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SOME FEATURES OF THE CONSTRUCTION OF AUTONOMUS DIAGNOSTIC SYSTEMS OF WIND TURBINE GENERATORS

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Abstract

The work proposes the structure of a diagnostic system, which is used to ensure the functioning of autonomous measuring transducers placed on the diagnosed parts of wind turbine generators (WT). For this purpose, the Energy Harvesting (EN) technology was used, which is designed to provide power to electronic devices in autonomous vibration measurement systems. Energy Harvesting technology converts the mechanical energy of vibrations into electrical current.

Keywords: wind generator, Energy Harvesting technology, vibration diagnosis.

1 Introduction

Today, diagnosis systems are getting more and more developed for generators of wind turbines, which allows to increase their reliability work and extend the remaining resource [1]. Operation energy-intensive equipment requires the creation of special methods and means that allow such exploitation at simultaneous provision of the necessary level of reliability and security The principles of building systems are considered in the report of technical diagnostics of moving nodes of the wind turbines with using autonomous measuring devices converters. When creating such systems, it is important the provision of independent power supply touch devices to give them greater autonomy and increasing the inter-service interval. Application with batteries and optimization of energy consumption by the devices themselves allows only a partial solution of the problem. Currently, Energy Harvesting technologies are actively developing using renewable energy sources. The use of these technologies allows to significantly increase autonomy of functioning of the sensor blocks [2, 4]. Generally, energy of vibration can be converted into usable by [4]:

- piezoelectric convertor;
- electrostatic convertor;
- electromagnetic convertor;
- magnestrictive convertor;
- triboelectric convertor.

Among the presented methods, piezoelectric modules are most often used. This is due to their stable and repeatable operation as well as the wide commercial access to piezoelectric materials.

Another interesting method used in energy harvesting technologies are thermoelectric devices. Using the Seebeck effect for a cold and hot surface, an electric current is generated. However, for solutions related to wind turbines, it is not always possible to generate an appropriate temperature difference [5].

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2 Construction of autonomous diagnostic system

At the Institute of Electrodynamics of the National Academy of Sciences of Ukraine, an autonomous block of sensors was created, which performs the function of measurement, processing and wireless transmission of measured information signals from individual nodes of electric machines to the central module of the diagnostic system [3]. The sensor unit is powered by a Li-Pol battery. Battery energy consumption depends on many parameters: EM operating mode, transmitter power, data transmission frequency, etc. To maintain long-term autonomous operation of the equipment, it is necessary to constantly top up the battery charge. For this purpose, the existing power supply modules based on EN technology were studied, the operation of individual mobile EM nodes was modeled to determine the optimal technology for obtaining electrical energy to power the sensor unit, and a sensor unit scheme was developed that uses the selected power module to recharge the battery of the sensor unit.

The developed power supply unit consists of two main parts: a unit for converting mechanical energy into electrical energy; control unit and energy storage.

The Energy Convertor is responsible for converting energy from various physical sources (vibrations, temperature fluctuations, etc.) into electrical energy, which is transfered into the Energy Storage Unit (Fig. 1) The Energy Storage Unit performs the functions of accumulating this energy and charging the battery. The LTC3588-1 microcircuit manufactured by Linear Technology was used for Energy Storage (Fig. 2).

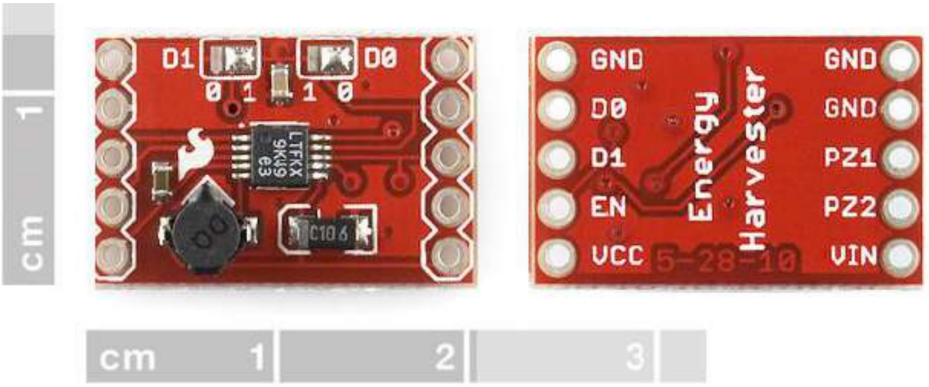

Figure 1. Piezoelectric Energy Harvesting Power Supply

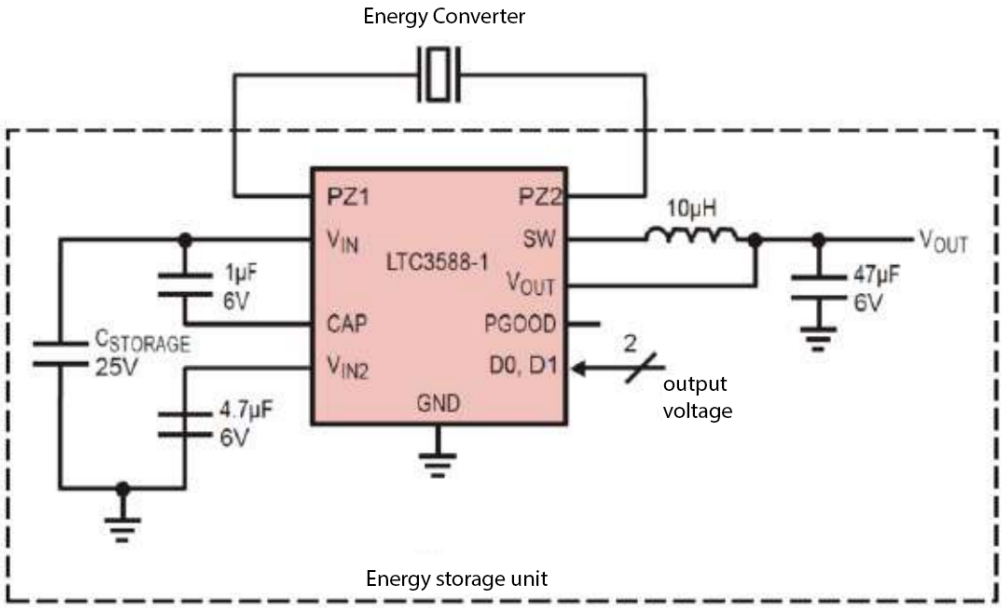

Figure 2. System overview

A piezoelectric power supply converter V21BL manufactured by Mide Technology was used in the project (Fig. 3).

Figure 3. V21BL piezoelectric converter

3 Conclusion

The power produced by the piezoelectric transducer is not enough to fully power the sensor unit in direct way, so the use of a battery remains mandatory. Based on the analysis of the features of each specific object, it is necessary to optimize the software to adapt the functioning of the Energy Harvesting blocks to a specific diadnosed object.

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