

Bohdan BOROWIK<sup>1</sup>, Igor P. KURYTNIK<sup>1</sup>, Barbara BOROWIK<sup>2</sup>

University of Bielsko-Biala(1), Cracow University of Technology(2)

## Applying ZigBee technique for monitoring vibration of dynamic object

**Keywords:** Microcontroller, Acceleration, Duty Cycle, Accelerometer.

### Abstract

The paper presents the model for measuring the vibration parameter of the dynamic objects and for presenting those data on the remote graphical display. Some programming examples for graphics display controller are presented. Wireless, RF communication in Tx/Rx duplex mode provides transfer of data with ZigBee transceivers. The ZigBee coordinator module is connected to intelligent PIC microcontroller for processing results and presenting them graphically. ZigBee technology can be alternative for other vibration research techniques.

Contemporary industrial world often creates requirements for microcontroller applications with the measurements of vibrations. Accelerometer applications due to embedded control and I/O digital signal processor DSP play the crucial role in determining vibration and machines fatigue strength testing. They record, among other, the temporary industrial parameters and monitor plant system parameters such as vibration and/or pressure. Our research, controlled by ZigBee technology can be alternative for other techniques of vibration research. In our investigation were used ZigBee network. The End Device module had its own I/O pins attached to sensor output and readings from sensor were sampled at several rates. On the side of the superior node – coordinator, the measurements from sensor were sent via USART to PC terminal and were presented graphically as chart on PC screen. Parent node in ZigBee PAN network is coordinator. If coordinator module has on its board the microcontroller and Mass Storage Device then additional scenarios are possible:

- Different threshold value and determining action after exceeding this value.
- If measurement data exceeded threshold values, microcontroller can turn the power off or make another action to prevent damaging machine working in inappropriate condition.

In order to match sampling frequency with the high vibration frequency of mechanical moving parts, the third scenario

has to be considered: arming the end device node with PIC microcontroller and use microcontroller to collect data and initially process the data. In many industrial processes, one of the major problems is the data sharing by cable connections. Also measurement and control of End Device board placed on the moving elements of various machines are strongly exposed for mechanical damage.

The Freescale ADXL330, 3-axis analog accelerometer sensor has been chosen because of its possibilities of the three axis operation. This way the data can be acquired during the normal work of the machine.

### REFERENCES

- [1] Borowik B. and Kurytnik I., P. *Microcontrolery PIC w zastosowaniach*, PAK- Pomiarzy Automatyka Kontrola, Warszawa, 2009
- [2] Wojnarowski J., *Ograniczenie Drgań Przecinarek z Taśmowymi Pilami bez Końca*, Monography of Silesian Politechnik, Gliwice 2007
- [3] Kurytnik I., Karpinski M., *Bezprzewodowa transmisja informacji*, PAK Pomiarzy Automatyka Kontrola Warszawa, 2008
- [4] 802.15.4 TM-IEEE Standard for Information technology, Telecommunications and information exchange between systems Part 15.4; Wireless Medium Access, Control (MAC) and Physical Layer (PHY) for Low-Rate Wireless PAN, New York 2003
- [5] Borowik B., et al., *Meandry języka /C++*, PWN Warszawa 2006.
- [6] Borowik B., Tilt and vibration measurement of the remote objects using ZigBee communication // *Przegląd Elektrotechniczny*. – 2010. – Nr 7. – S. 57-59.

**Authors:** Dr inż Bohdan Borowik University of Bielsko Biala, e-mail: bborowik@ath.bielsko.pl  
 Prof. Igor P. Kurytnik Head of Department KEiA University of Bielsko Biala,  
 Dr Barbara Borowik Cracow University of Technology