MAGNETIC CONTINUOUSLY VARIABLE TRANSMISSION

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Abstract— This project describes a continuously variable transmission device, in which torque transmission and variable gear ratio is achieved by magnetic means. It consists of three concentric pulleys: control pulley, input and output pulleys. All three pulleys have number of pole-pairs on the outer surfaces. The output shaft from engine is connected to input pulley. The output pulley is connected to final drive by means of centrifugal clutch. First pulley starts rotating with the help of engine. We use the control pulley to obtain similar direction movement from input pulley to output pulley. By use of this Magnetic CVT we can enhance the overall performance of vehicle. This Magnetic CVT has scope in future or we can say that it is the only option regarding to efficiency problem in automatic transmission vehicle.

Index Terms—mCVT, magnetic CVT,

I. INTODUCTION:

In automobile area power transmission is done by the gear, belt or chain. In car and heavy duty vehicle mechanical gear are use and in two wheeler chain are use. But in both case of transmission fix gear ratio use and the gear change manually for avoiding gear changing found automatic transmission system in which CVT (continuously variable transmission) system use. The term continuously variable transmission also usually implies that torque may be controlled independently of speed ratio and vice versa. In other words, the torque converter of the conventional automobile should not be considered a CVT because the speed ratio is set by the torque transmitted. The term infinitely variable transmission (IVT) means basically the same as CVT, with the added restriction that a speed ratio of zero must be available, i.e., it must be possible to have zero output velocity for any input speed producing an infinite ratio range. A CVT providing negative as well as positive speed ratios would also be considered an IVT since its range passes through a speed ratio of zero. Even though this definition of IVT is generally accepted, IVT is often used as a synonym for CVT by those not familiar with the difference. Ratio range is one of the most important parameters of a CVT in terms of characterizing it for possible applications. Ratio range is defined as the numerical ratio of the maximum to the minimum output speeds possible for a given fixed input speed. For example, if a CVT can be controlled to operate between 3000 and 1000 rpm for a given fixed input speed, its ratio range is 3.0. Ratio range is usually more significant than the speed ratios themselves, since the latter can normally be adjusted if necessary by other components in the drive line (e.g., the rear axle ratio of an automobile). The ratio range of an IVT is infinite, since it is calculated as a finite ratio divided by zero.

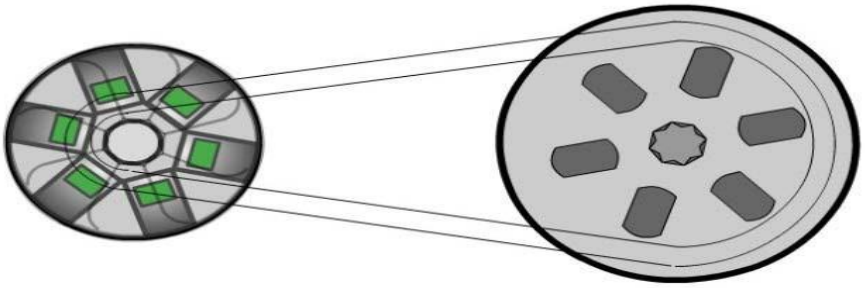


Fig 1. Layout of CVT

Magnetic CVT is a concept model which may become helpful to reduce the disadvantage of CVT. It consist a magnetic gear which is also know as a magnetic gear. A magnetic Continuously Variable Transmission operates by attraction and repulsion between magnets of the gears in the transmission. The gears have rectangle-shaped grooves on which the neodymium magnet is fitted. The speed of the gear can increases or decrease by controlling speed of engine.

A gear can be defined as a mechanism that a transfer a torque from one shaft to another shaft by use of magnets or mechanical teeth. Some of mechanical gears are very similar to magnetic gears for instance the magnetic spur gear. Figure shows mechanical spur gear and magnetic spur gear.

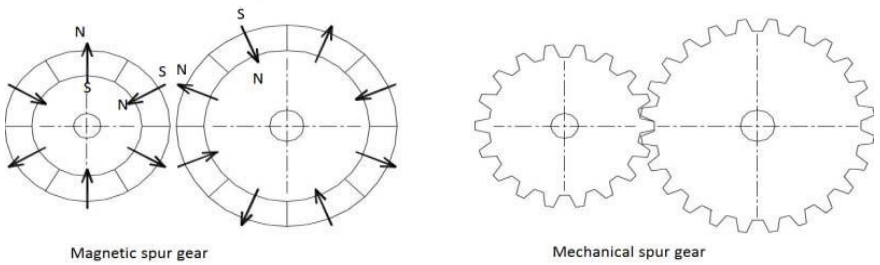


Fig 2. Magnetic and Mechanical spur gear

The torsion spring effect can be explained by imaging one wheel fixed and the other wheel is rotated a small angle. Then there will be a certain torque interaction between the gear wheels depending on angle displacement of the second wheel. This phenomenon is illustrated on Figure.

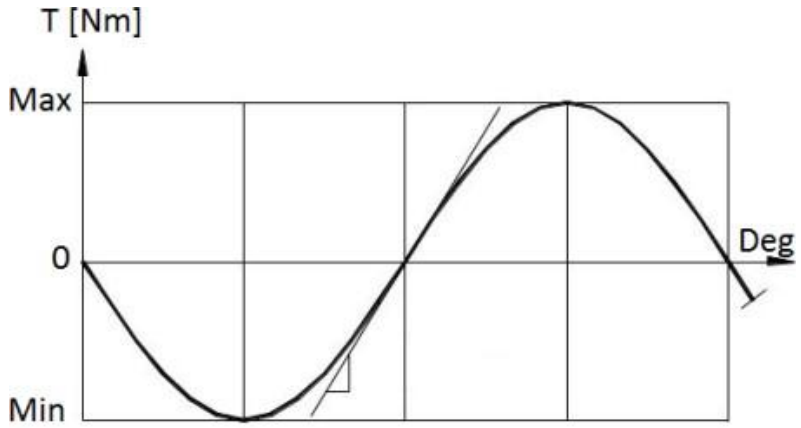


Fig 3. Torque and turning angle diagram

II. LIST OF ABBREVIATIONS:

1. RR_{gg} = Gearing Relationship 2. $NN_{pppppppp}$ = Number of magnet
3. $\rho\rho_{aa}$ = Active torque Density 4. TT_{mmaamm} = Torque maximal
5. TT_{mmmmmm} = Nominal torque
6. VV_{TT} = Total volume
7. $\rho\rho_{TT}$ = Total density
8. $\rho\rho_{RR}$ = total torque density
9. VV_{AA} = Volume of gear A
10. η = efficiency
11. PP_{ppoooo} = power output 12. PP_{mmmm} = power input

III. DESIGN CALCULATION:

1. From the number of magnet on pole one and number of magnet on pole two gear relationship Rg can calculate by following equation:

$$RR_{gg} = \frac{NN_{pppppppp\,1}}{NN_{pppppppp\,2}}$$

2. Active torque density:

$$\rho\rho_{aa} = \frac{TT_{mmaamm}}{VV_{AA}}$$

3. Total torque density:

$$\rho\rho_{RR} = \frac{TT_{mmaamm}}{VV_{TT}}$$

4. Mechanical gears have corresponding torque density factor this calculated from the rated nominal torque TT_{NNppmm}

$$\rho\rho_{TT} = \frac{TT_{NNppmm}}{VV_{TT}}$$

5. Mechanical and magnetic gears have certain efficiency. This efficiency is defined as the relationship between power at the output shaft divided with the power at the input shaft.

$$\eta\eta = \frac{PP_{ppoooo}}{PP_{mmmm}}$$

Types of Magnetic Gear/ pulley	Sm2Co17			NdFeB		
Air gap distance	1mm	2mm	3mm	1mm	2mm	3mm
Torque in Spur Gear/ pulley (Nm)	5.3	4.3	3.2	6	4.8	3.9

Torque analyses

IV. ADVANTAGES:

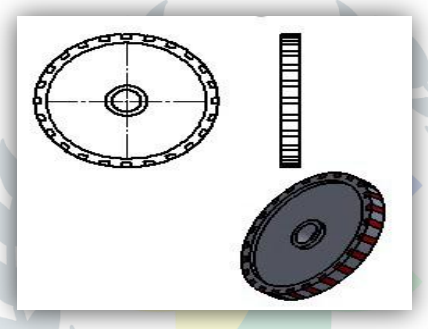
1. Simple structure.
2. Less friction drive with smoother transmission.
3. High efficiency.
4. Long life and less maintenance.

V. DISADVANTAGE

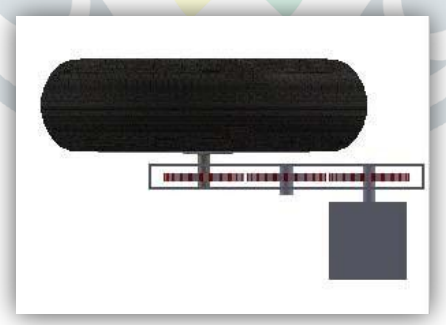
1. Slip of magnet at high speed.
2. Limited amount of torque, however technology is constantly being approved.
3. Difficult to transmit power in rear wheel.
4. A magnetic material is harmful for electric component.

VI. COMPONENTS

1. Magnetic gear:



2. Arrangement:



VII. LITERATURE SURVEY:

1. Liu XG

The present invention is fixed in the drive shaft conical wheel, driving wheel barrel by the permanent magnet and nonmagnetic tapered cone consolidation units composed of permanent magnetic tube perpendicular to the magnetization direction of the bus; a driven shaft is splinted shaft, the driven shaft is parallel to the axis of the drive wheel of the bus, on which sleeve the disc-shaped driven wheel, the driven wheel on the shaft can be slid in the axial direction, the driven wheel by an actuate radially magnetized permanent magnet segments, in a non-magnetic Ring, ring axially magnetized permanent, non-magnetic wreath consisting of consolidation, arc-shaped permanent block along the outer circumference of the non- magnetic rings alternating polarity contact consolidation, or in the circumferential direction on the outer periphery of the non-magnetic ring, etc. Interval several arc-shaped permanent mosaic block and make a curved conical permanent magnet permanent magnet blocks and cylinder relative to the driving wheel of the same polarity; pitchfork aside from Chazi, permanent magnet block consisting of consolidation, aside from the branches of a tree across the gap card outside wheel, and the end surfaces of permanent magnet blocks and driven wheels permanent ring opposite ends of the same sex ring surface and the permanent polar opposite parallel across the gap. Simple structure, speed without friction, and energy saving.

2. Gong Tsai

The step less speed variator consists of mainly one non-magnetic wheel mounted onto the input shaft, one magnetic wheel mounted onto the output shaft and one magnetic wheel and one non-magnetic wheel mounted onto middle shaft with movable axis position. It transmits motion and driving force via magnetic force between the magnetic wheel and the non- magnetic wheel and the position change of the middle shaft to change the applied point of the magnetic force, change transmission ratio and realize step less speed variation.

3. Michael Schlicht

A method and apparatus for providing a continuously variable transmission (CVT) is described. The CVT comprises permanent magnets to couple power, a coefficient of coupling controlled by an electronic servo control loop. Wherein torque multiplication is achieved by "duty-cycle" modulation of the magnetic coupling "pulses", between the input shaft and output shaft.

VIII. CONCLUSION:

Analysis shows that Magnetic CVT is easier to construct, low cost in manufacture, less maintenance and most important very less friction during transmission of power and torque. It is useful for reduce the pollution as the efficiency is increase. Also, it can play important role where very high speed is not needed. Hence, it is very useful for future transportation application.

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