

APPLICATION OF NEURAL NETWORKS IN SYSTEMS OF AUTOMATIC REGULATION OF TECHNOLOGICAL PROCESSES OF GRINDING

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This paper discusses the parameters used to automate and control the grinding and classification process and the capabilities of neural networks. It also analyzes a number of properties useful from the point of view of practical use of neural networks.

Keywords: Crushing, grinding, beneficiation, particle size distribution, control, automation, stabilization, optimization.

The economic potential of our country depends largely on the development of industrial productivity, mineral extraction performance, processing and beneficiation for future generations in our current democratic society.

The beneficiation processes are mainly based on the crushing and grinding process. Currently, crushing and grinding are very expensive processes. They account for more than 60% of ore beneficiation costs.

The grinding process is one of the main process parameters of beneficiation plants. Grinding is a multi-component process, and preparation for beneficiation is one of the final indicators of the process. The grinding performance affects the key performance of the beneficiation product. That is why energy and resource saving by optimizing the mode of operation of grinding units is one of the main tasks today.

The main process equipment of the grinding process are mills and classifiers. The input influences in the grinding process include: ore and water entering the mill, ore size distribution and hardness..

The indicators of the grinding process are usually the particle size distribution and density of the crushed product. Changes in the quality of the initial ore size, moisture, hardness and other factors significantly complicate the task of optimizing the crushing mode. The grinding process is closely related to the classification process. These two processes usually run in a closed loop. Therefore, the process parameters describing each process are in a dynamic relationship with each other..

Automatic control of crushing and grinding processes allows to save energy and resources by stabilizing and optimizing the operating modes of technological equipment, as well as to achieve economic efficiency by improving product quality. Fig. 1 shows the controlled parameters of the grinding process. The goal of optimal control of the grinding and classification process is to ensure maximum ore processing and a given quality of its crushing. In this case, the problem itself is aimed at finding the optimal control, transferring the system from the current state to the desired one, minimizing the given integral quality criterion.

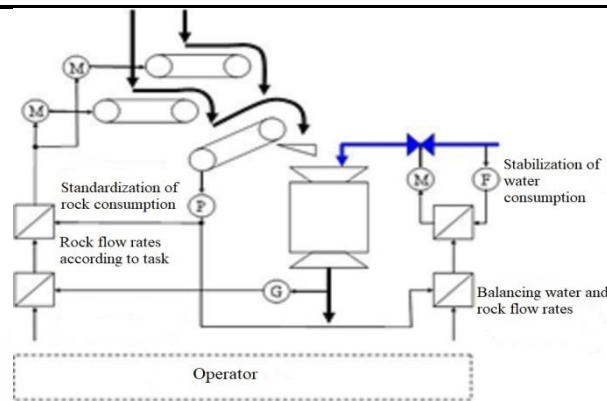


Fig. 1. Controlled parameters in the crushing and grinding process.

Given the specific conditions of the technological process of ore grinding, the construction of a typical control system in the form of local circuits of automatic control of individual parameters does not provide sufficiently optimal control. On this basis, it is preferable to develop a control system for decision-making and classification process on the basis of neural networks, because it is believed that neural networks have the ability to reproduce the specific characteristics of models and their complex interrelationships.

Neural networks have a number of properties useful in terms of practical applications in grinding and classification processes:

- extremely high performance due to the use of mass synchronization of information processing;
- Fault tolerance: the ability to function is preserved even if a large number of neurons are damaged;
- the ability to learn, Programming a computer system is replaced by training;
- Ability to detect images in high noise and distortion environments.

The above properties allow controlling the grinding and classification processes using neural networks.