Part I: Sensors, Actuators and Power Drivers for the 
Automotive and Industrial Environment

Man and machine perceive and control the physical world through physical parameters such as force and pressure, speed and acceleration, temperature, gas composition, electromagnetic fields, light... These parameters are, with a few exceptions, not electrical and an interface is required to measure and control them by an electrical system. Sensors translate the physical parameter in an electrical current or voltage and actuators do the opposite.

In the past, sensors and actuators were fabricated as discrete components and only their electrical interface was put on the chip. They were optimized for sensitivity and stability. Nowadays, more sensors and higher power actuator drivers are integrated on the controller chip. Due to the resulting technology limitations, the on-chip sensor has a lower sensitivity but since controllability and calibration flexibility improves and since interference from the environment on the sensitive connections between sensor and control chip is greatly reduced, the final system sensitivity comes close or even exceeds the sensitivity of the discrete sensor system.

The first paper describes the integration of high-quality passive devices on active wafers (RF-SOC) or on an intermediate glass or high resistivity silicon substrate (RF-SIP). Multilayer thin film technology allows the realization of passives with relevant values and quality for use in RF-applications. Resistors, capacitors, inductors and the device platform are described.

A smart CMOS camera, where image acquisition and processing are truly intermingled, is the subject of the next paper. The signal processing is realized in two steps and resembles natural vision systems. At the first step the data rate of the parallel vision signals is reduced by analog processing. At the second step, intelligent processing is realized on digitally-coded information data by means of digital processors.

The third paper describes an inductive contact-less sensor system for high resolution angular or linear position sensing, which is well suited for automotive applications. The sensor is a cheap PCB pattern and the ASIC integrates the actuator driver, the sensor interface and the analog and digital signal processing. Besides the circuits, also the special automotive and safety issues are detailed.
Currently, discrete, high mobility compound semiconductor Hall devices are used for the measurement of low magnetic fields such as the earth magnetic field. The fourth paper shows how these discrete devices can be replaced by an integrated, low sensitivity Hall effect sensor on a low voltage CMOS technology with an integrated magnetic concentrator post-processing. Extensive analog and digital signal processing and calibration is used.

The last paper focuses on a high-side power switch for automotive applications. It describes the functional and diagnosis requirements such as on-resistance and current sensing. Elaborate over-temperature, over-voltage, over-current, inductive clamping and loss-of-ground protections are described. The integration of these diagnosis and protection circuits allows the power switches to function in the harsh automotive and industrial environment.