Investigation on Capacitive Sensor Interface with Improved Immunity to External Interference

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Abstract

This thesis presents the results of the undertaken investigation on industrial capacitance sensor interface for measuring small displacements, with focus on immunity to external interference, especially when using long cables. Several principles have been investigated and comparison has been made, followed by the proposed measurement principle, which can be implemented without electrical contact with the target. The range of measurement is up to 10 pF. Such sensor interface is designed to tolerate up to a 10-meter cable, and more importantly, due to the special measurement principle, such system is designed to have an improved immunity to external interferences. There are several advantages of such a system, compared with existing capacitive sensor interfaces: (i) the special sensor configuration minimizes external interference (mostly electromagnetic interference); (ii) the measurement principle makes the front-end amplifier less sensitive to non-idealities like offset; (iii) a switch-capacitor type active shielding technique reduces the effect of cable capacitance. The results so far show that the dynamic range of such interface can reach more than 12 bits, with a measurement time less than 100 us.