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A Comprehensive Description of a Low-Cost Wireless Dynamic Real-Time Data Acquisition and Monitoring System

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1 Experiment

For testing this sensor and its reliability, an experiment has been implemented. With an electric jack, a sinus signal has been programmed, and the vibrations had been saved by the accelerometer(InvenSense, 2014). This jack can shake its bottom plate as was programmed. The instructions to the hydraulic jack were to make a wave with a fixed frequency of 5 hertz (5 complete waves in one second). The movement of the jack was to go up to 0.1 millimeters up and -0.1 millimeter down from its null axis to make a sinus wave. With a very simple two time differential, the acceleration equation could be calculated.

$$y = d * \sin(\omega * t + \varphi) \quad (1)$$

$$\omega = 2 * \pi * f \quad (2)$$

On the Eq.3, acceleration has been calculated from the Eq.1. This was done by getting the second-order derivative of the Eq.1. By putting all the data in the Eq.3, the maximum acceleration was calculated as 10.4352 g*10^{-3} m/s^2.

$$a = \frac{d^2 * y}{dt^2} = \ddot{y} = -d * \omega^2 * \sin(\omega * t + \varphi) \quad (3)$$

2 Conclusions

As in Fig.1, it is visible the sinus wave conducted from the accelerometer by the Arduino due(Blum, 2013) is quite close with the expected behavior. As it is observable, the sinus wave is fluctuating about 10.5 milli-g from its average as it was calculated in the last section, the graph should have had a 10.453 milli-g fluctuation. It is quite notable to see that they have worked out almost the same.

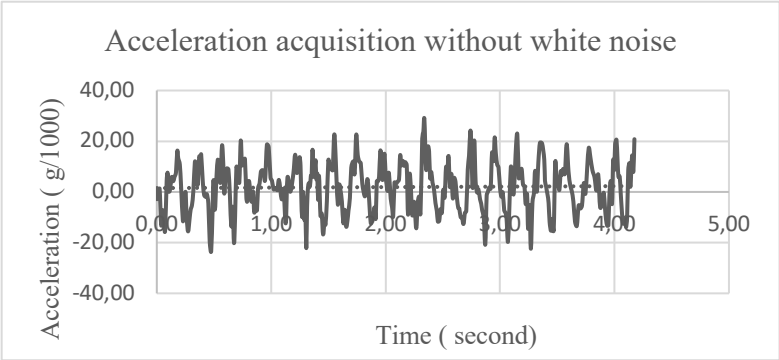

Figure 1. Acceleration, Time diagram without the white noise.

In Fig.1, the filtered data from the 5Hz experiment has been shown. As can be seen, the result is not so accurate, for the fluctuation has other unexpected data or noises as well. In the future works, filters must be applied to delete the unwanted data and ambient noises that may have entered into this experiment unwantedly.

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References

Blum, J. (2013). Exploring Arduino: tools and techniques for engineering wizardry.
InvenSense, T., 2014. MPU-9250, Nine-Axis (Gyro+ Accelerometer+ Compass) MEMS MotionTracking™ Device.