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LATEST TRANSMISSION TECHNOLOGIES IN PASSENGER CARS- A Review

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Abstract - A transmission system in automobile consists of a gear box and differential. A differential is a component used to distribute torque and helps while turning. It also provides better drivability. In this paper we are going to use a component that can transmit torque from the engine without a differential and act as automatic transmission. The purpose of this is to overcome the short coming of differential and provide automatic transmission for better drivability. For this, we have developed a component that will be connected through a gear array. It will act as automatic transmission.

The electronic control units of automatic transmissions have been greatly advanced to make smooth gear shifting and improve fuel economy. Along with it, the solenoid valves as electro-hydraulic actuators have been rapidly developed which have high pressure and large flow capacity. Control system, direct active shift control.

Key Words: Automatic Transmission, Direct Active Shift Control, Full Electronic Control System.

1.INTRODUCTION

1.1 History:

Through the years, there have been many efforts to improve the transmission for better fuel economy, drivability and other quality of vehicle operations. In a road vehicle, the functions of transmission are to match the running state of engine to the motion states of the vehicle. Among these studies, many were focused on modifying the transmission designs to keep the vehicle safe and controllable, and to make passengers more comfort introducing mechatroinic systems in automobile transmissions. Mechatronic is the engineering discipline concerned with the construction of systems incorporating mechanical, electrical and information technology components. Today, mechatronic is an area combining a large number of advanced techniques from engineering, in particular sensor and actuator technology, with computer science methods.

The purpose of transmission system is to provide high torque at the time of starting, hill climbing, accelerating and pulling a load. The vehicle will have to face the resistances like wind resistance, gradient resistance and rolling resistance. The tractive effort is different at various speeds. The variation of total resistance to the vehicle motion should be equal to the tractive effort of the vehicle at any given speed.

A transmission basically transfers the power from a car's engine to drive shaft and the wheels. The gears present inside the transmission change the drive wheel speed and torque in relation to the engine speed and torque (pulling power), Lower gear ratios helps the engine to build up enough of power so that the car can easily accelerate from a halt. The transmission is a device that is connected to the back of the engine and sends the power from the engine to the drive wheels. An automobile engine runs at its best at a certain RPM (Revolutions per Minute) range and it is the transmission's job to make sure that the power is delivered to the wheels while keeping the engine within that range. It does this through various gear combinations. In first gear, the engine turns much faster in relation to the drive wheels, while in high gear the engine is loafing even though the car may be going in excess of 70 MPH.

1.2 Objective of Study

- To provide a historical overview of the manual, automatic and automated transmission content in the major markets.
- To examine and draw conclusions on the factors which influenced adoption.
- To compare the new technical options for the future and their relative strengths and weaknesses in both economic and performance terms.
- To identify the trends for the future and the key players involved..

1.3 Scope of Study

- Nowadays, along with the efforts to invent novel transmission systems for various types of vehicles to improve their performance, the dual clutch transmission (DCT) is emerging as an innovative and useful technology to solve the issues driving inconvenience or low fuel efficiency of the conventional manual or automatic transmissions in ground vehicles.
- This emerging technology has the potential to improve the fuel efficiency, reinforce the gear shift performance, and maintain the convenience of the automatic transmission simultaneously. Such benefits can be obtained by using two clutches that engage alternately during the gear shifts to give efficient and seamless torque transmission.

1.4 Benefits Of Study

- The automatic transmission system gives more convenience.
- No training required with automatic transmission. Automatic transmission works well in heavy urban traffic because it can handle the stop and go traffic much better.
- Automatic transmission will have cruise control

2. Overview of Transmission System

2.1 Purpose of Transmission:

The purpose of transmission system is to provide high torque at the time of starting, hill climbing, accelerating and pulling a load. The vehicle will have to face the resistances like wind resistance, gradient resistance and rolling resistance. The tractive effort is different at various speeds. The variation of total resistance to the vehicle motion should be equal to the tractive effort of the vehicle at any given speed.

2.2 Types of Transmission System:

1. Manual
2. Automatic

1. Manual Transmission: As the name itself indicates, A Manual Transmission enables the driver to shift the gears manually as per the driving requirements and a manual clutch is pressed while shifting the gear from one to another, which uses a solid clutch plate. There is no doubt that a Manual adds the fun in driving due to the changing of gears but as long as you are driving on a clean empty stretch.

2. Automatic Transmission: Automatic transmission works exactly opposite to manual transmission. Yes, as it says "Automatic", this transmission works independently without a frequent interruption, resulting in the convenience of driver. With reference to Figure, The Automatic Transmission performs the job automatically depending upon the speed and here a hydraulic torque converter takes the place of clutch plate mechanism saving you from the hassle of pressing a clutch. The Automatic Gearbox has mostly the pre-defined gear ratios, which are as follows:

- Park (P)
- Reverse (R)
- Neutral (N)
- Drive (D)
- Second (S or 2)

Fig-1: Automatic Transmission System

Automatics are less fuel-efficient by design they don't maintain a continuous mechanical link between engine and wheels since the system always includes a fluid filled torque converter. A torque converter is a hydraulic fluid coupling between engines and gearing. Automatic transmission is less fuel efficient than manual transmission primarily due to pumping losses in the torque converter and hydraulic actuators. In addition, hydraulic control system demands power from the engine the case of automatic transmission there is a mechanism that changes the gear ratio automatically. This means that the driver does not have to change the gear manually.

2.3 ECT (Electronic Control Transmission):

The conventional automatic transmission operates by mechanically converting vehicle speed into governor pressure, and throttle opening into throttle pressure, and using these hydraulic pressures to control the operation of the clutches and brakes in the planetary gear unit, thus controlling the timing of up-shift and down-shift of the transmission. This is called the "hydraulic control method." In the case of the ECT, on the other hand, sensors electronically sense the speed of the vehicle and the throttle opening and send these information to the electronic controlled unit (hereafter called ECU) in the form of electrical signals. The ECU then controls the operation of the clutches and brakes based on these data, thus controlling the timing of the shift points.

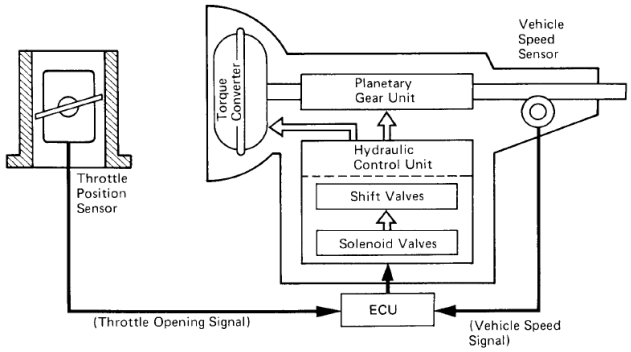

Fig-2 : Layout of ECT

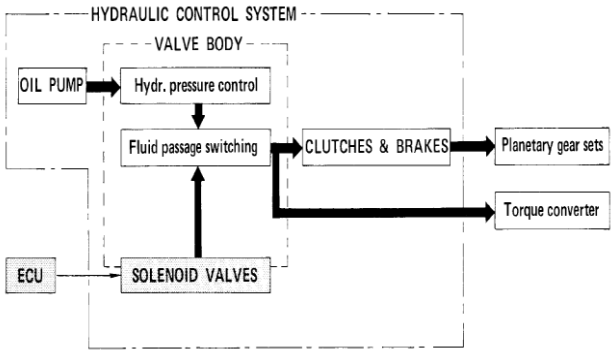

Fig-3 : Hydraulic Control System

A)Shift Control :

Hydraulic Controlled Transmission Shifting in the fully hydraulic controlled automatic transmission is carried out by the hydraulic control unit in the following way.

B) Throttle Valve:

Throttle valve in the hydraulic control unit generates hydraulic pressure in proportion to the amount that the accelerator pedal is depressed; this pressure (called "throttle pressure") acts as a throttle opening "signal" to the hydraulic control unit.

C) Governor Valve:

Governor valve generates hydraulic pressure In proportion to the speed of the vehicle; thispressure (called "governor pressure") acts as a vehicle speed "signal" to the hydraulic control.

2.4 Hydraulic Control System:

The hydraulic control system is composed of the oil pump, the valve body, the solenoid valves, and the clutches and brakes, as well as the fluid passages which connect all of these components. Based on the hydraulic pressure created by the oil pump, the hydraulic control system governs the hydraulic pressure acting on the torque converter, clutches and brakes in accordance with the vehicle driving conditions. There are three solenoid valves on the valve body. These solenoid valves are turned on and off by signals from the ECU to operate the shift valves. These shift valves then switch the fluid passages so that fluid goes to the torque converter and planetary gear units.(Except for the solenoid valves, the hydraulic control system of the ECT is basically the same as that of fully hydraulic controlled automatic transmission.)

A) Line Pressure:

Line pressure is the most basic and important pressure used in the automatic transmission, because it is used to operate all of the clutches and brakes in the transmission. If the primary regulator valve does not operate correctly, line pressure will be either too high or too low. Line pressure that is too high will lead to shifting shock and consequent engine power loss due to the greater effort required of the oil pump; line pressure that is too low will cause slippage of clutches and brakes, which will, in extreme cases, prevent the vehicle from moving. Therefore, if either of these problems are noted, the line pressure should be measured to see if it is within standard.

B) Throttle Pressure:

Throttle pressure is always kept in accordance with the opening angle of the engine throttle valve. This throttle pressure acts on the primary regulator valve and, accordingly, line pressure is regulated in response to the throttle valve opening. In the fully hydraulic controlled automatic transmission, throttle pressure is used for regulating line pressure and as signal pressure for up-shift and down-shift of the transmission. In the ECT, however, throttle pressure is used only for regulating line pressure. Consequently, improper adjustment of the transmission throttle cable may result in a line pressure that is too high or too low. This, in turn, will lead to shifting shock or clutch and brake slippage.

3. Function of ECU:

A) Control of Shift Timing:

The ECU has programmed into its memory the optimum shift pattern for each shift lever position (D, 2, L range) and driving mode (Normal or Power). Based on the appropriate shift pattern, the ECU turns No. 1 and No. 2 solenoid valves on or off in accordance with the vehicle speed signal from the vehicle speed sensor and the throttle opening signal from the throttle position sensor. In this manner, the ECU operates each shift valve, opening or closing the fluid passages to the clutches and brakes to permit up-shift or down-shift of the transmission. The electronic control system provides shift timing and lock-up control only while the

vehicle is travelling forward. In REVERSE, PARK, and NEUTRAL, the transmission is mechanically, not electronically controlled.

B) Control of Overdrive:

Driving in overdrive is possible if the OID main switch is on and the shift lever is in the D range. However, when the vehicle is being driven using the cruise control system (CCS), if the actual vehicle speed drops to about 4 kml/h*(2* mph) below the set speed while the vehicle is running in overdrive, the CCS computers ends a signal to the ECT ECU to release the overdrive and prevent the transmission from shifting back into overdrive until the actual vehicle speed reaches the speed set in the CCS memory. On this model, if the coolant temperature falls below 60°C (140°F), the Engine ECU sends a signal to the ECT ECU, preventing the transmission from up-shifting into overdrive.

C) Control of Lock-Up System:

The ECT ECU has programmed in its memory a lock-up clutch operation pattern for each driving mode (Normal or Power). Based on this lock-up pattern, the ECU turns lock-up solenoid valve on or off in accordance with the vehicle speed signals received from the vehicle speed sensor and the throttle opening signals from the throttle position sensor. Depending on whether lock-up solenoid valve is on or off, the lock-up relay valve performs changeover of the fluid passages for the converter pressure acting on the torque converter to engage or disengage the lock-up clutch.

4. Selector Control:

A) Selector Lever:

The selector lever, through the selector shaft (on the transmission), operates the multifunction switch and the manual valve on the hydraulic distributor.

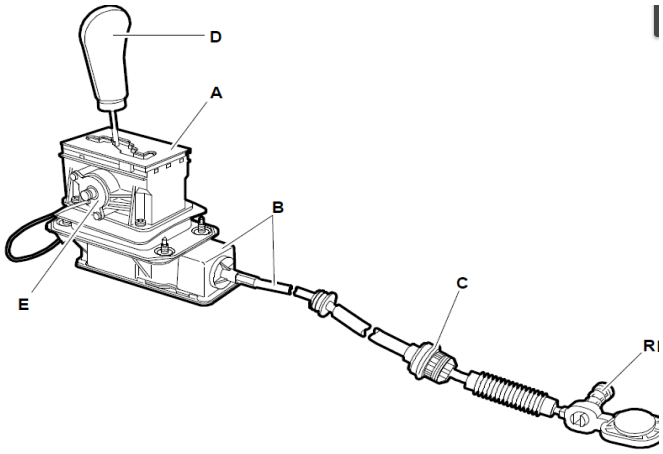

Fig-4 : Selector Lever

A - Upper part

B - Lower part

C - Sleeve stop

D - Control lever

E - Locking plunger for the Shift-Lock function

Ri - Initial setting

The selector lever, located on the central console, has six positions laid out on an offset or "stepped" grid. The lever has a mechanical safety device which is unlocked by exerting a radial action on the lever.

B) Program Selector:

- This is located on the central console next to the selector lever and has 3 push buttons. The driver can therefore inform the ECU of his selection: Desired program.
- 1st imposed this is obtained by pressing the "1" button of the selector with the selector lever in position 2 on the grid. Gears change automatically depending on vehicle speed and engine load in accordance with various gear changing laws. The gear changing laws are chosen by the ECU as a function of one of the three programs available to the driver. The driver can select a program by pressing one of the "S" or "*" program selector buttons.

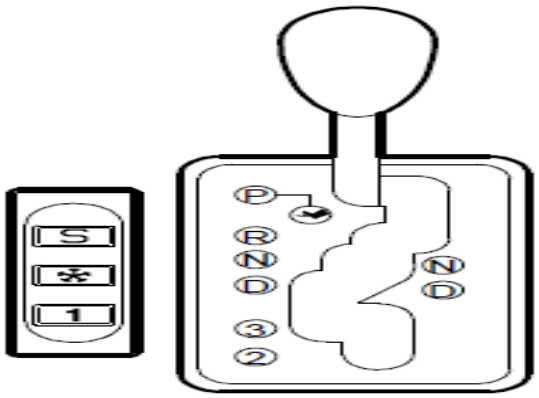

Fig-5: Program Selector

Gears change automatically depending on vehicle speed and engine load in accordance with various gear changing laws.

1. Auto adaptive or "normal" (no buttons pressed): This is the basic program; the ECU adjusts the operation of the automatic transmission to the style of driving, the road and engine load; it promotes fuel economy.

2. "Sport" (S button pressed): This program promotes sporty driving to the detriment of consumption. Gears are still changed automatically.

3. "Snow" (* button pressed): This program is suited to driving on low adherence ground. In drive, this meansthat either first gear or first and second gears are no longer available and gears are changed down less frequently using a specific set of changing laws.

5. Advantages:

- Automatic transmission system offer convenience while driving.
- Automatic transmission system is user friendly.
- The operation of the automatic transmission system is easy.
- It provides better performance in traffic.
- Automatic transmission system has higher resale value.
- Automatic transmission system is more powerful and accurate.

6. Disadvantages:

- Automatic transmission system is costly to purchase.
- The fuel consumption is more in this system.
- It has restricted gear ratios.

7. Field of Applications:

- It is used in expensive cars like Porsche, Honda, BMW and AUDI.
- It can be also used in light vehicles.

8. Conclusion:

- It is new dimension in the car system; this is simple and versatile pack.
- By implementing this system in a car, we can achieve smooth operation, reduce shift jerk and decrease friction in a clutch to controllable limits.
- When changing gears, the driver only needs to operate the shifter.
- An electromechanical or hydraulic actuator can be used to perform the engaging and disengaging of the cutch.
- It can relieve driving effort, making gearshift easier and improve the comfort with respect to a conventional manual transmission.

9. FUTURE SCOPE

As we all know there are no limits for improvements in any kind of work There is always scope for improvements in present work. In this automatic gearbox, further modifications that can be carried out are as listed below:

- Button operated gear shifting mechanism can be employed with automatic gearbox.
- The mechanism can be hydraulically operated.
- Just touch button can be used instead of push button.
- Gear indicator i.e. Visual representation of gear in which the vehicle is presently been driven, can be employed.

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REFERENCES

[1] Hayashi K., Shimizu Y., Nakamura S., Dote Y., Takayarha A. and Hirako A "Neuro Fuzzy Optimal Transmission Control for Automobile with Variable Loads", *IEEE* 1993.

[2] Nelles O. IntelligenTip"A Learning Driving Strategy for Automated Transmissions",*SAEWorldCongress* Detroit, Michigan 2003.

[3] P. SarathBabu, "Analysis of Developing New Smart Systems in Automobile Transmissions"*The International Journal Of Science &Technoledge*(ISSN 2321 – 919X) Vol 3 Issue 1, January, 2015.

[4] P. SarathBabu "Mechatronic System Based Manual Transmission" *IJMET Volume 6, Issue 1,* January (2015).

[5] Prakash Kumar Sen1, Omprakash Baghel2 , Shailendra Kumar Bohidar,"Study Of Automatic Transmission Based On Electronic Control System" *International Journal of Advanced Technology in Engineering and Science* Volume No 03, Special Issue No. 01, April 2015.

[6] Qin G. Ge A., Zhao J. and Lee J. Cruise "Control of Automated Manual Transmission Vehicle", *IEE Computing and Control Engineering*, April 2003.

[7] SusrajRaut"Automatic Transmission Gearbox With Centrifugal Clutches" *IJRET* vol 3 issue 10 oct 2014.

[8] RomeshMakwana, Prof. RajnishKatarne, "Analysis of Auto-Gear Shifting Mechanism on different Load Conditions"*IJESRT* August, 2014.

[9] SreeHarshaBandaru"Alternative Transmission System For 4 Wheeler"*IJMERR* Vol No 1 Janaury 2015.

[10]Xiaofeng Y, Jingxing T, Yulong L and Anlin G. *"*Research on a Neural Network Model Based Automatic Shift Schedule with Dynamic 3Parameters*".SAE World Congress,* USA, 2005.

[1] Yang Z., Cao C. and Su Y. *"*A Method of Optimal Shift Control Based on Pattern Recognition and Learning Algorithm*",4th World Congress on Intelligent Control and Automation*, China, 2002