

Yaroslav Magas
S.M. Triputen, research supervisor
V.V. Gubkina, language adviser
SHEI «National Mining University», Dnipropetrovsk

Optimization of Conveyor Workload Using Artificial Neural Network

Currently, the use of conveyors in the industry is enough widespread. It should be noted that in a number of industry spheres stream of supply on conveyor is of stochastic quantity. Nonuniformity of freight traffic is associated with the problem of uniform conveyor load and maintenance of given workload level. Exceeding of the required load level can lead to conveyor belt breaking while low workload level can result in inefficient conveyor using.

To solve the problem of maintaining a given load level PID-controller can be used. However, it should keep in mind that the static characteristic of the given controller is linear. A stream of supply in the present case is non-stationary stochastic quantity that contains the non-linearity, pauses of duration varied and frequency of occurrence. Idea of optimization consists in the fact that a controller should immediately react to long duration of the stream of supply pause, and there should be insignificant response to the short duration of the pause. Significant response to the short duration of the freight traffic pause is associated with additional energy consumption and additional load on the conveyor in connection with its inertia. For preliminary identification of pause duration and its occurrence, it is necessary to predict the following freight traffic values.

Artificial neural networks have high approximating properties and ability to detect hidden regularities. In addition, there is the possibility of using artificial neural networks to forecast current problems. Multilayer perceptron is a unidirectional multilayer artificial neural network which can be used to determine the predicted values. Current and previous freight traffic values having being stored in memory beforehand are sent to the input neurons layer of a network. After completing the calculation of the neural network, the output layer contains predicted values. Statistics of the freight traffic is taken in the form of time series as the initial data for training a neural network. The multilayer perceptron is trained with the back propagation algorithm. The data from the time series are sent to perceptron inputs and outputs and then learning algorithm is started. Thereby, the proper input and output values of the time series are established and the training of the neural network takes place.

Thus, artificial neural network can be used as an option to solve optimization problem of conveyor workload. On the base of predicted values it is possible to determine timing and duration of freight traffic pauses. In the case of a long duration pause, PID-controller parameters will be changed in advance, thus providing necessary immediate response if there is a deviation from the given workload level. And that is fuzzy logic which is used to provide the correspondence between the duration of freight flow pauses and PID-controller parameters.