speed at highway. The power from the engine to the rear wheel of the motorcycle would be transferred with the help of chain and sprocket assembly. This mechanism would be supported with the help of a chain shifter which would be mounted on the frame of the motorcycle. This shifting of the chain from one sprocket to other will be monitored by shifter provided at the handle bar. This will be manually controlled by the driver with the help of a shifter mechanism. After going through the study and analysis of the newly added sprocket gears, it's verified that the sprocket can undergo loads without getting damaged while torque is applied and thus, future, this paper helps the researchers to identify the influence on the mechanical properties of gear mechanism and the study in gear noise and fuel saving behavioral of vehicle investigations.

Index Terms: Gear mechanism, Fuel economy, noise, engine performance.

1. INTRODUCTION

This A sprocket is a toothed wheel, commonly used in drive systems, to which the strength and wear resistance of the teeth are important. Sprockets are conventionally fashioned by hobbing, followed by heat treatment. However, the fine-blanking process has recently seen increasing use by sprocket manufacturers. Silent chains have largely substituted irritating noise issues with roller chains. In this research, taxi motorcycle silent chain noise is explored first by order assessment and time-frequency (TF) analysis of measured noise, and second by frame-based noise origin assessment, transmission and amplification. At dynamic resonances, which are the root cause of gear durability and noise issues, large amplitude gear tooth forces and bearing loads are developed. This requires dynamic behavior forecast at the design level. A range of mathematical models have been designed by researchers to explore gear vibration and noise [1–3]. In practice, due to the wide range of particular systems and applications, there are numerous models. However, the nucleus of all designs is the modeling of the contact behavior of the gear tooth. One category of tooth mesh model includes parametrically excited models with regularly variable mesh stiffness and gear teeth shape deviations [4-5]. This paper investigates on the chain drive system is optimized on motorbikes. Chain drives are used for the vast majority of sports motorbikes as they are much more effective than belt drives and prop shafts.

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Chain drives compare positively with gear drives for noise, price, and durability, particularly when designers are confronted with spanning big center distances, one or idler gears, idler shafts, and bearings are needed for a gear drive. As background noise concentrations continue to fall in vehicles, the noise from the chain. In addition, background noise such as intake and exhaust noise generally reduces to a minimum level when driving the car in a condition of motoring. Some noise, such as chain noise, belt noise, equipment noise and others, can delay and disturb riders. In detail the search for chain drive system noise and vibration. For chain-noise studies, the mechanism of noise source must be investigated in a major way; however, the route and final reaction of the noise involved must also be studied in order to provide a detailed overview of a noise issue [6]. The paper discusses both the study of the noise concerned and the design modification to reduce the noise and the increase in efficiency of the vehicle and as well as fuel consumption. The order analysis was used to manufacture the measured enraged noise and corresponding vibration. Each intensive-energy component of a dynamic gearbox revolutionary signature can be highly lit with a two-dimensional rpm-spectrum after processing. Thus, a particular collection of revolving components may be linked to this noise element of concern. This can be used to identify silent loop noise [7]. Three primary problems related to noise generated by vehicle design from its creation to amplification are analyzed and addressed, namely the origin of noise, transmission route and reaction. The mode shape at 1650 Hz has also been designed depending on the channel concept for interpreting a noise part arising from structural resonance with the largest modal radiation effectiveness.

Methods & Methodology:

Wear resistance is the most significant property in the sprocket manufacture. Commercial sprockets are generally made from medium-carbon S50C steel to be used after tooth forming from

the hobbying method for inductive heat treatment. The commercial S50C sprocket was contrasted with the fine-blanking SS400, both as wear resistance and surface hardness, to explore possible replacement of standard sprocket manufacturing with the fine-blanking method. The S50C commercial sprocket has been examined for its structure and surface hardness. In the rpm range as Fig. 3 Shows, during the coast down-stage of the snap-ping there are mostly three elevated energy intensity ranges. Based on the velocity of the engine, the three dominant components are operation 14, order 32, order 44, and 56. The tooth number of the time sprockets on the cam shaft, the sprocket mounted on the line of the crank and the equipment linked to a kicker base, respectively, a mound 14, 32, and 44 and 56 gear tooth profile, according to the evaluation of transmission components. Thus, these device components can be reasonably attributed to these primary noise elements. Approaches to Noise Reduction from vehicle: Chain noise is like noise from the strap, engine noise or noise from the gear. When your throttles shut, backdrop sound and engine sound are mostly absorbed To a large measure will be diminished. Meanwhile, the background noise would not mask transmission sounds, such as belt noise and equipment noise, etc. When developing the modern two-stroke motorcycle vehicle model, Considering the annoying noise shafts with a change in engine velocity, the noise must reasonably come from a number of transmission components that are in Motor-driven straight. The following can be described in some experimental circumstances.

• In a semi-anechoic chamber, all sound measuring was done.

• The primary stand was maintained as irritating ring was obviously sensitive to the conditions when sound information was obtained.

• The bike sample operating conditions were cracking.

Fig.1 *The Vehicle design of Hero Honda passion*

Approach to Reduce Annoying Chain Noise:
Three key sections can be categorized when dealing with the noise issue, i.e., source of noise; route of transmission and reaction as well as the vehicle specification has been evaluated.
• Noise Source: interface of contact between silent chain and timings, adjustment of thrust.
• Path of transmission: mounting unit to frame mounting points.
• Response: Metal sheet bowl-shaped.
The efficiency of the noise reduction can be contrasted with the engine velocity through the order 14 chain noise SPL plot. In fact, at certain engine speeds, Table 1 summarizes chain noise.

3.2 Dimensions and specifications

Numerical Evaluation:

A. Gear ratios :

1st gear ratio = 3.182:1
2nd gear ratio= 1.706:1
3rd gear ratio = 1.238:1
4th gear ratio = 0.958:1

B. Passion sprocket Ratio:
44/14 = 3.1428
32/14 = 2.28
56/14 = 4

A. Calculation of the sprocket for the diameter is shown below:
Teeth pitch: 1.3cm
Teeth height: 0.64 cm

A. For 44 teeth sprocket: (G.R. =3.14)
Circumference: 1.3 X 43=55.9cm
Dia=55.9/π=17.793cm
Outer dia. =17.793 cm
Inner dia. = 17.793 - (2 X 0.64) =16.513cm

B. For 32 teeth sprocket: (G.R.: 2.283)
Circumference= 1.3 X 31 =40.3cm
Dia. = 40.3/π=12.827cm
Outer dia. =12.827
Inner dia. =12.827 - (2 X 0.64)= 11.547cm

For 56 teeth sprocket: (G.R. =4)
Circumference=1.3 X 55=71.45cm,
Dia. =71.5/π= 22.759cm
Outer dia. = 22.759cm
Inner dia. = 22.759 - (2 X 0.64)=21.479cm

For 14 teeth sprocket (driver):
Circumference=1.3 X 13=16.9cm,
Dia. =16.9/π= 5.38cm
Outer dia. = 5.38cm
Inner dia. =5.38- (2 X 0.64) =4.1cm

Max. speed the vehicle can attain(Theoretically):

At 32 teeth sprocket:
1st gear = 37.20kmph
2nd gear = 69.38 kmph
3rd gear = 95.61 kmph
4th gear = 123.56 kmph

At 44 teeth sprocket:
1st gear = 27.01kmph
2nd gear = 50.37 kmph
3rd gear = 69.43 kmph
4th gear = 89.71 kmph

At 56 teeth sprocket :
1st gear = 21.20 kmph

2nd gear = 39.54 kmph
3rd gear = 54.49 kmph
4th gear = 70.43 kmph

Modification 1 (for high torque)
*Number of teeth on driver gear= 14 teeth
*Number of teeth on driven gear= 56 teeth
*Therefore final gear reduction ratio= 4.0:1
Overall gear ratio:-
1st gear = 3.182 x 4 = 12.7:1
2nd gear = 1.706 x 4 = 6.8:1
3rd gear = 1.238 x 4 = 4.9:1
4th gear = 0.958 x 4 = 3.83:1

Modification 2 (for high speed):-
*Number of teeth on driver gear = 14 teeth
*Number of teeth on driven gear = 32 teeth
*Therefore final gear reduction ratio = 2.28:1
Overall gear ratio:-
1st gear = 3.182 x 2= 6.3:1
2nd gear = 1.706 x 2= 3.4:1
3rd gear = 1.238 x 2= 2.4:1
4th gear = 0.958 x 2=1.9:1

We have to find the torque acting on the sprocket to analyze it.

The torque acting on the sprockets is:

On 44 teeth:
Max torque = 8.04 X 3.182 X 3.14 = 82.85 Nm
On 56 teeth:
Max torque = 8.04 X 3.182 X 4 = 102.33 Nm
On 32 teeth:
Max torque = 8.04 X 3.182 X 2.28 = 58.33 Nm

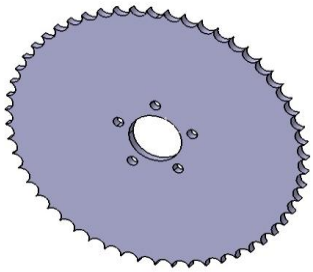
Considering the model on “Passion Pro Drum self cast” 4-speed constant mesh gear box.

Different gear ratios:
1st gear= 3.182:1
2nd gear= 1.706:1
3rd gear= 1.238:1
4th gear= 0.958:1
Number of teeth on driver gear = 14 teeth
Number of teeth on driven gear = 44 teeth
Final reduction ratio = 3.143:1

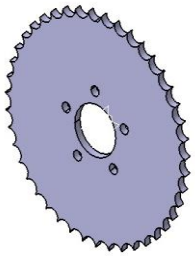
Normal overall gear ratios:-
1st gear = 3.182 x 3.143 = 10:1
2nd gear = 1.706 x 3.143 = 5.3:1
3rd gear = 1.238 x 3.143 = 3.8:1
4th gear = 0.958 x 3.143 = 3:1

3.3 Modelling of sprockets:

For modelling of sprockets we use the software CATIA.



A. Fig: The above sprocket consists of 56 teeth. It’s outer and inner diameter are 22.759cm and 21.479cm respectively.



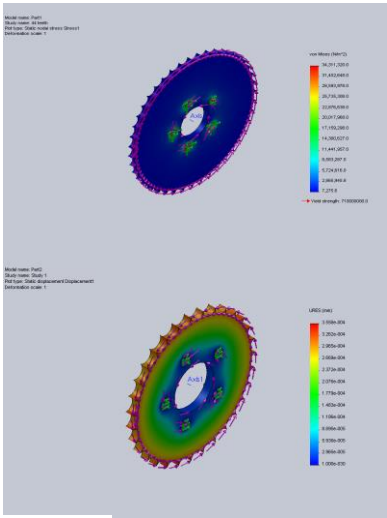
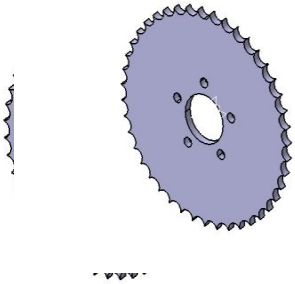
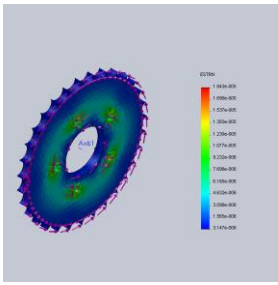


Fig: The above sprocket consists of 32 teeth. It’s outer and inner diameter are 12.827cm and 11.547cm respectively.





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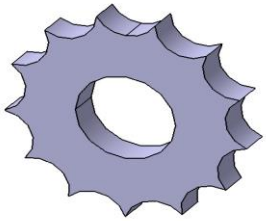
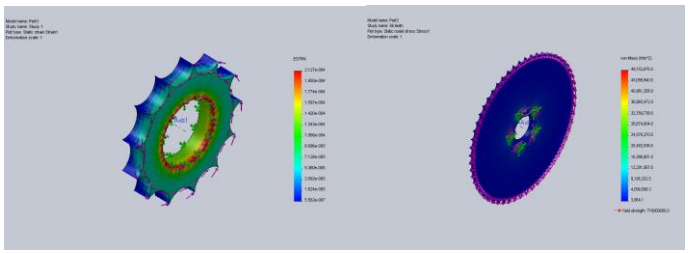
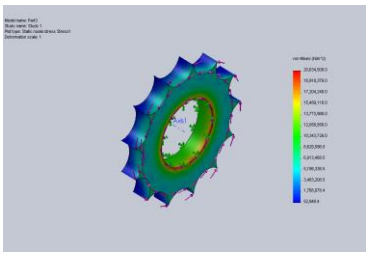


Fig: The above sprocket consists of 14 teeth. It’s outer and inner diameter are

5.38cm and 4.1cm respectively

Analysis Experimentation in CATIA

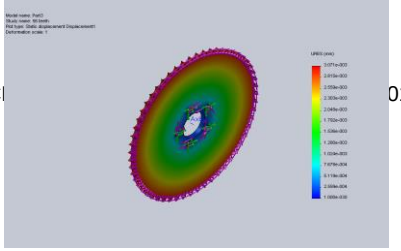




RESULT AND DISCUSSION

Properties of carbon steel (for sprocket):
Sprocket is the significant part in Bikes In which to meet the higher efficiency of the vehicle through the upgradation of sprocket by modulation of gear tooth has been achieved in the current manufacturing material in the production of manufacturing Carbon Steel. As per the American Iron and Steel Institute, carbon steel has the properties made up mostly of the element carbon and which relies on the carbon content structure. First let us see some information about its mechanical properties. These are true when the temperature is 25°C.

- Its density is 7.845 (×1000 kg/m 3).
- Its tensile strength is 518.8 Mpa (Mega Pascal) and its yield strength is 353.4 Mpa.
- "Now let us see some of its physical and structural properties."
- The minimum level of chromium, cobalt, zirconium, vanadium, nickel, molybdenum, tungsten, titanium, etc. when not specified in the alloying of steel along with carbon, gives rise to carbon steel.
- The minimum level is not specified because they don't make a major difference in the alloying abilities of the steel.
- The percentages of Cu, Si and Mn in the alloy do not change from a standard 0.60, 0.60 and 1.65 respectively.
- The higher the content of carbon in the steel, the higher is the tensile strength of the steel.
- This steel has the ability to become even stronger when given heat treatment.
- Though the strength of the steel may increase, its ductility (the ability to be drawn into wires) reduces when the content of carbon used to alloy it increases.
- Also, if subjected to very intense heat treatment, the steel can also lose its ability to be welded. Ductility and weld ability are very important



- Properties of carbon steel. These are the properties that reduce with heat treatment. So it should be done in moderation.
- There are two categories of carbon steel: mild or low carbon steel and high carbon steel.
- Mild steel has carbon content of about 0.15%. Needless to say, it is weaker and not ductile. However, it is very malleable. This means that it can be drawn into sheets easily.

- High carbon steel contains carbon in percentages between 0.8 and 2.10, averaging somewhere around 1.5%. It is extremely hard. However, it is also extremely brittle as a result of this hardness. Hence, even though it widely used, it has the highest chances of getting broken down.
- Low carbon steel can be used in industries that involve welding. The welding uses that it has are in the steel applications for bars, angles and plates in industries.
- Medium carbon steel is used in the manufacture of domestic appliances,
- Car bodies, chips, etc.
- High carbon steel is used to manufacture high strength products like
- Knives, blades, cutting tools, etc. This is because high carbon steel can absorb a lot of heat, which makes it extremely hard. Those were some of the most important properties of carbon steel. It is the most widely used metal in the manufacturing industries and so plays a very important role in our lives.
- Carbon steels contain trace amounts of alloying elements and account for 90% of total steel production. Carbon steels can be further categorized into three groups depending on their carbon content:
- Low Carbon Steels/Mild Steels contain up to 0.3% carbon
- Medium Carbon Steels contain 0.3 – 0.6% carbon
- High Carbon Steels contain more than 0.6% carbon

CONCLUSION

The approach to modification of gear ratio to increase efficiency as well to achieve the silent chain noise reduction was studied in this article. The silent chains operation caused noise transmission can be recognized by using CATIA dynamic signature analysis. In re-guarding noise sources, transmission tracks and responses, the annoying noise was investigated. In order to check noise reduction efficiency, machine components linked to these three problems were altered. Furthermore, a study was carried out of structural resonance and its associated structural noise. Finally, some practical guidelines can be summarized below in order to take into account the design amendment. The effect between the silent chain and the sprockets can be reduced by a gentle force pushing the guide.

• The timing angle of the tooth pressure in the involvement of the silent chain and sprockets can influence the sprocket.

For reducing chain noise the altered pressure angle is an additional factor from 31, 5 deg to 30 deg.

Excellent noise reduction can occur from the engine unit.

• A tube frame with a plastic body covers can dramatically alter the features of the response mechanism if a different type of frame may be considered. There can be a substantial decrease in noise. Thus we conclude that the following experiment would increase the performance in the given two wheeler depending upon different terrains, which would be a boost for middle class people.

APPENDIX

CC : Cubic Centimetre
RPM : Rotation Per Minute
mm : millimetre
V : Volt
Ah : Ampere
W : Watt
Kg : Kilogram
Rs : Rupees
OHC : Overhead Camshaft
CDI : Capacitor Discharge

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