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ANALYSIS OF ENHANCEMENT OF ENERGY EFFICIENCY IN INTELLECTUAL MANAGEMENT OF ELECTRICAL SYSTEMS OF ENTERPRISES

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A R T I C L E I N F O.

Key words: Electric circuits, winding machine, electric motor, mathematical model, classifications, neural network, periodic electric circuit.

Abstract

Energy consumption of existing technological equipment in food production and agricultural enterprises can be observed mainly in electrical circuits of electrical equipment. The use of variable speed controls in the enterprise shows that energy consumption can be reduced by up to 55%. The concept of improving the performance of complex dynamic systems of technological equipment with the help of intelligent control systems, the principles of building intelligent automated systems of technological process control for objects with increased work intensity were proposed. The structural and functional diagrams of multi-motor electrical systems controlling the electrical drives of the winding mechanisms were modeled using the Matlab program.

Introduction. Today, the concept of reliability is broadly defined as the fact that electrical equipment produced by a manufacturing enterprise is more "reliable" than another enterprise. In such cases, the "reliability" of electrical equipment is taken into account when relative costs are not important.

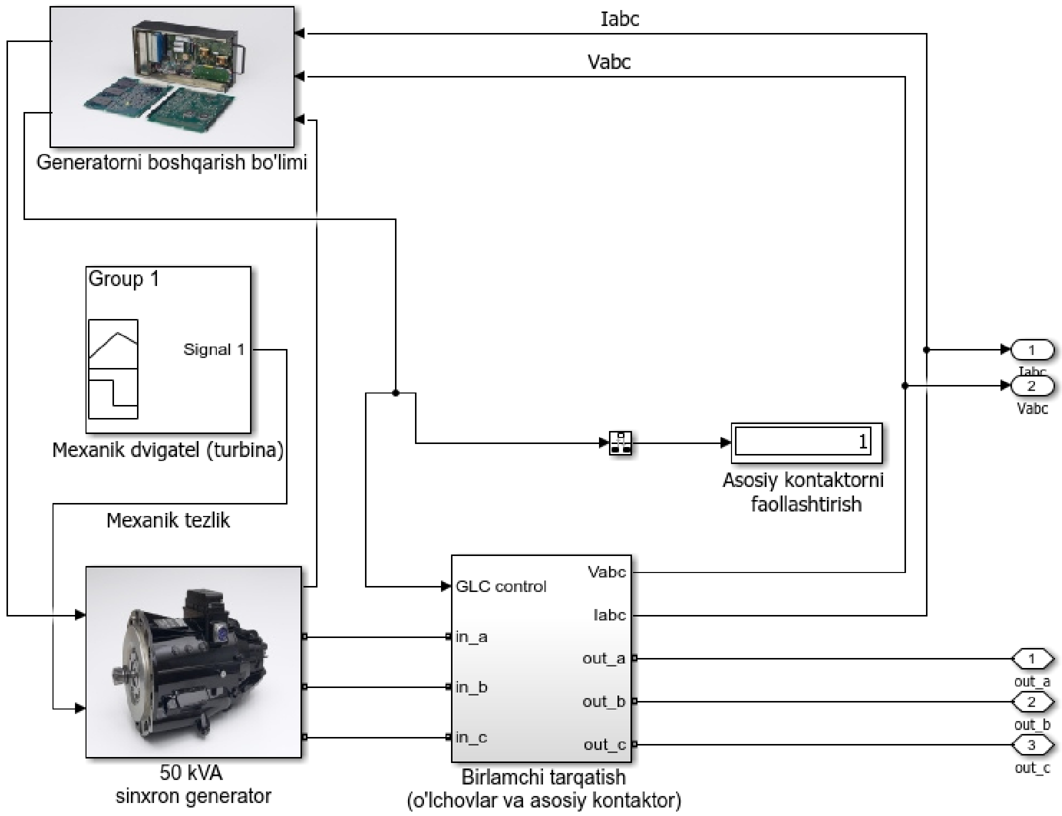
An important indicator of energy saving is the optimal management of dynamic objects to minimize energy consumption in real operating conditions, i.e., when object parameters, operating modes, restrictions, and final state tasks change. The rational use of electrical systems, which are part of controlled electrotechnical complexes, ensures energy saving, allows obtaining new qualities of systems and objects. [1].

The main part. The asynchronous electric motors used in the agricultural industry based on intelligent electric drive systems are mainly designed to be controlled based on the above model. Based on this, we will be able to evaluate them in the following order.

Through a modern intelligent control system for food production and agricultural enterprises, we achieve the following:

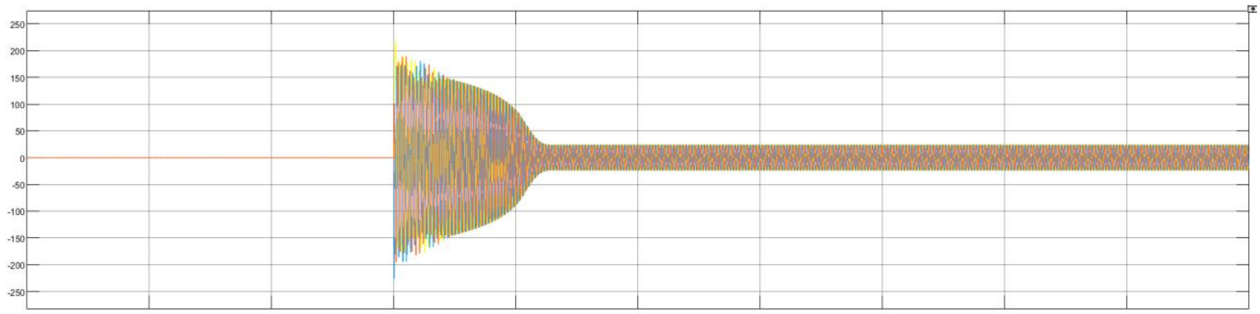
- Determination of parameters using measuring devices
- Adaptation of equipment to electric drives
- Management
- Energy calculation of electricity consumption
- Adjustment range
- Economical operation and management of electric machines

In order to analyze the electrical energy system and energy consumption of food production and agricultural enterprises, we need to familiarize ourselves with their equipment . In order to supply the analyzed enterprise with electricity, a synchronous generator with a capacity of 50 kW was used (Fig. 1).



1. Model of power supply of the product shop of the food production enterprise.

In this case, we introduce a generator management system to increase energy efficiency. In this case, we can get the following characteristics:



***1. Fig. 1 . The graph of the variation of the current I_{ab}* in the generator control system**

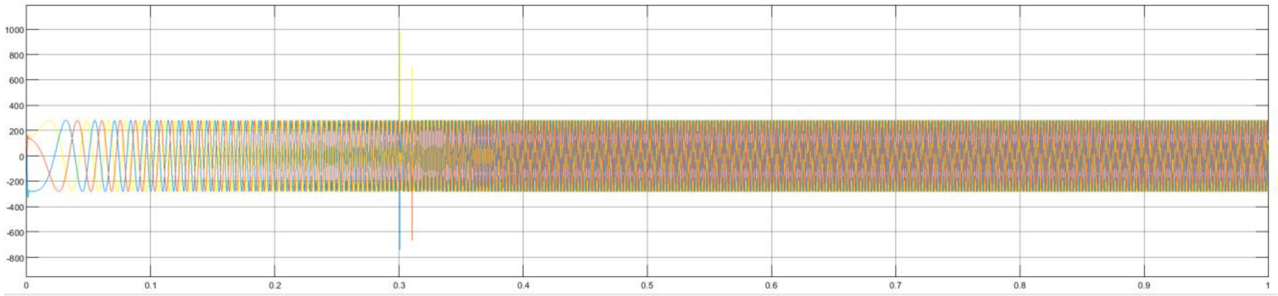


***Figure 1.2. Amplitude change graph of the supply voltage* in the generator control system.**

Table 1

No	Available equipment and supplies	Parameters
Working in constant current		
1	Illumination lights (3 pcs.)	R=1 Ohm
2	DC motor (1 piece)	Ra=0.35 Ohm
3	Heater for regulating room temperature (1 piece)	R=1 Ohm
AC operated		
4	Asynchronous motor (1 unit)	P=12 kVA
5	Synchronous motor (1 unit)	Rn=0.2 Ohm
5	Transformer (1 piece)	P=4200 KVA

Based on Table 1, we will create a model of a general production workshop in order to determine the energy consumption of an agricultural industry enterprise using the MATLAB simulink program (Fig. 2)

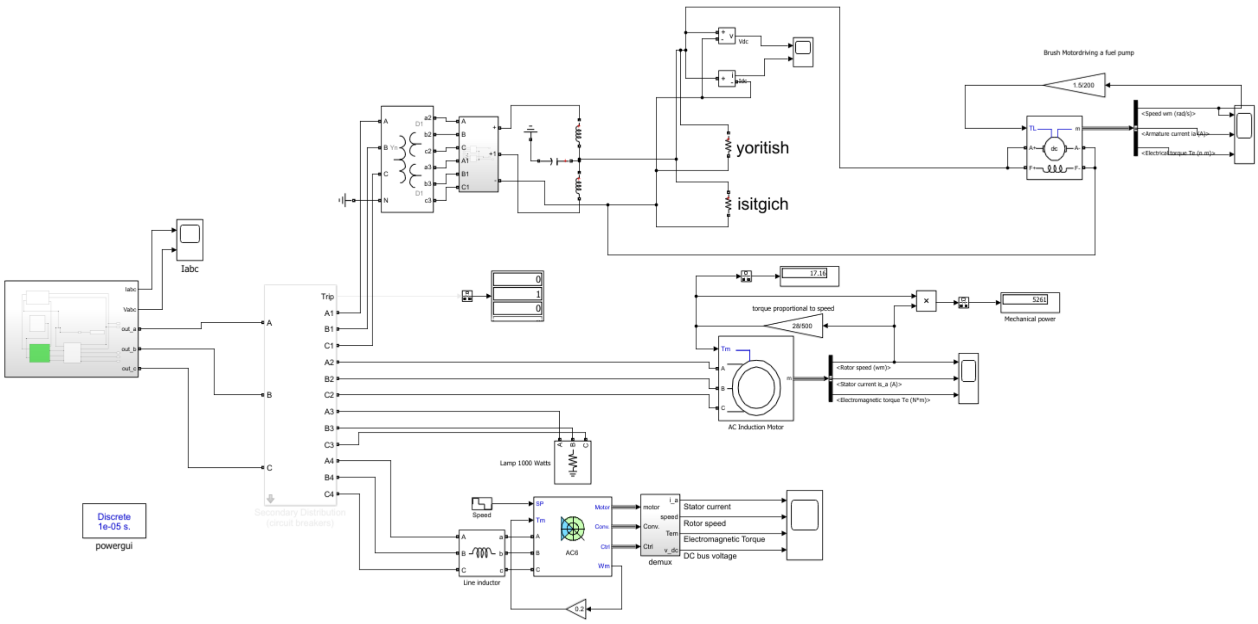


Figure 2. A general model of the production workshop created in the MATLAB simulink program.

Existing fixed current units (TRUs) in the enterprise: we install a 4 kW transformer and a rectifier (Figure 2.1).

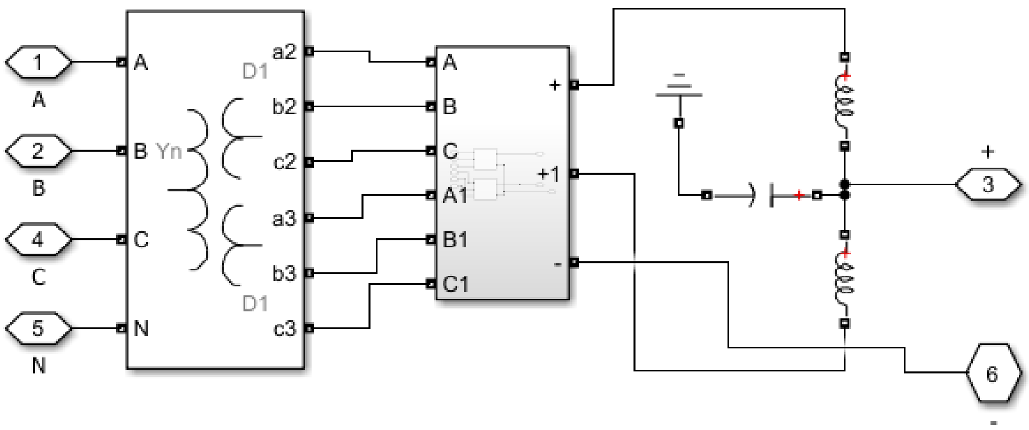


Figure 2.1. 4 kW transformer and rectifier.

In our analysis of the DC motor available in food production and agricultural enterprises, it is possible to monitor the consumption in the power supply system, taking into account the basic connection scheme and equations.

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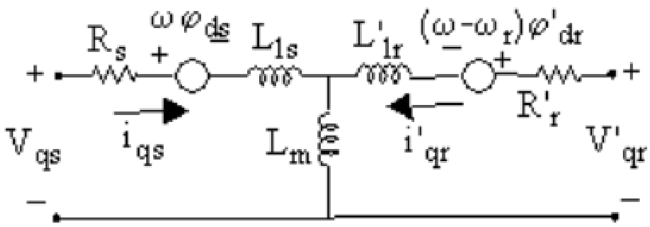


$$V_{qs} = R_s i_{qs} + d\varphi_{qs}/dt + \omega\varphi_{ds}$$

$$V_{ds} = R_s i_{ds} + d\varphi_{ds}/dt - \omega\varphi_{qs}$$

$$V'_{qr} = R'_r i'_{qr} + d\varphi'_{qr}/dt + (\omega - \omega_r)\varphi'_{dr}$$

$$V'_{dr} = R'_r i'_{dr} + d\varphi'_{dr}/dt - (\omega - \omega_r)\varphi'_{qr}$$

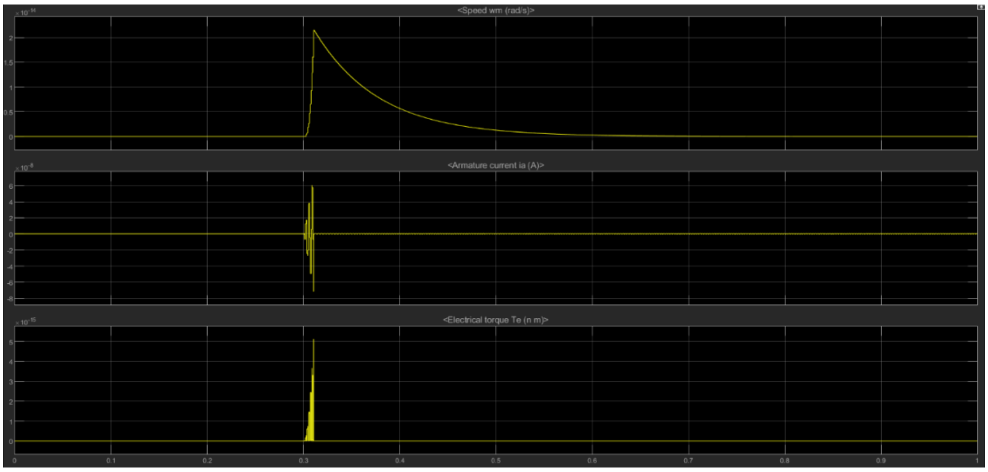
$$T_e = 1.5p(\varphi_{ds} i_{qs} - \varphi_{qs} i_{ds})$$

And in the mechanical system:

$$\frac{d}{dt}\omega_m = \frac{1}{2H}(T_e - F\omega_m - T_m)$$

$$\frac{d}{dt}\theta_m = \omega_m$$

Based on the above equations, we can see the following characteristic (Fig. 2.2)



2.3. A graph of the starting process of a DC motor.

We can determine the mechanical power in an asynchronous motor with the help of a model, based on which the main values can be seen in Figure 3.

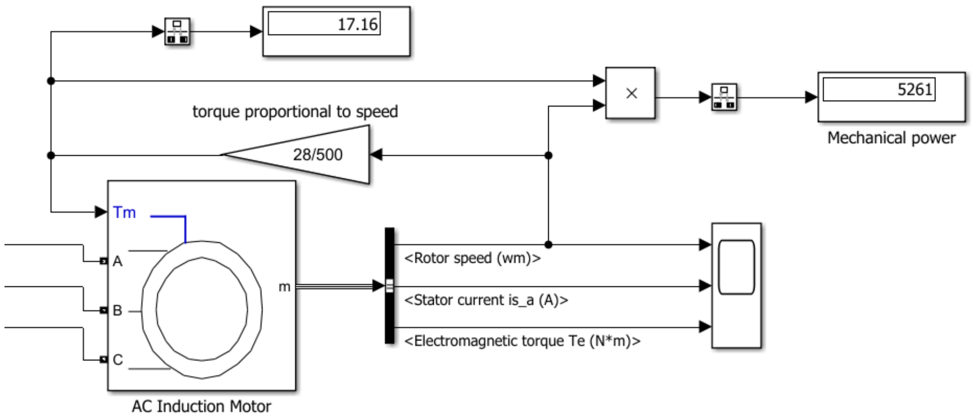


Figure 3. State of electricity consumption during operation of asynchronous motor.

Conclusions and suggestions. An optimal management process has been applied to the above model and includes the following:

- minimization of net consumption;
- minimization of operational costs;
- to maximize efficiency;
- maximum security;
- Quality according to the given standard.

Using high-efficiency asynchronous motors instead of standard electric drive motors clearly increases the initial cost of the electric drive system. However, these costs can be offset by reducing losses and reducing operating costs [6]. For example, a 6% increase in efficiency is obtained in a 10 kW engine. In addition, electrical management systems can affect the economic performance of the enterprise in the process of electricity consumption. As a solution to this, there will be an opportunity to compensate for the lost energy by improving the electrical control system [10].

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