Introduction

Differential Capacitive Sensors (DCS) are novel devices that find their most use in applications measuring pressure change, displacement, and force. These devices are commonly used in the aerospace industry, mechanical systems industry, and acoustical industry, however these sensors are becoming increasingly attractive in the automotive industry. DCS are used as monitors for automobile engine stability and are increasingly being applied for other automobile uses. This review focuses on the use of Differential Capacitive Sensors as moisture detection devices for automated automobile windshield wipers.

Capacitive Basis

The fundamental elements of DCS are the capacitor elements. A simplified schematic layout of a differential capacitive circuit resembles two parallel capacitor elements terminated at separate input terminals. Typically one input terminal is designated as the reference input while the opposing input terminal is the test input. The capacitance values are typically equal and opposite [1]. An applied force to the test input has the effect of deflecting one plate of the capacitor towards the other plate, thereby changing the capacitors’ effective capacitance [2]. The amount of force applied to the capacitor plate determines the extent of plate deflection and consequently the change in capacitance. This change in capacitance of the input capacitor now differs from that of the reference capacitor. Through a signal-conditioning circuit the capacitances can be converted to a voltage, current, or frequency parameter which can then provide operation.

DCS as Moisture Detection

The premise of DCS as a moisture detection device mirrors the scenario above with moisture/rain serving as the force on the input capacitor plate. A typical example resembles two electrodes placed strategically on opposing surfaces of a glass windshield which serve as the capacitor plates. Another setup involves the use of the windshield as a dielectric between the capacitor plate sensors. This setup takes advantage of the different dielectric constants of water and glass. As moisture accumulates on the outside of the windshield the dielectric value between the sensor plates change thereby changing the effective capacitance sensed by the sensors[3]. U.S. Patent 5402075 demonstrates the setup as: “Capacitive moisture sensor includes insulator means and capacitance means including”…Capacitive sensor conductors mounted for exposure to the atmosphere. With means of applying a periodic input current across the first and second electrodes and detecting the change in capacitance indicative of the presence of moisture [3]. This setup may also include a reference capacitor with the its’ own sensor conductors. With this setup sensors must be integral to the windshield which leads to questions about initial cost, maintenance, and long term reliability. The key component to any success is the sensitivity of the sensors to distinguish between rain moisture and other types of moisture conditions such as condensation to work effectively. In summary the key components for
any DCS are the capacitive sensors, insulative media (i.e. glass, plastic, etc), current generation, and some circuit comparator.

Commercial Marketability

The proposition of DCS serving as automated Windshield Wiper detection is definitely feasible; however the marketability of such a technology has not been determined. Currently there exist three patents that cover the majorative basis of DCS as Moisture detection devices. Presently, there is no evidence that this technology has been implemented or experimented in the automotive industry. Other types of rain detection applications such as Infrared detectors and water level meters have had more success commercially.
Works Cited


[6] Automotive ICs vol.5 iss.4