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Automatic Manual Transmission System in Automobile

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ABSTRACT

Electric vehicles (EV) equipped with automatic manual transmission (AMT) offer many advantages in terms of transmission efficiency, improvement of driving comfort, and shifting quality. Conventional AMT for vehicles powered by internal combustion engine (ICE) requires an electronic controlled clutch to separate/engage engine power for gear change smoothly, because of high inertia of the ICE. This complicates the system and thus raises higher cost. Hence, a Clutchless Automatic Manual Transmission (CLAMT) with the advantages of high efficiency, low cost, and simple structure is adopted and developed in this paper. The objective of this article is focused on gear-change control technique of CLAMT, including model parameters identification, synchronization speed control during gear engagement and motion control of gear-change actuated mechanism. Through theoretical analysis, simulation, as well as experimental verification, the results confirm that the designed control technique is able to make smoothly gear-shifting and the feasibility of CLAMT is verified.

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I. INTRODUCTION

A semi-automatic transmission (SAT) (also known as a clutchless manual transmission, automated manual transmission, flappy-paddle gearbox, or paddle-shift gearbox) is an automobile transmission that does not change gears automatically, but rather facilitates manual gear changes by dispensing with the need to press a clutch pedal at the same time as changing gears. It uses electronic sensors, pneumatics, processors and actuators to execute gear shifts on input from the driver or by a computer. This removes the need for a clutch pedal which the driver otherwise needs to depress before making a gear change, since the clutch itself is actuated by electronic equipment which can synchronise the timing and torque required to make quick, smooth gear shifts. The system was designed by automobile manufacturers to provide a better driving experience through fast overtaking maneuvers on highways. Some motorcycles also use a system with a conventional gearchange but without the need for manual clutch operation.

II. LITERATURE REVIEW

Steve Andreasson & Malin Reinholds-
To be able to change gears in a transmission it is necessary to remove the torque when disengaging and engaging gears in order not to damage the teeth of the cogs. If the driving torque from the engine to the wheels is interrupted for a longer period of time it can be perceived as very uncomfortable. A gear change can be divided into three main stages; disengaging the current for both the driver and passengers in the vehicle gear, synchronizing the countershaft and finally engaging the new gear. Engaging and disengaging a gear is a very fast process as it is and no attempts are made to improve upon this further. However, synchronising the countershaft is rather slow in conventional hybrid vehicles thus the potential for improving this stage is vast. One way of speeding up the synchronisation process is to actively steer the speed of the countershaft with the aid of an electrical machine. A long and slender machine is preferable since the acceleration is

proportional to the inertia of the machine, and therefore increases with the radius. This thesis studies the potential of such an electric machine aided dynamic gear change. The investigation is carried out as a series of empirical tests in a testing rig comprised of a transmission, an electric machine, a flywheel, power electronics and a control system based on both hardware and software from National Instruments.

A key element to achieving a successful gear change is a quick yet stable motor control since this determines the synchronisation time. In a conventional vehicle the countershaft brake used for synchronisation can achieve a deceleration of 2000 rpm/s. Using the electrical machine instead a deceleration of 3347 rpm/s is recorded which corresponds to a 67 % time improvement. It is also shown that a full gear change from 3rd to 5th gear can be completed in 160 ms. These are very positive results and the main objectives o the thesis have been met.

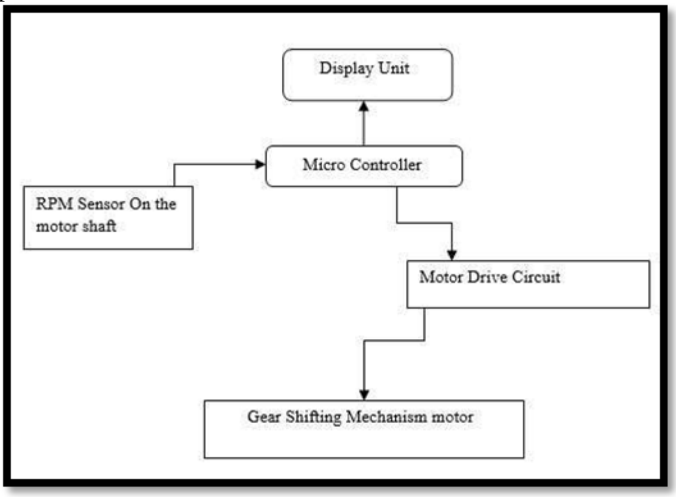
Dr.-Ing. Reinhard Berger- The normal approach to shifting a manual transmission in a vehicle includes a clutch which connects the engine to the transmission. When shifting, the relative speed of the engine and wheels changes. The transmission is disconnected from the engine with the clutch and the gears in the transmission are pressed together until they engage. There are small friction synchronizers inside the transmission, but these are only designed for the inertia of the gears and the clutch pressure plate. The clutch is required to synchronize the transmission speed with the engine speed after a shift, and to remove the load from the transmission before a shift. Described is a method for automating a manual transmission hybrid-electric powertrain which doesn't require a clutch. A hybrid drivetrain including an electric motor and a combustion engine has the benefit of much better speed and torque control than a combustion engine alone. Drivetrain speed can be controlled to take the load off the transmission, allowing it to be shifted into neutral. Once the transmission is in neutral, the electric motor can synchronize the engine side to the correct speed quickly and accurately, allowing the transmission to shift into the next gear. This provides rapid, efficient shifting without a clutch.

Dr. techn. Robert Fischer- With Electronic Clutch Management (EKM), the driver determines whenand how the gears change. In this respect, the behavior is very similar to aconventional manual transmission. LuK mastered the clutch strategies for all vehicle and torque classes. Therefore, the EKM can be offered in every torque class for drivers who like to shift gears themselves. The gears are changed automatically with the automated shift transmission. In contrast to the automatic step transmission, the ASG must interrupt the tractive force when shifting. This is more clearly detectable the higher the tractive force that is interrupted. For this reason, it can be surmised that ASG will be accepted mainly in small cars. The increasing use of electronic throttle simplifies the introduction of ASG.

III. AUTOMATIC MANUAL TRANSMISSION

In automatic gearboxes various techniques are used for gear shifting whose are mechanically controlled. The present paper discussed the gear shifting using an embedded system has small dimensions, economical and low maintenance cost. In this the “microcontroller” selects the transmission gear as per speed of the vehicle without any human interference

As per comparison between manual and automated transmission, manual transmission don’t want much maintenance cost and support to save fuel. In automated transmission there is more comfort during driving situation and minimize daily normal driving difficulties which arrive in hills, traffic orsituation where we required rapid gear shifting The gearbox which is operating under different load condition and diagnose the common mechanical faults. In this paper an experimental setup is designed and calculate the characteristic performance on different load condition Different methods and discussed for power loss reduction in gearbox. No load losses can be reduced especially of low temperature and part load conditions. Low loss gears can contribute substantially to load dependent power loss reduction in the gear mesh. Automatic transmission shift process has joint elements such as clutch and bands engage, linking sets of gears to create a fixed gear ratio. Since these ratios differ between gears in a fixed gear ratio transmission, the motion of the vehicle could change suddenly during shift process.



IV. FABRICATION OF MODEL SET-UP & METHODOLGY

In our research we fabricate a proto-type model of gearbox. On this we calculate the torque and rpm on different load condition and check the performance of gearbox model for gear shifting according to load and ratio of power transmission to the rear drive which is given by an electric motor to the gearbox. In our model mainly we have fabricated a gear boxwith the four speed level and hence we have four output torques. There is an RPM measuring sensor mounted on the engine shaft which measures the rpm of engine shaft and this data is given to the micro controller. There is a gear shifting mechanism comprised of a screw jack system which shifts the gear in to and fro manner. As we know vehicle running on some speed if encounter a load or breaks are applied the rpm of engines goes down, the micro controller watches this down fall and shift the gears to next upper level with the help of gear changing mechanism so that vehicle can bear the load encounter, if the encountered load is greater the rpm remains down and hence the micro controller continuously looking for rpm shift the gear to another next upper level and vehicle we achievethe auto transmission.

V. DYNAMIC CHANGING OF RANGE GEAR

To show a full acceleration and deceleration drive cycle the range gear must also be able to be changed dynamically in order to be able to shift between 5th and 7th gear. The range is a planetary gear set and is automatically synchronized when changed as long as the main gears are in neutral position. Therefore, adding the function to dynamically change the range gear does not present any major problems. The reason it is not yet implemented is a lack of time and space on the FPGA. Adding a further six gears means that the possible combinations of gear changes requested by the user increases from 36 to 144. Even if the possibilities where the gear change clearance would not be given due to unreasonably large speed steps the code would more than double in size. The matrix shows these possible combinations, where the blue field signifies the gears covered by the sequence as it is now; without the dynamic changing of the range gear incorporated.

VI. CONCLUSION

According to advantages and simplicity the suggested mechanism is realizable and workable.Now a days the scope for this mechanism in the automobile industry's. The application of this mechanism leads to make the driving process easier and fuel efficient driving can be achieved**.**

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