Research Paper Engineering

Differential Control for Continuously Variable Drive

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ABSTRACT

Continuouslyvariable drive is a type of automatic transmission that allows selection of infinite number of transmission ratios within the finite range between minimum and maximum value. Continuously variable transmission is 35% more efficient than that of manual transmission. Improvement of fuel efficiency can be considered to be vital importance to meet the requirement for emission reduction as well as fuel economy. Performance of continuously variable drive can be improved by coupling differential gear assembly to one of variable speed drives.we can increase the horsepower capacity at the expense of the speed range or we can increase the speed range at the expense of the horse power range. Numerous combinations of the variables are possible. It also gives greater drive accuracy.

KEYWORDS | Differential gear assembly, CVT, Power, Torque.

INTRODUCTION

CVT allow the engine to operate always in its optimum R.P.M., whatever the vehicle's speed.Which leads to improve the fuel economy.Continuously variable transmission is 35% more efficient than that of manual transmission.

The existing inventions are based on frictiontype,hydrostatic type,ratcheting type which are all mechanical systems with inherent limitations, (compared to traditional transmissions). Though CVTs are not new technology, limited torque capabilities, poor reliability and the poor control schemes have inhibited their growth.

Controlled differential continuously variable drive can improve CVTs capacity, efficiency & durability. Performance of continuously variable drive can be improved by coupling differential gear assembly to one of variable speed drives.we can increase the horsepower capacity at the expense of the speed range or we can increase the speed range at the expense of the horse power range.

The acting forces within the drive can be precisely calculated, assuring a sound drive design which is especially important for heavy-duty applications.Another important feature of this drive is its compactness, low weight and obviously its low cost.

PROBLEM DEFINITION

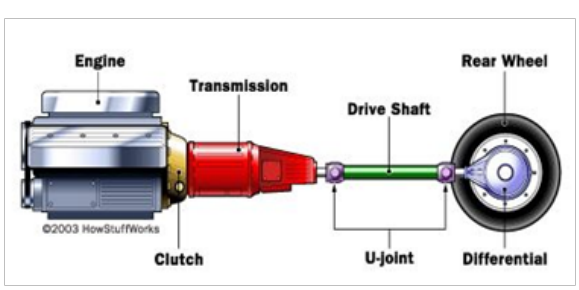

Figure.1.Manual Transmission system.

The undesirable results of Manual Transmission:

- Manual Transmission has limited set of fixed gear ratios.
- Manual Transmission greatly affects on environmental pollution.
- Manual Transmission has limited speed variation range and hence efficiency.
- Manual Transmission has high tractive effort & running resistance greatly affects on sudden jerks.

CONVENTIONAL SOLUTION

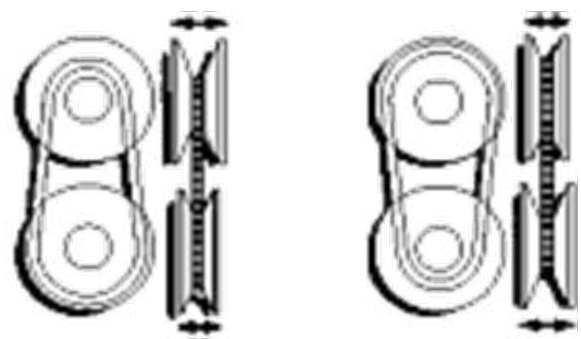

Figure.2 .Variable-diameter pulley V-belt continuously variable transmission.

The simple and most conventional solution for better efficiency, simpler & effortless operation is continuously variable transmission.

Though CVTs are not new technology, limited torque capabilities, Poor reliability and the poor control schemes have inhibited their growth.

A CVT can be regarded as a system dedicated to converting the torque delivered by the engine to the wheels conversely it can be seen as an actuator applying load to the engine.

Performance of friction type CVT depends on the way the traction forces are generated & controlled.

As present CVTs have inherent limitations hence understanding of controlled differential concept in comparison with conventional CVT for further development in technology & improvement of its performance.

The undesirable results of Conventional CVTs include:

- Limited horse power capacity adversely affects on efficiency of continuously variable drive unit .
- Continuously variable transmission has limited speed variation range.
- Limited torque capabilities and the poor control schemes.

NEW SOLUTION

The solution to the above problem is controlled differential continuously variable drive which we develop to partially overcome the poor efficiency characteristics of certain CVTs.

The main features of the drive being;

Controlled differential continuously variable drive will have more speed variation range.

This drive will have high horse Power Capacity & hence efficiency.

High torque transmission capacity with simpler& effortless operation.

Eco friendly drive with greater drive accuracy.

CONSTRUCTION & WORKING

Schematic diagram of Controlled differential continuously variable drive shows that source of powerlike Motor/Engine (Main Input) connects to the differential gear assembly.Further differential gear assembly connects to one of the variable speed drives.

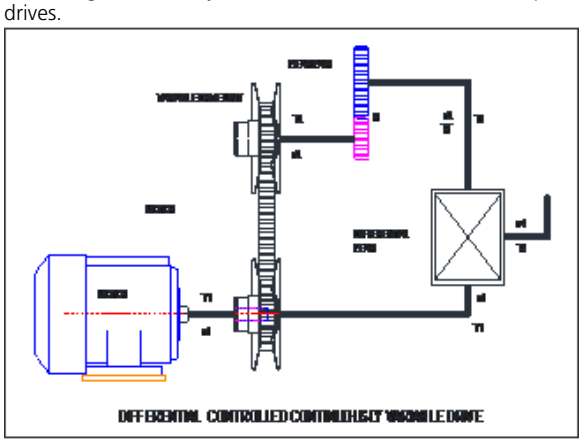

Figure.3.Controlled differential continuously variable drive.

Numerous combinations of the variables are possible.The type of differential depends on the combination that we desire. System can be developed using bevel gear or planetary gear set. Both single and double differential configurations are possible.Differential gears in an automobile's drive-train allow the driving wheels to transmit torque or twisting force, at different turning rates. Thus one wheel can follow the longer arc around the outside of a turn while the other wheel tracks the shorter inside arc without skidding on the road surface.

This combination will add up the advantages of CVT with the robustness and high efficiency of the differential gear. By coupling a differential gear assembly to one of the Variable speed drives we can increase the horsepower capacity at the expense of the speed range or we can increase the speed range at the expense of the horse power range.

In first case we can provide controlled input from one of shafts of differential gear assembly and output results measured at variable drive unit. In second case we can provide controlled input from variable drive unit and output results measured at one of shafts of differential gear assembly. In both case we add up the advantages of CVT with the robustness and high efficiency of the differential gear. Major output results are Torque Vs Speed; Horse power Vs Speed; Efficiency Vs Speed and speed variation range.

FUTURE SCOPE

The following features of the drive will lead to application of drive in variety of field applications:

1. Step-less variation of speed: Any speed between N max to N min can be obtained. The conventional gives fixed speed ratios, that too in steps. This will help replace the costly electrical variable speed drives conventionally used for spindle and slide drives in machine tool applications, packaging machinery etc.
2. Wide range of speeds Ratio: The speed ratio can be varied one a wide range which is not possible in conventional gear box. This will be especially useful in spring making machinery, textile machinery, printing machinery and automatic transfer lines.
3. Compact size: The size of the gear less variable speed reducer is very compact; which makes it low weight and occupies less space in any drive.
4. Ease of operation:The changing of speeds is gradual one hence no calculations of speed ratio required for change gearing.Merely by rotating hand wheel speed can be changed.
5. Singular control: Entire range of speeds is covered by a single hand wheel control.

COMPARATIVE STUDY

Sr. No.	Parameter	Manual Transmission	Conventional CVT	Controlled Differential CVT
1	Horse Power Capacity	High	Medium	High
2	Operating Speed Range	Medium	Medium	High
3	Drive accuracy	High	Low	High
4	Efficiency of transmission	Medium	Low	High
5	Cost	High	Medium	Medium
6	Size	Large	Medium	Medium
7	Torque Transmission Capacity	High	Low	High
8	Weight	High	Medium	Medium
9	Transmission Ratios	Fixed number of gear ratios	Infinite G.R within finite range	Infinite G.R. within finite range
10	Emission of flue gasses	High	Medium	Low

Table No.1.Comparative Study.

CONCLUSION

The controlled differential continuously variable drive was described in this paper emphasizing on improvement of two concepts mainly horse power capacity and speed variation range. This drive also allows betters torque transmission capacity. This drive enables for eco friendly drive by minimizing emission of Cox and Nox gasses. The acting forces within the drive can be precisely calculated, assuring a sound drive design which is especially important for heavy-duty applications. So these merits are useful in some applications such as in Automobile transmission, spring making machinery, textile machinery, printing machinery and automatic transfer lines.

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