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New model of piezoelectric accelerometer relative movement modulus

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Abstract

A piezoelectric accelerometer is the first element of a vibration measurement chain, and its improvement can enhance measurement quality. In this work, a new model of relative movement modulus as a function of measurement error is developed, thus minimizing the measurement error and increasing the measurement precision of the accelerometer. Therefore, a precise relationship between the movement relative frequency and the piezoelectric accelerometer natural frequency is extracted in order to determine a good frequency range relative to the piezoelectric accelerometer. Thus, the failure risk of the resonance phenomenon is minimized and the accelerometer piezoelectric reliability is optimized. The developed model is confirmed and validated by experimental tests. The purpose and the objective of this work is to improve the performance and the design of the accelerometer.

Keywords

Development, frequency, model, sensor, simulation, vibration

Introduction

The performance level of an industrial plant depends directly on its maintenance function. Its optimization is a complex operation because it must sometimes take into account conflicting criteria such as availability and cost. The criteria that influence the maintenance of an industrial plant are maintenance type, task types and their frequency, and the intervention level.

The main objective of maintenance is to minimize equipment failure to avoid a drop in production. An improvement in equipment reliability and control of malfunctions and failures depends on the development of preventive maintenance.

Maintenance plays a very important role in industries that apply a greater maintenance policy to reduce or eliminate unnecessary repairs, prevent the failures of industrial installations and minimize the negative impact of maintenance operation on business performance (Glade, 2007; Lyonnet, 1999). Conditional preventive maintenance is largely used in various industry organizations because its supervision and monitoring does not require downtime.

Usually, rotating machines in operation generate effort by causing failures of machine parts. To make the right diagnosis, the conditional preventive tools must be chosen such as vibration analysis, oil analysis, thermography, etc. For early detection of defects encountered in most production machines, measurements must be taken followed by technical analysis of machines in operation (e.g. vibration analysis).

The different defects identified by vibration analysis technique are shaft misalignment, poor machinery coupling, degradation and bearing wear, and even electrical faults can be detected early in order to plan for intervention before failure.

The development of information processing capacity allows the control and automation of more complex systems. The possibilities of calculating the order of parts seem limited only by the quantity and quality of the provided data. As the part orders increase in power, the calculation requires an increasing information flow. The sensor and especially the accelerometer plays an important role in the monitoring and control of industrial systems. In an industrial environment, the word 'sensor' is often reserved for compact cameras. For bulkier cameras, the sensors are called transmitters or specialized devices for physico-chemical measurements, called industrial analysers.

Vibrations are detected using sensors called accelerometer or vibration sensors. Their function is to transform the level of vibration into a timed electric signal. The remaining

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