

2. Бородай В.А. Компенсація різко-змінного струму якоря потужних синхронних приводів засобами автоматичної системи збудження із нестандартним алгоритмом керування [Текст] / В.А. Бородай, Р.О. Боровик, О.Ю. Нестерова // Електротехніка та електроенергетика. – 2018. – № 1 – С. 72-80. DOI 10.15588/1607-6761-2018-1-8.

3. Шевченко І.С. Спеціальні питання теорії електропривода. Динаміка синхронного електропривода [Текст] : навч. посіб. / І.С. Шевченко, Д.І. Морозов. – К. : Кафедра, 2014. – 267 с.

CHOICE OF CONTROLLED VARIABLES FOR ENERGY MANAGEMENT SYSTEM OF PISTON COMPRESSOR UNITS

BOBROV Oleksii

Rocket-and-Space Engineering College of Oles Honchar Dnipro National University Ukraine, Dnipro

Introduction. Nowadays on-off control system is common for piston compressors delivery. The control system is applied in case there is no technological need in maintaining the stable pressure level in pneumatic system and there are no dramatic changes of compressed air consumption. Its advantages are described in terms of simplicity of implementation and reliability. The principle of on-off control system operation is based on setting of predetermined pressure limits. Reaching the upper level of pressure the compressor is switched off and it is switched in reaching the lower level. This occurs under the condition of single variable change control (intake pressure) in the system by means of sensor, which is installed. The regular operation of compressed air consumers is provided by means of pneumatic system pressure maintaining in the predetermined range.

Purpose statement. The main disadvantage of the system is its negligibility as for the factors influencing the general energy efficiency of «grid – compressor – pneumatic circuit» complex. It does not consider such substantial parameters as losses in power for grid, compressor, and pneumatic circuit. Hence, there is a need in describing the parameters to be changed by control system for losses determining and thus working in the proper regime of their minimizing for maintaining the regular operation of compressed air consumers.

Problem solution. To answer the question it is required that we consider the losses in power for various components of the system. The active power losses in electric grid. The losses in asynchronous drive and compressor unit. The losses in the compressed air pipelines.

Considering the abovementioned issues, to enable the control system being sensitive to losses in all units of «grid – compressor – pneumatic circuit» system it is need to install: ammeter, A, flow rate meter for compressed air, m³/sec, pressure sensor in the receiver.

If compared to on-off control system, the two devices, ammeter and flow rate meter for compressed air, are added. Thus, the cost of a control system and its assembly complexity increase, its reliability decreases. Let us consider the possibility of quantity reduction for indicators of controlled variables with maintaining the control system ability to monitor the losses in different units and thus to work in energy efficient modes.

The losses in electric grid may be linked to the active power consumption for asynchronous drive of air piston compressor unit considering its dependence on pressure rate in the pneumatic circuit and some allowances: power supply voltage of asynchronous motor does not depend on consumed power $U = \text{const}$; efficiency coefficient of asynchronous motor is independent from load $\eta_{\text{mot}} = \text{const}$; the influence of temperature of intake air on consumed power is neglected. The calculations should be carried out for $T_1 = 20 \text{ }^\circ\text{C}$ parameters, as the intake air temperature decrease for stable pressure reduces the quantity of moisture vapour resulting in its performance improvement.

To determine the real performance of compressors and pneumatic circuit the trial run is needed. The trial run is carried out at off hours and for compressed air consumers switched off.

Conclusions. As based on the empirical data from the expression we can obtain the dependences of compressors delivery, m^3/min from pressure, Pa, and air leaks, m^3/min from pneumatic circuit pressure, Pa. Knowing the volume of pressure for every timepoint the volume compressor delivery may be determined, and, thus, having calculated the power consumed by asynchronous drive we may obtain power losses for compressor.

The power losses in the pneumatic circuit may be determined by controlling only a single variable – pressure, and knowing the dependence of air leakages from pressure in pneumatic circuit.

From the mentioned above it is clear that monitoring of a single variable, pressure, is needed, as we may calculate power losses for all elements of the electric grid – compressor – pneumatic circuit system as based on it. This means that it is possible to develop on-off control system for air piston compressor units with asynchronous drive by means of using the only one pressure controller in the air collector. And this enables modernization of existing systems being under exploitation by means of substitution of compressor controllers with programmed logic sensor with energy efficient control algorithm.

References

1. Экономия электроэнергии при производстве и использовании сжатого воздуха. У.П. Назаренко. - М. Энергия – 1976.- 103 с.
2. Бобров О.В. Оптимізація режиму роботи електромеханічної системи виробництва та розподілу стислого повітря: дис. ... канд. тех. наук : спец. 05.09.03 "Електротехнічні комплекси та системи"/ М-во освіти і науки України, ДВНЗ "Нац. гірн. ун-т".- Дніпропетровськ, 2015.- 166 с.

3. Pivnyak, G., Dychkovskiy, R., Smirnov, A., & Cherednichenko, Y. (2013). Some aspects on the software simulation implementation in thin coal seams mining. Energy Efficiency Improvement of Geotechnical Systems, 1-10. DOI: <https://doi.org/10.1201/b16355-2>

4. Бобров А.В. Управление электроприводом компрессорной установки на основе определения КПД электротехнического комплекса: Т.1. Материалы междунар. молодёжной науч.-техн. конф. "Энергосистема и активные адаптивные электрические сети: проектирование, эксплуатация, образование", 21–25 ноября 2011 г. – Самара: СамГТУ, 2011. – 423 с.

OPTIMIZATION OF INVESTMENT FOR COAL MINES BASED ON NEURAL NETWORK MODEL

PISTUNOV Ihor & CHURIKANOVA Olena
Dnipro University of Technology, Dnipro, Ukraine

Purpose. The main objective of the paper is to develop a system of economic and mathematical models for managing the investment activity of the coal mining enterprise, including improving the principles and methods for analyzing the profitability of investment projects and the optimal allocation of investments.

Methodology. According to the goals, data on investment activity of mines for 13 associations, every one of which consists of 3 to 7 privately owned mines, was used in this article over the period 2003 - 2011 to construct a model for determining the efficiency of investments, which allows to determine the profit of a coal mining enterprise from the implementation of an investment project. Unlike the existing ones, the group of factors peculiar to the coal mining industry, such as geological factors and technical properties of coal, was taken into account.

Findings. With the help of neural networks, a model was built based on 12 kinds of investment (9 kinds of investments into equipment, capital investment, portfolio investment, intangible assets investments) which are the most typical for a coal-mining enterprise.

The method of optimization of investment allocation on a coal mine was developed, which, in contrast to the existing ones, determines the optimal investment volume, which helps to maximize profits for 12 investment models.

Created economic and mathematical models solve such questions as:

- 1) analysis of the influence of geological factors and technical characteristics of coal on the efficiency of the coal mining enterprise and on the efficiency of investment;
- 2) analysis of the influence of volumes of 12 types of investments on the level of profit of a coal mine;