Signal Processing Method for Vehicle Wheel Force Sensor using DSP

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Extended Abstract

A vehicle wheel force sensor is used for measuring the forces and moments applied on the wheel, which is installed on between the vehicle wheel and power transmission axle [1-4]. The sensor must be very rugged and the shape is of pan cake type similar to the vehicle wheel. In order to obtain the measuring signals there are many strain gauges attached on the bridge beams. Conventional load cell used in weighing scale is operated in static conditions where the very narrow dynamic range is acceptable. However, since a vehicle runs very fast, the dynamic rage required for the wheel force sensor should be wide in very high frequency and the signal processing should be done in very short time. Furthermore, around the engine room it is noisy because of the engine.

In this paper a signal processing circuit and algorithm are developed and tested for the sensor. The analogue signal amplifier circuit was designed theoretically and in simulation in order to remove the noise but have uniform gain over the working frequency range [5-8]. Obtaining the Bode diagram the performance is confirmed by a series of experiments. Because the wheel rotates continuously during the vehicle runs the coordinate of the sensor is changed according to the wheel rotation. Since vehicle designer, however, wants to know the reaction forces in the stationary coordinate, the obtained strain gage signals have to be converted to the forces in the coordinate. So, the signal processing algorithm and conversion formula are implemented using digital signal processor (DSP) and the processed output signal is transmitted to the data gathering computer via wired or wireless communication line [9,10].

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