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DRIVE BY WIRE TECHNOLOGY

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ABSTRACT

Drive-By-Wire is one of the recently developed technology in the automotive industry. This technology ensures completely new driving with new dimension. It changes bulky and inaccurate mechanical systems with highly advanced and accurate electronic system. It currently used by many automotive companies all over the world to replace steering control, brake control, and throttle control. It also gives the designers more space because there is reduction in mechanical linkages inside the car. Some safety issues of which the people would have to be made aware, such as this system is completely safe as it is being used successfully in civil aircrafts and military for many years now.

I. INTRODUCTION

Drive-by-wire is one the most precise and currently used technology in the automobiles field. It ensures to develop the way cars are being driven today with whole new experience for the driver. It also has new features, which were once only dreamt of.

It is nothing but combination of mechanical and electronics engineering sides which gives a totally different product. This technology may be new to the automobile field but it has been practically in use for last few decades in aerospace industry where fly-by-wire technology used in most of the new planes, which is similar to, drive-by-wire.

In this system mechanical linkages in an automobile are replaced by electronic system, which works of transmitting and receiving signals and gives quick response. But this system is not totally depend on electronic system it has supportive mechanical system, which is small in size with less fundamental function.

Drive-By-Wire increases the accuracy as it eliminates the mechanical linkages. Because of its advantages over traditional control systems, it is preferred by the world's best business companies. Some of them are Daimler-Chrysler, General Motors, Citroen, SKF, Toyota, Ford and Bertone etc.

II. DRIVE BY WIRE CONSIST OF THREE SUB-SYSTEMS

1. Throttle by wire
2. Steer-by-wire system
3. Brake by wire

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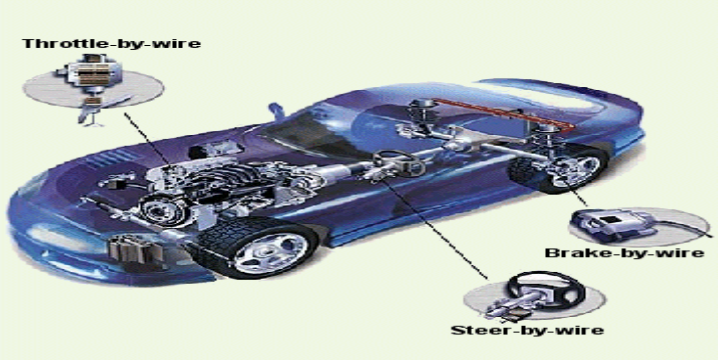

Fig.1 Sub systems of drive by wire

2.1 Throttle by Wire

Throttle-by-wire was the first type of drive-by-wire system established. These systems utilize pedal and an engine management system. The accelerator pedal movement by driver measured by sensors and this information collected by sensors send to the engine management system. The engine management system is nothing but a computer that determines how much fuel is required, and it provides this input to an actuator system that converts energy into mechanical motion.

It provides several advantages over mechanical systems are:

1. Eliminates binding problems in mechanical linkage preventing the throttle from sticking
2. Allows automated control of the throttle that helps to reduce emissions and improve fuel economy
3. This system can be modelled and installed as a modular system
4. Allows the ECM to integrate torque management with cruise control, traction control and stability control.

The similar operation could also be performed by joystick, which would get rid of the need for a foot pedal completely. this would require drivers to use their hands for acceleration, braking and steering. Throttle-by-wire is an automotive technology that is mostly used on today's vehicles. It changes the conventional throttle linkage with an accelerator pedal position sensor and an electronically operated throttle.

The accelerator pedal sensor senses the position of the accelerator pedal. This information is conveyed to the ECM as a change in the electrical resistance. The ECM actuates a servo-motor which actuates the butterfly valve in the throttle assembly. The position of the throttle is continuously monitored and the information is conveyed to the ECM using a feedback circuit.

Sensors: accelerator pedal position sensor, throttle valve

Position sensor

Actuators: motor controlling throttle valve position

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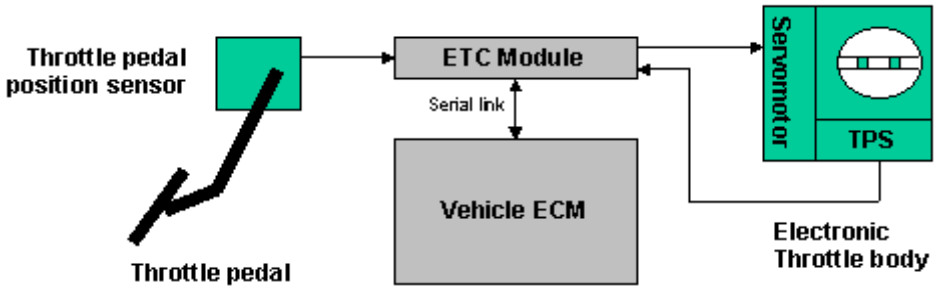

Fig. 2: Electronic Throttle Control (ETC)

The most common type of throttle control uses a cable that is directly connected to both the gas pedal and the throttle. When the gas pedal is pressed down, the cable pulls the throttle open. In vehicles that use electronic throttle control (ETC), there is no physical connection between the gas pedal and the throttle. Like brake-by-wire systems, the gas pedal sends a signal that causes an electromechanical actuator to open the throttle.

2.2 Steer-by-Wire System

Steer-By-Wire technology increases the versatility of vehicle. It changes the way we deals with the vehicle and opens the door for new body designs. Imagine no pedals, or even a steering wheel Everything could be handle with just a joystick, like the video games. A more conventional application could use a steering like an airplane. Removing the steering rod, pedals, and front mounted engine could allow dramatic enhancement in passenger safety.

Fig.3 Steer by wire

Drivers now have the function to brake and accelerate with either the right or left hand. The driver accelerates by slowly twisting either the right or left handgrip, and brakes by squeezing the brake actuator also located on the handgrips. The handgrips glide up and down for steering, somewhat differ than today's vehicles where the steering wheel rotates around a steering column.

2.3 Sensotronic Brake Control (Brakes of the Next Generation)

I will now take the Sensotronic Brake Control (SBC) by DaimlerChrysler as a technology demonstrator to explain the drive-by-wire system further. This is brake-by-wire system developed and employed in their top of the line vehicles by DaimlerChrysler. Mercedes-Benz (Now DaimlerChrysler) a brake technology pioneer yet again. Sensotronic Brake Control (SBC) is the name given to an innovative electronically controlled brake system which Mercedes-Benz will fit to future passenger car models.

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Following on from the Mercedes innovations ABS, ASR, ESP® and Brake Assist, this system is regarded as yet another important milestone to enhance driving safety. With Sensotronic Brake Control, electric impulses are used to pass the driver's braking commands onto a microcomputer which processes various sensor signals simultaneously and, depending on the particular driving situation, calculates the optimum brake pressure for each wheel. As a result, SBC offers even greater active safety than conventional brake systems when braking in a corner or on a slippery surface.

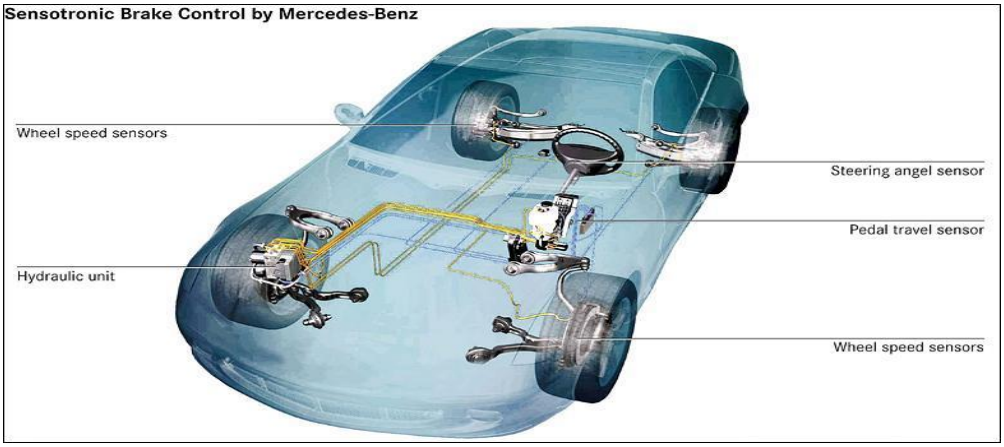

Fig. Fig.4 Location of Components

- **Technical Highlights: Sensotronic Brake Control - The Brakes of The Future**

It turns the conventional hydraulic brake into an even more powerful mechatronic system. Its microcomputer is integrated into the car's data network and processes information from various electronic control units. In this way, electric impulses and sensor signals can be instantly converted into braking commands, providing a marked safety and comfort gain for drivers.

2.3.1 Brake Pedal: Electronics Instead Of Vacuum

To turn to the technical side: when drivers hit the brake pedal today, their foot moves a piston rod which is linked to the brake booster and the master brake cylinder. Depending on the pedal force, the master brake cylinder builds up the appropriate amount of pressure in the brake lines which – in a tried and tested interaction of mechanics and hydraulics - then presses the brake pads against the brake discs via the wheel cylinder.

To provide the driver with the familiar brake feel engineers have developed a special simulator which is linked to the tandem master cylinder and which moves the pedal using spring force and hydraulics. In other words: during breaking the actuation unit is completely disconnected from the rest of the system and serves the sole purpose of recording any given brake commands. Only in the event of a major fault or power failure inside the 12V vehicle battery does SBC automatically use the services of the tandem master cylinder and instantly establishes a direct hydraulic link between the brake pedal and the front wheel brakes in order to decelerate the car safely.

The central control unit under the bonnet is the centerpiece of the electro hydraulic brake. This is where the interdisciplinary interaction of mechanics and electronics provides its greatest benefits - the microcomputer, software, sensors, valves and electric pump work together and allow totally novel, highly dynamic brake management.

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In addition to the data relating to the brake pedal actuation, the computer also receives the sensor signals from the other electronic assistance systems. For example, the anti-lock braking system provides information about wheel speed, while Electronic Stability Program makes available the data from its steering angle, turning rate and transverse acceleration sensors.

2.3.2 Control Unit: Pressure Modulators for Each Wheel

The driver's brake command is transmitted electronically to a powerful micro-computer, which simultaneously processes data on the current ride status collected from variety sensors and other electronic assistance systems such as ABS supplies information on the speed of the wheels, provides data from its steering angle, rotational speed and lateral acceleration sensors and the electronic management systems for the engine and transmission transmit the relevant engine or engine braking effect and the current driving stage via a high-speed data line. These calculations result in high-speed brake commands which ensure the highest degree of deceleration and ride stability for each particular driving situation. Calculate the braking force for each wheel individually.

2.3.3 High-Pressure Accumulator

The high-pressure reservoir contains the brake fluid which enters the system at a pressure of between. The SBC computer regulates this pressure and also controls the electric pump which is connected to the reservoir. This ensures much shorter response times and a rapid build-up of pressure than on conventional brake systems.

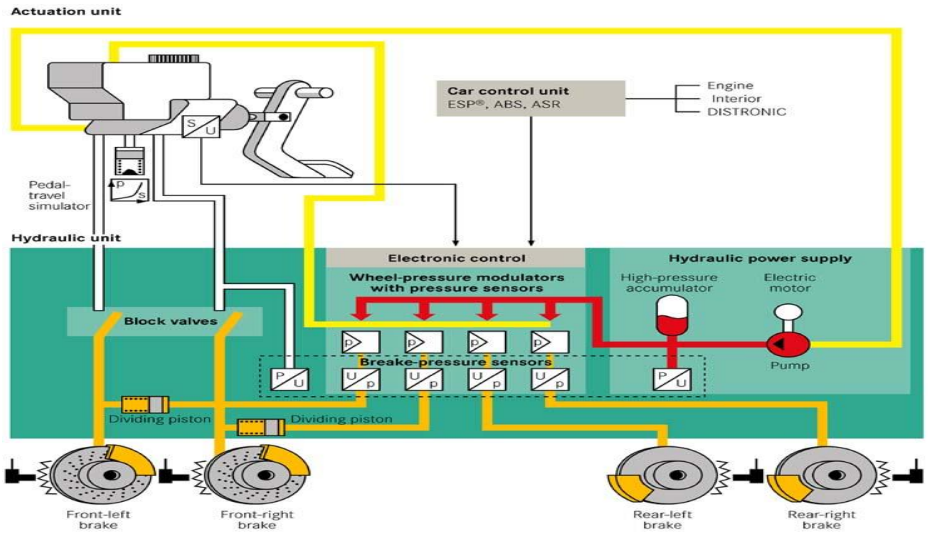

Fig.5 Block Diagram of Sensotronic Braking Control

2.3.4 Hydraulic Unit

This SBC component essentially consists of the four wheel pressure modulators. They meter the brake pressure according to requirements and pass it to the brakes. The specifications of the microcomputer are implemented in this manner and each wheel is individually braked in such a way as to ensure ride stability and the greatest possible deceleration. Four pressure sensors in the wheel pressure modulators and one pressure sensor each for the hydraulic accumulator and for the brake commands monitor the processes.

III. ADVANTAGES

- Ability to tailor the system's characteristics at each point in the vehicle envelope.

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- Increased capability due to fault monitoring and diagnostics.
- Reduced maintenance costs, resulting from the reduction in mechanical complexity and introduction of built-in testing.
- Reduced operational costs, through improved maintainability and higher dispatch reliability.
- It also gives the designers more degree of freedom because there are no positioning constraints on controls inside the car.

IV. DISADVANTAGES:

- Electromagnetic Interference (EMI) can play havoc with the electronic circuitry.
- Nuclear, biological, chemical (NBC) compliance: Ability of the system to withstand Nuclear, Biological, Chemical warfare has to be checked if it to used in the military applications.
- Also increase in the cost of the vehicle due to all the new components has to be weighed against the benefits accrued.

V. CONCLUSION

The complexity of drive-by-wire systems is a concern to many automotive customers who worry about the failure of software and possible electronic malfunctions in sensors resulting in car accidents and passenger injury. On the other hand drive-by-wire systems have been used by commercial aircraft for many years and have an excellent safety record. Ultimately, the enhanced safety features and the other benefits of automated electronic controls are expected to outweigh concerns about the complexity and reliability of these controls and drive-by-wire systems will be widely used in.

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REFERENCE

1. " International journal of research science & management", Lokesh Kumar Chaudhary1 ISSN: 2349-5197(march 2015)
2. Loránd Szabó, Mircea Ruba, "Fault tolerant Drive By Wire System" IJEET Control system magazine. Vol.5 (2009)
3. "Electrical Drives for Drive-by-Wire Sstems in Surface Vehicles" BOLOGNESI Paolo ISBN : 90-75815-07-7 EPE (2003)