3D Magnetic Sensor for Rapid-Reaction Gas Pedal

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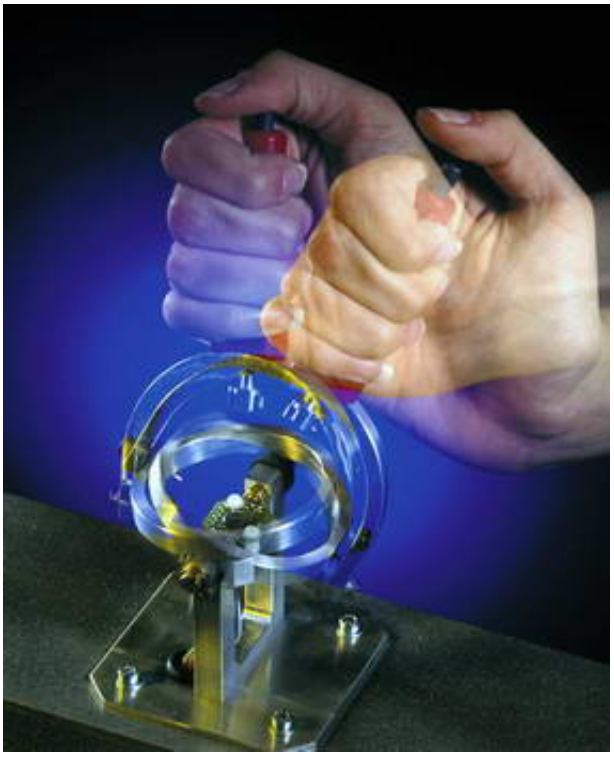

Gas and brake pedals have to react quickly and reliably if the occupants of the vehicle are not to be unnecessarily endangered. Engineers have developed a 3D magnetic sensor which digitally registers the pedal deflection by its angle. BMW is currently testing the system.

Image: In a joystick, the sensor measures the spatial position of a small

magnet. From it, the evaluation electronics determines the position of the lever. © Fraunhofer IIS/Kurt Fuchs

When a driver has to slam on the brakes in an emergency, or when making a miscalculated overtaking maneuver, fractions of a second can often decide between life and death. The brake and gas pedals therefore have to react very quickly. By depressing the gas pedal, the driver sets off an elaborate mechanical system that causes a disk to swivel. Several magnetic-field sensors close to the disk register the angular speed. A linear movement is thus converted into a circular one, and this in turn is converted into the electrical signal used to control the engine and the brake. The conversion takes time, is technically complex and makes the entire system expensive.

Research engineers at the Fraunhofer Institute for Integrated Circuits IIS have developed a new process which instantly translates the deflection of the gas pedal into an electrical signal. “This renders the chain of signals through to the computer control system completely digital - eliminating the need for error-prone transmission mechanisms,” explains marketing director Klaus Taschka. “Our sensor is located under the gas pedal and measures the magnetic field in all three spatial directions simultaneously, to an accuracy of 0.1 degrees. This is unique worldwide.”

Like its one-dimensional predecessors the sensor measures on the basis of the Hall effect: When a conductor carries current across a magnetic field the electrons are deflected to the side, producing a transverse voltage which is proportional to the strength of the magnetic field. The sensor is produced using inexpensive standard CMOS techniques. It is inserted in a microchip on which the research engineers have also integrated most of the evaluation electronics. In order to identify errors quickly, the sensor monitors itself: A small coil surrounding it is switched on periodically, and the sensor measures the additional magnetic field. If the sensor is defective, no extra signal is received by

the vehicle's control system and the driver is informed of the fault.

Development engineers at BMW have already subjected the magnetic sensor to precision testing in the laboratory. Further tests are planned on gas, brake and clutch pedals. However, the sensor's 3D measurement principle makes it equally good at registering the position of car headlights, joysticks and other moving machine components.

Source: Fraunhofer-Institut für Integrierte Schaltungen