

Design & Development of Continuous Variable Transmission with Launch Gear

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Abstract : Transmission system is one of the most important systems in every automobile that has a significant impact on the transmission efficiency. A transmission is what changes the gear of an engine, thereby transferring engine's power to wheels with purpose of moving vehicle ahead. Transmission also provides a reverse gear resulting in backward motion of vehicle. CVT or continuous variable transmission provides an automatic feature for changing the gear ratio depending upon different engine load conditions. Even being an automatic transmission, CVT consists of lesser moving parts and is simpler and compact design. Metal belt and variable pulleys, one of the most popular kinds of CVT that are used in the automobiles widely because it can provide better acceleration because of higher low ratio and better fuel consumption because of less over drive ratio. Despite of providing such advantages CVT generates less torque at lower engine RPM. This is due to slipping of belt over the tapered surfaces of variable pulley. Therefore, mechanism with a launch gear driving the pulleys to reduce belt slip is to be introduced and developed to overcome this problem increasing torque at lower rpm.

Keywords- CVT, Gear ratio, Launch gear, Transmission system.

I. INTRODUCTION

Nowadays, automobile companies produce different kinds of transmissions systems around which can be divided into two main groups: the first group is manual transmissions and second is automatic transmission. There are different types of automatic transmissions like Automated Manual Transmission (AMT), Dual Clutch Transmission (DCT), Automatic Transmission (AT) and Continuous Variable Transmission (CVT).

Automakers will be able to improve the efficiency of their production, if they can equip them with CVT and afterwards they can increase the CVT efficiency with improving its mechanism, components efficiency, control strategies, etc. The Continuously Variable Transmission (CVT) is a force-closed transmission that enables uninterrupted shifting and a continuous range of ratios within its range. The automotive CVT driveline typically consists of a starter device, like a torque converter, a Drive-Neutral-Reverse (DNR) gear set, and a final reduction gear. The starter device facilitates smooth start up from vehicle stand still. After a certain minimum vehicle speed is reached, the starter device is usually locked, and is not required for further operation.

Cars with a CVT system make use of a pair of variable-diameter pulleys and belts to provide varied gear ratios. The input pulley is connected to the engine, whereas the output pulley is connected to the drive wheels. A metal belt runs between the two pulleys. When the pulley halves come closer to each other, the metal belt or chain goes higher on the pulley, thereby increasing the diameter of the pulley.

Different gear ratios are achieved through the change in the diameter of the pulleys. Lower ratio would be achieved when the diameter of the input pulley is smaller than the output pulley and vice versa. Thus, the change in the diameter of pulleys plays a great role in changing the ratio of engine speed to car speed.

II. REVIEW OF LITETRATURE

1. Continuous variable transmission, Mane L.J, Kekan S.N. Vol.2, Issue 2, www.paperpublications.org : A CVT is promising automotive technology that can further provide improved vehicle performance restricted emission. This paper not only the research accomplished towards understanding CVT control and dynamics but also tries to highlight difficulties or directions for future research that might lead to better improvement of such systems and their controllers.

2. Examining the effects of CVT, Ehsan Maleki pour, Sa'id Galobi, Vol.3, Issue 9. Sept 2014, www.ijaieem.org: It improves the efficiency of the automobiles and it can help to reduce air pollution. This paper reveals that this system can ameliorate even more by improving its mechanisms and probably designing a new generation of it in the future.

3. Design of centrifugal clutch, Prof. Nitinchandra R. Patell1, Sanketkumar Dalwadi2, Vijay Thakor3, Manish Bamaniya4:The shaft diameter and drum diameter are considered same for both the methods for comparison of

clutch used in different applications. Further the power and rotational speed of shaft are taken as specified in standard applications.

4. Analysis, Design and Application of Continuously Variable Transmission (CVT) Vishnu selaan, ISSN : 2248-9622, Vol. 5, Issue 3, (Part -1) March 2015, pp.99-105: “A Continuously Variable Transmission or CVT blends the ease of an automatic transmission with the efficiency of a manual transmission.” This statement made by the Honda Motors completely summarizes the concept of CVT. CVT is definitely a technology of the future with its higher fuel efficiency, infinite gear ratios, lower manufacturing costs, steady cruising speeds & better acceleration capabilities.

4. Advanced CVT Modeling and Control: The CVT technology is not limited to automotive driveline applications. Thus the final axis is new application areas, which will bring more innovation and market acceptance to the CVT. In addition to the main driveline, the CVT can also be used in other areas to benefit vehicle efficiency. Some examples for these new areas are mechanical hybridization (van Berkel et al., 2012), auxiliary load electrification and CVTs for heavy vehicles (Aladağlı et al., 2014b). Even though they exist, applications outside of the vehicle domain are out of the scope of this thesis.

III. SIGNIFICANCE OF WORK

Our project centers on to increase the torque of conventional CVT at lower rpm with the help of launch gear. After researching and investigation, we outlined our needs to be the following: To-

- Increases starting torque or torque at lower engine RPM and overall speed range of CVT.
- Decrease belt wear and tear and CVT components life gets increase.
- Better efficiency of Continuous Variable Transmission.
- Design and develop launch gear mechanism.
- Develop a new actuating mechanism to operate launch gear.

Our aim is to vehicles can get better efficiency from Continuous Variable Transmission. And also because of less wear of CVT components the maintenance life of vehicle will be increased and the main advantage will be increase in fuel economy.

IV. PROPOSED WORK

Conventional CVT has major drawback of slipping of belt from pulley. Because of this sudden acceleration condition or at lower engine rpm the slipping of belt occurs.

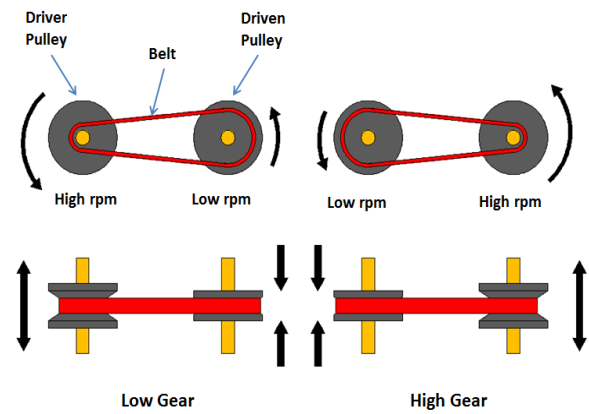


Fig 1 .Conventional model of CVT

This leads to loss of torque in form of friction resulting less efficiency at lower engine rpm. But CVT as advantage in medium and higher speed, because of its infinite gear ratios.

In case of gear train there is very minute loss of torque. So it is beneficial to use gear train at lower rpm.

So combining both gear train and CVT will give better torque transmission with better efficiency.

This is done by using First gear or lower gear train and combining with conventional CVT. For this the gear are mounted on input and output shaft. Input CVT pulley is mounted on input shaft and output CVT pulley is mounted on output shaft.

At lower rpm the gear drive comes in work and after that gear drive is disconnected by gear selector mechanism and CVT comes in work. This transmission system by passes the power transmission and gives better torque at lower rpm and increase speed range.

V. METHODOLOGY

In this project a gear drive is used to connect driver shaft and driven shaft. A launch gear or sliding gear is used to connect and disconnect the driver and driven shaft.

On this arrangement CVT is fitted. So at lower RPM power transmits through gear and after that gear disconnects and CVT engages.

When engine RPM is low then the Launch gear engages and power is transmitted through gears.

When engine RPM increases the Launch gear disengages and power is transmitted through CVT.

VI. Modified design

The modified design of CVT is as follows:

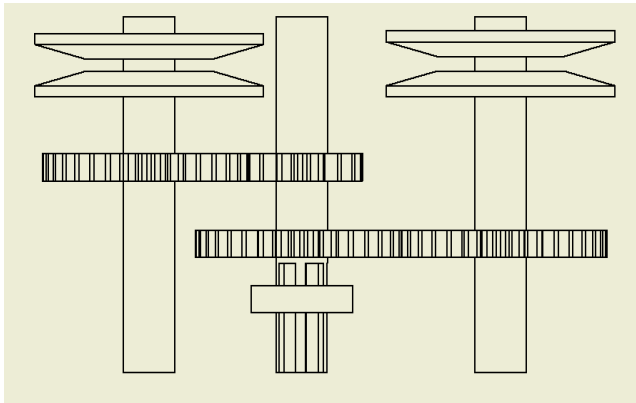


Fig.2: Modified Design of CVT

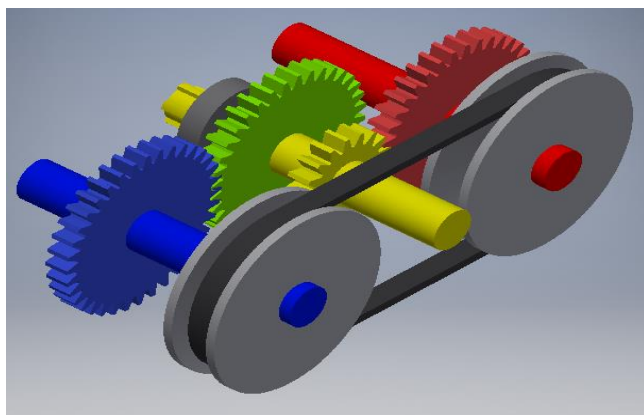


Fig. 3: CAD MODEL

PART LIST:

The parts required for the design and development of CVT are as follows:

- | | |
|-----------------|-------------------------|
| 1. Input shaft | 6. Splined Shaft |
| 2. Input gear | 7. Intermediate gear |
| 3. Output shaft | 8. Idler gear |
| 4. Output gear | 9. CVT Pulley |
| 5. Dog clutch | 10. Reinforced CVT belt |

Input shaft- The shaft which is connected to engine
(shown in Blue colour).

Output shaft- The shaft which deliver power to wheels.
(shown in Red colour

Intermediate shaft- This is a splined shaft which situated between i/p and o/p shafts.(shown in Yellow colour)

Gear Drive with Launch gear- This s type of reverted compound gear train, which is arranged on i/p and o/p shaft.

Reinforced CVT belt- The belt which is fabricated by using composite material of carbon fiber which is mounted on the CVT.

CVT assembly- This is complete CVT system which mounted on i/p and o/p shafts as shown.

Power Transmission in modified CVT design:

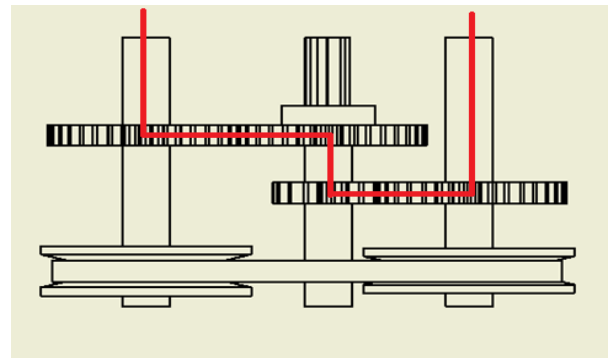


Fig.4. At lower engine RPM

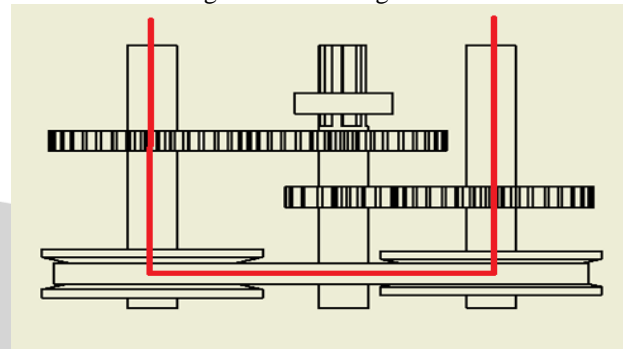


Fig.5. At higher engine RPM

VII. ADVANTAGES & LIMITATIONS

• Advantages:

1. A CVT is an automatic single speed and gear less transmission that can shift through infinite number of gear ratios.
2. These gear ratios provides a number of benefits including extremely smooth shifts.
3. It provides exceptional fuel economy as compared to conventional CVT.
4. More fuel efficient than conventional automatics.

• Limitations :

1. A vehicle equipped with a CVT can provide a very different driving experience.
2. Maintenance and repair costs can also be expensive.
3. Whenever a CVT fails, it is usually bound for replacement. This is because individual components can be very expensive or the specific faulty component can be difficult or impossible to locate.

VIII. CONCLUSION

The new transmission works just like a regular CVT, though it employs a single Launch Gear, which is like first gear in a conventional transmission, or the "easy" gear on a bicycle. Engaged when the vehicle is at rest, Launch Gear is used solely to help the vehicle accelerate up to speed more quickly and efficiently from a stop. Once the vehicle has

reached a speed where the CVT transmission is more efficient, the launch gear is disengaged and the transmission functions like a CVT.

IX. RESULT AND DISCUSSION

By this project vehicles can get better efficiency from Continuous Variable Transmission. And also because of less wear of CVT components the maintenance life of vehicle will be increased and the main advantage will be increase in fuel economy.

After the project is done the expected outcome will be increase in Torque at lower engine RPM compared to standard CVT, increase in launch acceleration and CVT components life will get extend due to less wear and tear.

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