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# Methodological Design and Commissioning of an Experimental Stand for the Study of the Spread of Harmful Substances in the Air of Work Areas during the Processing of Metals in Industry

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## Abstract

The present publication presents preliminary advances about the experimental design related with the emission of impurities in the work environment during processing of metals, so as to study the result of thermal destruction of substances used in the optimization of technological processes. These results will be the basis for the design of new experimental models based on techniques and tools of computational simulation in order to set up a mathematical model describing the spread of harmful substances into the environment during the application of lubricating cooling technical means during the cutting and processing of metals in the industry.

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*Keywords:* technological process; lubricating cooling technical means; engineering industry; metal processing.

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## 1. Introduction

Modern methods of production in engineering are characterized by enhancement of all parameters associated with the use of tools, instruments and special materials to improve the quality of production processes such as turning, milling, drilling, grinding and other most commonly used in the processing of various materials to obtain the finished product [1-11]. Tools, which are used during these processes, gradually wear out. Among the main factors are the high temperatures in the cutting zone. They play an important role and should be considered because

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of the significant effects arising in the equipment during operation, due to the quality of performance of technological processes and emission of products of thermal destruction.

In the engineering industry in general and technical systems in particular, the employee regularly must have in account the polluting impact on the environment as consequence of substances released to air during technological processes. All this contributes with the deterioration of the quality of technological processes, increasing the risks of production and reducing the competitiveness of products [12,13].

It is known that one of the factors in the development and improvement of modern production is the creation of friendly technologies with the environment in mechanical engineering. Modern technological processes of machining use coolants LCTM (lubricating cooling technical means) to reduce the negative effects of high temperatures on the instruments, although its application is also cause harmful effects on the environment because of substances emitted by thermal destruction. Therefore, the objective of this work is to obtain preliminary experimental results in order to model the spread of harmful substances in the air, using a stand of laboratory specially designed to simulate the high temperatures during the cutting process of metals.

## 2. Statement of the problem research

In relation with the continuing deterioration of the environmental quality in the air, water and soils as a result of human activities, one of the most important problems in the present, according to various experts, is the question about the impact of these activities on the environment. The increase in air pollution as one of the most important components of the environment represents a threat not only to human health but also to nature and life on the planet as a whole. To obtain reliable knowledge about the level of atmospheric pollution due to harmful emissions should be carried out numerous studies related to the collection of a large number of gas samples to determine the concentration of aerosols in the air. In some cases, this process is very expensive and requires too much time. In practice, this problem is solved by defining, building and joint management of physical and analytical-computational models as seen in figure 1.

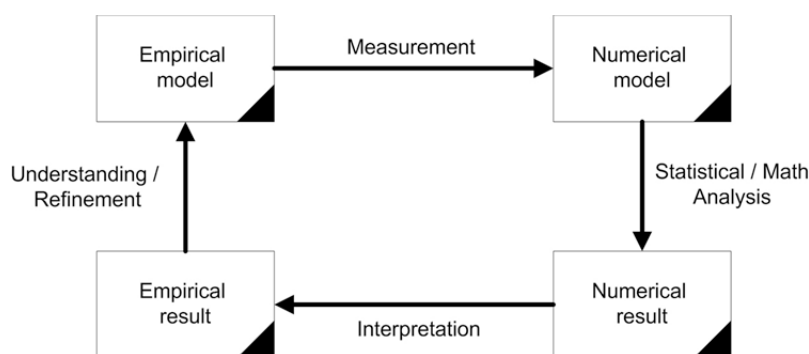


Fig. 1. Measures based on models [14].

The solution of environmental problems using mathematical modeling about distribution of substances in the air is one of the most important topics of research to prevent the spread of pollutants and accumulation of high concentrations in the environment [15-17]. The process of cutting is a complex set of physic-chemical phenomena (mechanical, thermal, electrical, etc.) that occur due to the interaction of the tool with the processed material under high contact pressures and temperatures, altering the properties of the components in the technological system [18]. The wear of tools used in the implementation of technological processes related with the processing of metals is the result of a combination of many factors like diffusion, fatigue, adhesive, abrasive and oxidation wear.

Because of all these factors as a result of high thermal intensities, different mixtures of substances are used as lubricants/coolants. The purpose of this multicomponent system is the elimination of negative consequences that occur in the processing of products: reduction of temperature and wear of the cutting tool, ensuring a satisfactory quality of the processed surfaces. Although the use of coolant is one of the main factors that increase the

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