Magnetic Gear Shifting Mechanism

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Abstract— With the advent of magnetic gears, researchers have developed a new breed of permanent-magnet machine. These magnetic geared permanent-magnet machines artfully incorporate the concept of magnetic gearing into the permanent-magnet machines, leading to achieve low-speed high-torque direct-drive operation. Gears and gearboxes are extensively used for speed change and torque transmission in various industrial applications. It is well known that the mechanical gear has a high torque density, but suffers from some inherent problems such as contact friction, noise, heat, vibration and reliability are of great concern. In order to avoid these types of problems we are using magnetic meshing gears.

Key words: Gear Box, Servo Motor Transmission, Magnetic Meshing, Torque Density

I. INTRODUCTION

The basic idea of a gearing is to convert mechanical power from one rotational speed and torque to another speed and torque. Many applications require power input with a high torque and low revolution speed. An example can be a conveyer belt for a production machine. Drive shaft for the conveyer belt must pull a relative heavy load with relative low angular velocity. Power sources for mechanical systems are often available with high speed and low torque. Examples of such a power source can be an electrical machine or a combustion engine. These machines have a relatively low torque and runs at high rotational speeds. The problem is often lack of torque from the source drives. The physical size of a direct drive electrical machine able to drive a conveyer belt directly will typically be too large and expensive. A more cost effective solution will be to place a transmission between the conveyer belt and the electrical machine. This transmission will be able to convert the electrical machine power from a low torque to high torque on the conveyer belt with almost the same power level.

Mechanical gears are often used for such transmission purposes. These gears have often a high torque capability and relatively high efficiency and that is why these transmissions are a good choice for many applications. A magnetic gear is also a transmission device that can transform low torque and high rotational speed to a high torque low rotational speed. Magnetic gears can also achieve high efficiency, but a high torque capability can be hard to achieve unless carefully considerations are made regarding magnetic gear technology and design. That is why torque density is a major issue for the magnetic gear technology.

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

II. OBJECTIVE

The main objective of this system is to minimize the human errors in operating the gears with the avail of automatic technology. Other objectives include optimum gear ratios, reducing wear and tear of the gears, shifting the gear efficaciously, optimum performance of the gear box, optimum force exerted by the cylinders to move the shifting levers (pedals).

In this project, we tried to shift the gears in a two wheeler with a help of buttons. This could be done by electromagnets. We use electromagnets which attract the gears and helps in meshing of gear.

III. LITERATURE REVIEW

The idea of MGs can be tracked down to the beginning of the 20th century. In 1913, a US Patent Application described an electromagnetic gearing which should be the original topology, but almost no one was interested in it at that time. Until a MG topology quite similar to a mechanical spur gear was proposed by Faus in 1941, people gradually paid attention to MGs. However, low utilization and poor performance of ferrite permanent magnet (PM) material made it impossible to be widely used in industry. Until the high-performance neodymium iron born (NdFeB) PM material was invented in the 1980s, the research on MGs aroused great interests again.

Naturally, the earlier MG topologies were converted from mechanical gear topologies. These converted MGs simply replaced the slots and teeth of iron core by N-poles and S-poles of PMs, respectively. The low utilization of PMs was the key problem which caused poor torque density. The power transmission is mechanical in most machines, and it is commonly achieved in the use of gear transmissions. Mechanical gear transmissions have a high torque Density, but the friction occurs in them, which is often the cause of the gear failure. Also, the noise, heat and vibration are present, so the reliability of these gears is reduced.

IV. METHODOLOGY

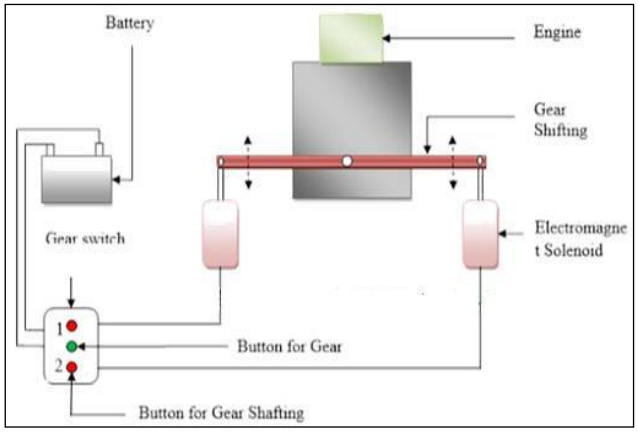

Fig. 2: Circuit of gear shifting mechanism

When a gear shifting-up of an automatic transmission is to be effected, the load applied by the load device is increased, or the load is connected to an output rotation shaft of the engine via a selectively-connecting device, thereby reducing the rotational speed of the output rotation shaft of the engine to a required level. In this work, two electromagnetic coils are coupled to the gear rod of the two ends. The two buttons are used to activate the electro-magnetic coils so that the gear will be shifted.

Automotive technology has been developed in many areas, like ABS system, active steering system and other safety systems, which are implemented to increase the passenger safety and comfort. The development has concluded also the gearbox, which became much smoother and produces less noise. Gear shifting mechanism must be easy to use and workable, these demands are very important especially for small cars used by special needs people.

For some drivers, the gear shifting can cause some confusing at driving specially at critical situations. A crowded road on a hill or a sudden detour makes a lot of tension on the driver. One of the difficulties in this situation is to choose the right reduction ratio and engaging it at the right time.

V. APPLICATIONS OF MAGNETIC GEARS

A. Turbine generator

- Reduce weight+ Increase reliability
- Reduce direct drive diameter

B. Energy storage flywheel

- Commercial power utility backup
- Automotive regenerative braking system

C. Robotics

- Easy moment arms for other parts
- Reliability

VI. CONCLUSION

Magnetic gears afford the opportunity to provide speed and torque multiplication similar to a traditional geared gearbox or transmission, but by using magnetic attraction between rotating members rather than actual physical contact, as between gear teeth. It may be possible to greatly reduce, or potentially eliminate, lubrication requirements, compared to existing traditional gearboxes. A magnetic gear based gearbox for winch applications could increase reliability and mission availability by reducing or perhaps eliminating wear-related gearbox failures attributable to traditional tooth-to-tooth contact.

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