

Vehicle Features:

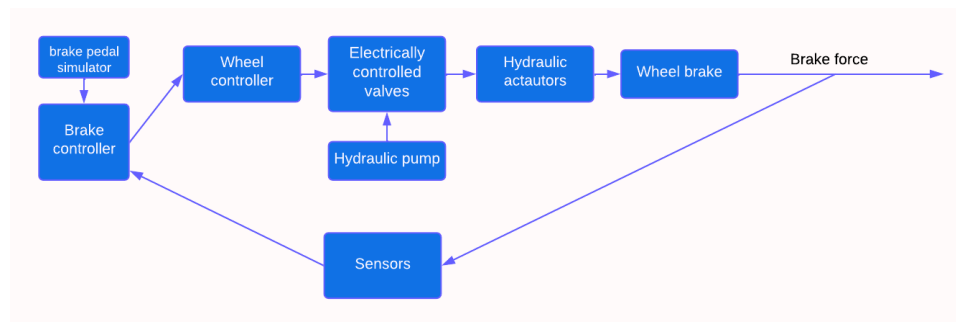
Brake-by-wire system (BBW):

Unlike conventional brakes which use a basic hydraulic and mechanical system, brake-by-wire technology uses electric motors to extract braking force. The principle of brake by wire is based on recognizing the driver's desire to brake the vehicle by a sensor that delivers a signal according to the brake pedal simulator which is transmitted to the brake-controller and then the brake controller generates signal to the wheel controller which addresses the electric control valves. The brake controller generates signal to the wheel controller which addresses the electric control valves.

There are three types of wheel brakes for brake by wire:

a. Electro-hydraulic brake system (EHB)

The system includes hydraulic actuators connected with the hydraulic pump through solenoid valves which are controlled with an electronic signal to vary the braking pressure.

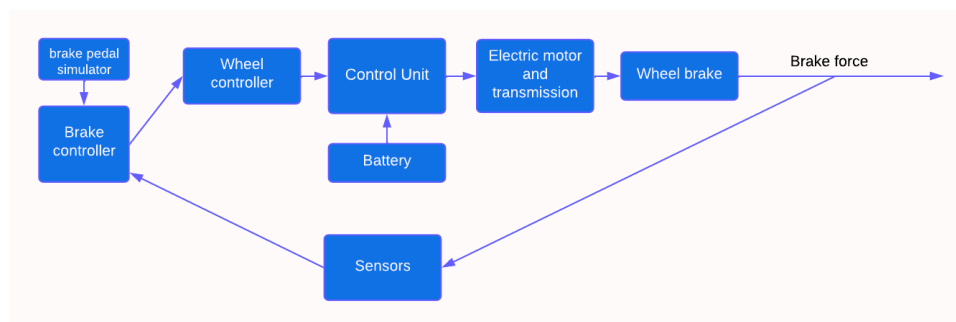


Electro-Hydraulic Brake EHB

b. Electro-Mechanical brake system (EMB)

The electromechanical brake is composed of an electric motor, a transmission system and a roller screw to energize the brake pad.

This type of brake is designed for a working voltage of 42 volts then a 42-volt motor is needed.



Electromechanical Brake (EMB)

The main difference between the electromechanical and electro-hydraulic brakes is the presence of some hydraulic parts such as hydraulic pumps instead of an electric power supply with the electromechanical brake.

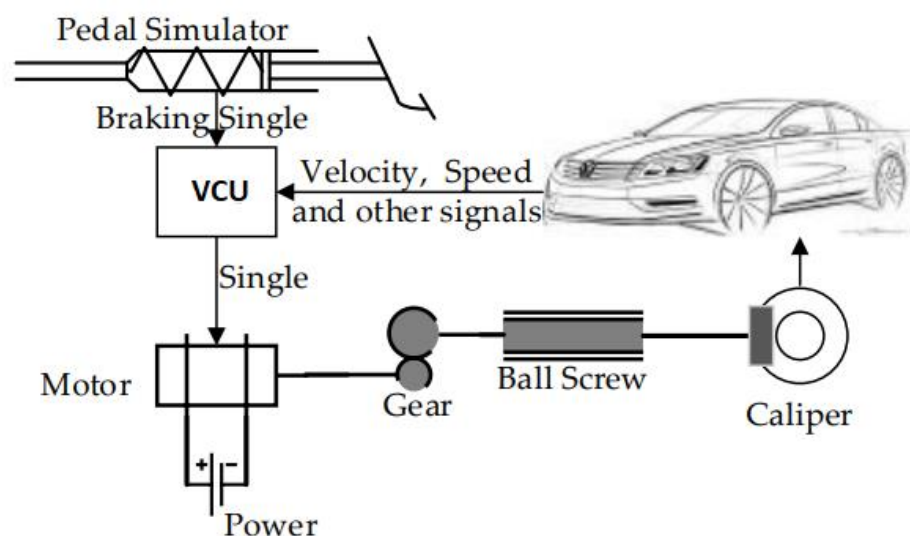
c. Electronic Wedge Brakes (EWB)

A wedge mechanism is used in electronic wedge brakes to create a brake caliper, which is drawn into the brake and uses less energy because it utilizes the wheel's rotation. They usually need a 14 V supply as opposed to the 42 V of the electro-mechanical brake.

solution: integrated electro-hydraulic brake system

Since Electronic Wedge Brakes and Electro-Mechanical brakes are expensive compared to electro-hydraulic brakes as they are recent technologies and need more testing and research before, they can be reliable enough to go into production, we chose to use an integrated electro-hydraulic brake system uses an electro-mechanical actuator (like an electro-mechanical brake) as a modulator of a master cylinder. This electro-mechanical actuator uses a servo motor to rotate a gear mechanism and a ball-screw that pushes the piston. This axial force pressurizes the brake fluid inside the master cylinder. The pressurized brake fluid is then transferred to the wheel chamber using a high-pressure pipeline, where this pressure displaces the caliper.

The electrohydraulic system is a relevant vehicle part to guarantee safe and efficient braking maneuvers. Moreover, the system enables improved brake force control and cuts the braking distance.



Composition of our integrated electro-hydraulic brake system:

master cylinder

brake caliper

servomotor

gear mechanism

a ball-screw

solenoid valves