**Anti-lock Braking System (ABS)**

**Main Components**

1. **Speed Sensors**: Installed at each wheel, these sensors continuously monitor the speed of each wheel.
2. **Electronic Control Unit (ECU)**: Acts as the brain of the ABS, receiving data from the speed sensors and making decisions to modulate braking.
3. **Hydraulic Control Unit (HCU)**: Executes the commands from the ECU by adjusting brake pressure at each wheel.
4. **Valves**: Part of the HCU, these control the brake pressure to each wheel.
5. **ABS Pump**: Restores pressure to the braking system after it has been released by the valves to prevent wheel lock-up.

**Operation**

The ABS system prevents the wheels from locking up during braking, maintaining traction and allowing the driver to retain control of the vehicle. Here’s a simplified explanation of how it works:

1. **Normal Braking**: Under normal conditions, when the driver applies the brakes, brake fluid pressure is evenly applied to all wheels.
2. **Detection of Locking**: During a sudden or hard brake, if the ECU detects from the speed sensors that a wheel is decelerating too rapidly and is about to lock, it intervenes.
3. **Pressure Modulation**: The ECU sends a signal to the HCU to modulate brake pressure. The valves in the HCU quickly open and close to reduce and increase brake pressure on the affected wheel, preventing it from locking up.
4. **Continuous Adjustment**: This process of modulating the brake pressure occurs many times per second, ensuring that the wheels maintain traction and the vehicle remains steerable.

**Example Scenario**

**Scenario**: Imagine driving on a wet highway and suddenly a person runs across the road.

1. **Immediate Reaction**: You slam on the brakes to avoid hitting the person.
2. **ABS Activation**: The speed sensors immediately detect that one or more wheels are about to lock up due to the slippery road conditions.
3. **Controlled Braking**: Because the wheels are prevented from locking, the tires maintain traction with the road surface. This allows you to continue steering and potentially maneuver around the deer while bringing the vehicle to a stop.

