



International Conference on Industrial Engineering, ICIE 2017

Analysis of Sources and Methods for Reducing Noise by Minimizing Vibrations of Engineering Technological Processes

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Abstract

Noise is one of the factors, which is the result of almost any production process and substantially characterizes its quality. There has been made a research of the basic sources of industrial noise in the engineering production technological processes. One of the noise sources is the mechanical system elements vibration. This process is an interaction of the mechanical system elements of the production equipment, including imbalance, impact and other processes. The experimental research determines the qualitative and quantitative correlation between the parameters characterizing industrial noise and vibration. The results of the experimental research analysis allow for the determination of the direct proportionality between parameters characterizing industrial noise and vibration. Researching the methods for reducing industrial noise is conducted by minimizing vibrations of technological processes of engineering production. Noise control automated system analysis is carried out by means of vibration control. The use of this control algorithm will automate minimization of noise at the source.

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Peer-review under responsibility of the scientific committee of the International Conference on Industrial Engineering

Keywords: noise; vibration; control; engineering; automated system; source; equipment.

1. Introduction

Noise is one of the factors, which is the result of almost any production process and substantially characterizes its quality. Noise impact reduces the ability to focus attention, as well as precision of work based on the reception and analysis of information and production effectiveness.

Functioning of engineering industries shows the increased requirements in organization of processing technologies and safety of technological processes [1-3]. Minimizing the emergence and impact of industrial wastes

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enables environmental quality [4]. Today, the achievement of environmental and safety technological processes is becoming an actual direction of the modern engineering industries development [5,6]. The problem of economical use of resources is among the most important ones for production [7-9].

Acoustic noise has long been recognized as a source of environment pollution that can have adverse effects on human life in numerous ways. Noise, like other forms of pollution affects the quality of life. Industrial noise has a negative effect on human health. The noise has a negative impact on hearing. Hearing damage is the best-documented effect of noise on human beings. Excessive noise adversely affects not only the hearing, but also can cause hypertension, fatigue, heart trouble.

2. Formulation of the problem

The negative effect of noise predetermines a set of measures to reduce it. These measures relate to design and technology developers, safety experts, working comfort, and environmental protection.

The measures represent a different kind of design techniques, technological and protective measures.

In addition, a source of mechanical noise is an interaction of mechanical system elements of production equipment, including imbalanced shape and surface errors. Thus, noise reduction is based mainly on improving the production system technological equipment and thereby minimizes noise at the source.

However, methods based on the absorption of noise propagation path, widespread in the industry, such as sound insulation and sound absorption are passive methods for reducing industrial noise.

Besides, technical methods are perspective methods for noise reduction in production equipment.

One of the sources of noise is vibration of mechanical system elements. Consequently, the problem of determining a correlation between the noise and the vibration for noise control by means of vibration control systems is an actual problem of modern production.

It has particular importance for the mechanical system elements of production equipment, containing the gears in its composition.

3. Noise and vibration sources

In technological equipment of engineering production, the process of transfer of mechanical energy from the electric motor in the processing zone causes energy loss due to the partial transformation of mechanical energy into other forms of energy, including sound and energy of mechanical vibrations made by mechanical system elements. [10-12].

The main cause of these losses is a variety of processes, which should include the interaction of different mechanical system elements of production equipment.

The main sources of technological equipment vibration are:

- sources of steady state;
- sources of unsteady state;
- accidental sources.

Steady sources include impact processes and imbalance of mechanical system elements of the production equipment. Unsteady state sources include different transitional processes of the production equipment. Accidental sources include friction of mechanical system elements of the production equipment.

There are mechanical, electromagnetic, hydrodynamic and aerodynamic noises in the production system. The sources of industrial noise are different processes that cause medium disturbance.

These processes include:

- interaction of mechanical system elements of production equipment including imbalanced shape and surface errors are the sources of mechanical noise;
- fluctuation of details and elements of electromechanical devices by electromagnetic fields are the sources of electromagnetic noises;
- interaction of air flows in gases is the source of aerodynamic noise;
- different processes in liquids are the sources of hydrodynamic noise.

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