



+ Feature

The Electronic Braking System (EBS) consists of an Electronic Control Unit (ECU) and a Hydraulic Control Unit (HCU). This project has developed a control unit for EBS which includes software of Anti-lock Braking System (ABS), Electronic Brake-Force Distribution (EBD), and Hill Hold Assist (HHA). The unit calculates the slip ratio and deceleration through the wheel speed sensors to identify the condition of each wheel and the vehicle. Based on the situation, the device modulates the hydraulic pressure of each caliper in a short time so as to prevent wheel lock and ensure directional control, vehicle stability and shorter braking distances. The control parameters have been tuned on the real vehicle to fulfill braking performance requirements.

+ Technique

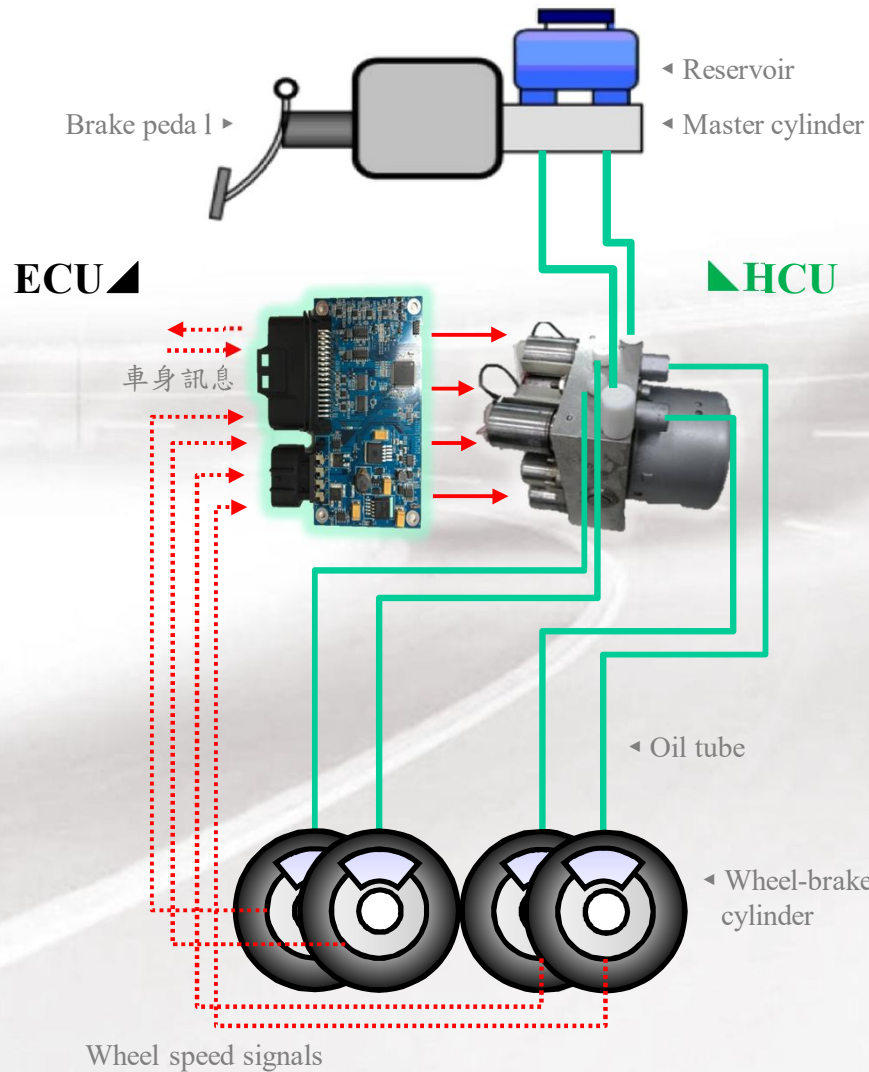
1. ABS, EBD and HHA control algorithm
2. Embedded hardware circuit design
3. ABS, EBD parameter tuning and test technique
4. System integration technique

+ Specification

1. Input voltage range: 9 ~16V
2. Temperature range for operation: -40 ~ 125 °C
3. ABS performance meets regulation requirements (Standard of Vehicle Safety Testing Direction 43-2)
4. The wheels should rotate again in 0.2 sec while passing from high to low friction coefficient road surface.
5. The braking force should reach 70% of its maximum value in 0.4 sec after passing from low to high friction road surface.
6. EBD deceleration $\geq 0.85g \cdot u$, u stands for friction coefficient of road
7. Split-u braking yaw rate limitation: $\leq 10^\circ/\text{sec}$
8. HHA applied the vehicle's brakes for 2 seconds when the vehicle is on an uphill or downhill slope and driver's foot leaves the brake pedal.

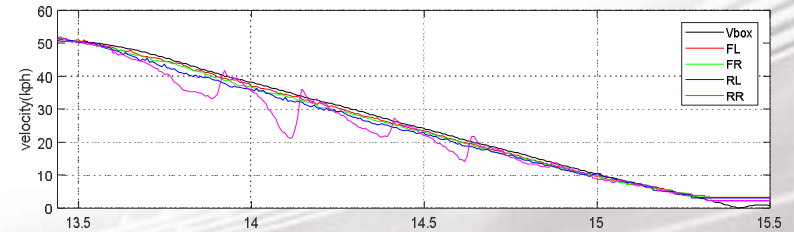


Demonstration

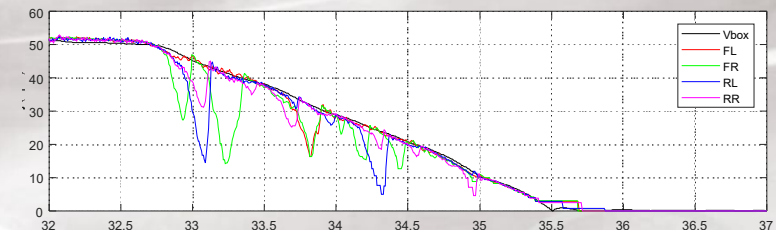


Architecture of Electronic Braking System

TRL 6 System Prototype on Proving Ground



Wheel speed on high μ surface



Wheel speed on low μ surface



Real vehicle performance tuning