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A REVIEW ON AUTOMATIC MANUAL TRANSMISSION

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Abstract

As the name suggests, Automatic Manual Transmission is a manual transmission with clutch and gear actuation performed using either electromechanical or hydraulic actuators. In order to determine the actuation of actuators, the entire AMT system has a control strategy. Major research efforts have been conducted over the last two decades to improve vehicle transmissions that reduce the energy consumption of a car. This initiative has been a direct consequence of the increasing environmental concern placed on current vehicle manufacturers by the Directives on lower exhaust emissions and improved vehicle performance. Consumers often demand a reasonable price to achieve the same level of efficiency, comfort and ease of use as in regular cars. In order to create a competitive solution, the efficiency, comfort and price of existing vehicles on the market must all be comparable. The best competitive solution to address the problem of performance, comfort, cost, efficiency is automated manual transmission (AMT). The main objective of this paper is to review the different research work conducted in terms of design and control strategy on the AMT system.

Keywords: *AMT, Automated Manual Transmission, Transmission, and Actuators.*

I. INTRODUCTION

In terms of vehicle efficiency and fuel economy, transmissions play an important role as a power transmission unit[1]. Several types of transmissions and associated technologies currently exist that deliver various vehicle priorities. The overall effectiveness of manual transmission is 96.2 percent, which is the highest of all forms[2]. CVT belt types have an average efficiency of 84.6%[3]. The efficiency of Automatic Transmission (AT) is 86 percent, while the efficiency of Automated Manual Transmission (AMT) is equivalent to that of manual transmission[4]. In the automotive industry, it is popular to use analytical models

for prediction and persuasive evaluation. There has been a need for improvement in architecture, transmission principle to the day-to-day

1. Reduce interruptions in gear torque.

2. Reduce the time spent on gear changes and boost driving comfort.

3. Raising fuel efficiency.

4. Improve the consistency of the gear shift.

A. Principle of working of AMT

AMT is a manual transmission system without a clutch (without a clutch pedal) that uses electronic sensors, processors and actuators (hydraulic or electro mechanical) to perform clutch actuation and gear shifts as per the driver's order[5]. Fig. 1 shows that a traditional manual transmission, actuators and control unit are used by the Amt system to automate the entire operation. Figure 2 demonstrates AMT's control architecture scheme. The scheme consists of three sensor, processor and actuator parts. The TCU (Transmission Control Unit) processor receives input signals from different sensors such as Gear Position Sensor, Clutch Position Sensor, Brake Position Sensor, Transmission Output Speed and Vehicle-related signals such as Torque Requirement, Motor Speed and Throttle Position from ECU (Engine control unit). The TCU has a control strategy that produces the output signals for the clutch actuator and gear shifting actuator while receiving the input signals.

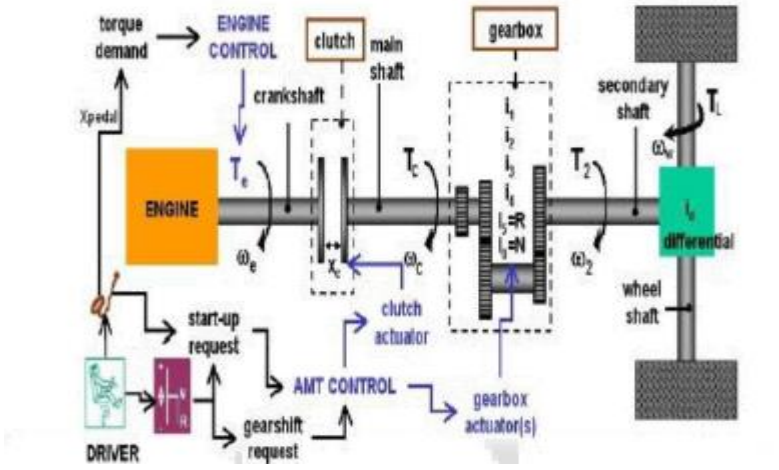

Fig. 1: AMT system

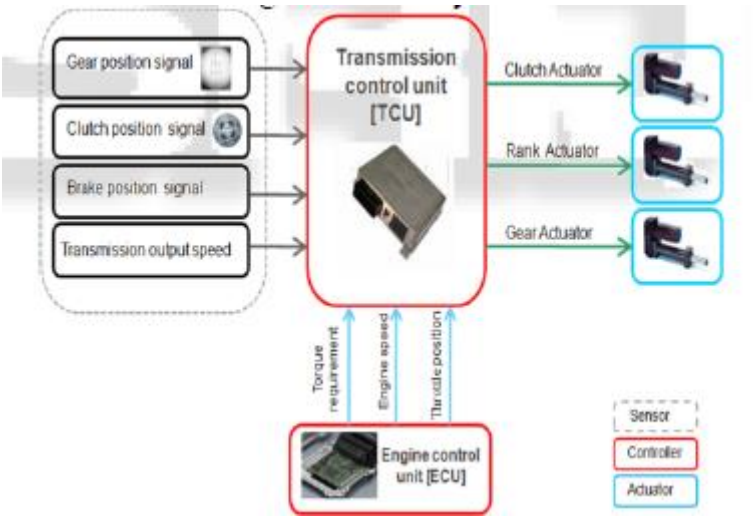

Fig. 2: Control Architecture of AMT

Transmission's contribution to the fuel economy of automobiles by D Simmer illustrates the value of transmission for fuel performance. This study illustrates how transmission plays a major role in fuel economy. The transmission system can affect fuel economy, which is the primary factor, in four ways and not just transmission efficiency alone.

1. Parasitic transmission losses, i.e. Gas churning, sealing, dragging bearings.

2. Proportional losses of power in gear, chain or belt mesh.

3. The weight of the transmission and driveline components and their rotational inertia.

4. Configuration and monitoring of actual hardware for transmission.

Automated Manual Transmission (AMT) of Zeroshift by R. P. G. Heath, A. J. Child, demonstrates that Zeroshift technology allows in zero seconds a manual transmission to change gear[6]. This technology is patented as a new transmission design. The Zeroshift Automated Manual Transmission (AMT) is simple to produce and allows for a cost-effective alternative to the automatic transmission based on the conventional torque converter. Zeroshift provides potential increases in fuel economy from driveline performance and the highest possible acceleration for vehicles. Zeroshift provides an uninterrupted torque route from the engine to the vehicle compared to an established AMT, allowing for a smooth gearshift. This article, together with test data from a demonstrator vehicle, offers an introduction to technology.

Yinong Zhaoaa and Jiabao Chena's Electric Hydraulic Accelerator Control Device in AMT shows that it is necessary to design independent accelerator auxiliary control devices to regulate the fuel injection quantity for the non-electronically controlled engine during the automatic shift process[7]. The accelerator control device should not only meet servo requirements in normal driving, but also servo requirements in normal driving. The design of the electric hydraulic accelerator control system is primarily defined in this paper and the

experiments show that the device can meet servo requirements and automatically regulate the amount of fuel injection. The paper introduces a new accelerator auxiliary control device for a non-electronically operated engine automatic shift control system. The new system will automatically regulate the injection quantity during the automatic shift process, not reducing the engine control efficiency. And it can solve problems such as safety, efficiency, the complex nature of the method of control and so on for the motor-driven common linear accelerator scheme.

The production by Yoshinori Taguchi, Yoshitaka Soga, Akira Mineno and Hideki Kuzuya of an Automated Manual Transmission E.system based on Robust Architecture showed the use of three actuators for the automation of gear shifting and clutch actuation processes. For the AMT, a traditional actuator transmission method was used[8]. For shift and pick activation, two additional actuators were used. To enhance power, stability and system robustness, a system control device has been developed. The outcome showed a way forward for the AMT solution to be cost-effective. The automatic clutch consists of a regular electro-hydraulic servo-controlled dry clutch. Disks between the flywheel and the clutch plate, the surfaces of which are coated with high-friction materials, constitute the clutch actuator. Pressure is exerted by an electro-hydraulic clutch actuator operated by a three-way spool servo valve to control the displacement of the clutch piston that pushes on the release bearing. The transmitted torque can be assumed to be stick slip friction, while the usual force applied to clutch disks modulates the maximum transmittable torque (related to static friction).

It has been developed in a clutch actuator model focusing on the hydraulic portion and involving the position of the release bearing as the output variable. Considering the relationship between the force applied to the release bearing and the clutch torque transmitted, the model is refined. Flywheel and clutch disks are pushed together by Belville and pre-load springs when no external force is applied and motor torque can therefore be transmitted. The hydraulic piston, acting as a lever, forces the release bearing The Belville spring to release the clutch, minimizing the usual force applied to the clutch surfaces, thereby separating the friction disks. The Belville spring acts both as a spring and as a variable coupling ratio lever. The piston force of the steady state is thus related to the force applied to the clutch plate by a nonlinear relationship depending on the displacement of the clutch piston.

II. CONCLUSION

The different research work shows that hydraulic actuators or electro-mechanical based actuators can be used for the AMT system. For clutch and gear shift actuations, actuators are basically used. However, actuators are often used in some systems to handle the feedback of the accelerator to control fuel injections. The secret to the efficient operation of the Amt method is an optimal control strategy, which has been successfully demonstrated in numerous research papers. All research work has concluded that the AMT enables improved driving comfort, enhanced fuel efficiency and consistency of gear shift with regard to manual

transmission. AMT has the advantage of lower weight and higher performance with respect to other typologies of automatic transmissions for business segments such as large series and eco-friendly vehicles. In addition, because AMT is directly derived from manual transmission with actuator incorporation into existing equipment, the cost of production and manufacturing is usually lower than other automatic transmissions. After researching different actuators, the best option appears to be electromechanical actuators. Since electromechanical actuators are lightweight and compact, they can be easily operated with the aid of an actuator. Solving packaging problems such as the availability of space, weight added to the car load of vehicles.

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