

Leonhard M. Reindl

**Abstract** – Surface acoustic wave (SAW) devices can be used as identification and sensor elements (SAW transponders) for measuring physical, chemical and biological quantities such as temperature, pressure, torque, acceleration, humidity, etc. that do not need additional power supply for the sensor elements and may be accessed wirelessly. The complete wireless sensor system includes a transponder, consisting of an antenna wired to a SAW device, and a local reader unit, consisting of a radar transceiver linked to a signal processing and controlling unit. An RF burst transmitted by the radar transceiver is received by the passive SAW transponder. The passive transponder responds with an RF signal - like a radar echo, which can be received by the front-end of the local transceiver. Amplitude, frequency, phase, and time of arrival of this RF response signal carry information about the SAW reflection and propagation mechanisms which in many cases can be directly attributed to the sensor effect for a certain measurand. Due to the high delay time of the SAW transponder in the order of a few  $\mu\text{s}$ , usually no intersymbol interferences (ISI) due to environmental reflections occur when the system operates in typical, i.e. harsh indoor/outdoor environments. The present work reviews the operating principle of such sensor systems and their state-of-the-art performance by way of a few examples which include the wireless measurement of temperature, pressure, torque, acceleration, tire-road friction, magnetic field, and water content of soil.