ACADEMICIA

ISSN: 2249-7137 Vol. 11, Issue 10, October 2021 Impact Factor: SJIF 2021 = 7.492

ACADEMICIA
An International Multidisciplinary Research Journal
(Double Blind Refereed & Peer Reviewed Journal)

DOI: 10.5958/2249-7137.2021.02355.7

ANALYSIS OF THE BASIC PRINCIPLES OF ENERGY SAVING REGIMES IN ASYNCHRONOUS ELECTRIC POWERS

Rustamov Suhrob Shuhrat oglu*; Norboyev Abbos Askar oglu**

*Doktoral student of the Department of Electrical Mechanics and Technology,
Bukhara Institute of Engineering and Technology,
UZBEKISTAN

**Lecturer of the Department "Electrical mechanics and technologies ",
Bukhara Institute of engineering and technology,
UZBEKISTAN

ABSTRACT

The role of science and technology in achieving energy efficiency in all areas of production is invaluable. That is, the use of energy-saving technologies and processes in production must be the result of scientific research. In particular, the efficient use of electricity, first of all, the use of energy-saving motors in electric drives, load adjustment, adjustment of active and reactive power consumption depending on the load level, reducing power loss, optimal management and finding solutions to dozens of other pressing issues research and design activities.

KEYWORDS: *Efficiency, Current, Electricity, Electric Drive, Voltage, Power Coefficient.*

INTRODUCTION

In accordance with the Resolution of the President of the Republic of Uzbekistan PQ-3379 "On measures to ensure the rational use of energy resources" Consistent modernization and technological re-equipment of electricity and gas supply in the country, the basics of energy saving measures are being taken to improve the mechanisms of mutual settlements for energy and natural gas.

At the same time, the lack of a differentiated approach to determining the value of energy resources delivered to different categories of consumers leads to their irrational use and does not encourage the introduction of energy-saving technologies and alternative energy sources.

Current norms and regulations in the field of urban planning do not meet modern requirements for energy efficiency of facilities. Insufficient attention to the use of energy-saving materials and technologies in the construction and reconstruction of buildings and structures also leads to excessive consumption of energy resources.

It is known that about 60-70% of the electricity generated worldwide is consumed by electric drives of various mechanisms and equipment. Almost 50% of the world's electricity is generated by AC and DC electric drives. Therefore, it is important to ensure energy efficiency through automated electric drives and training competitively qualified personnel in this field. There are several basic ways to save energy with an automated electric drive:

- Correct selection of the motor power of the electric drive by improving the motor selection method depending on the real change in the load of the production mechanism, because if the motor power is less than the load capacity, the motor inefficiently changes energy and the power dissipated in the transmission line is greatly increased.

- Replacement of automated electric motors of production mechanisms with energy-saving electric motors with increased efficiency and power factor due to the increase in the active mass (copper and iron);

- The transition from non-adjustable electric drives to speed-adjustable electric drives will save resources (water, heat, etc.) not only in the automated electric drive system, but also in the production mechanism.

- Development and creation of special technical solutions that ensure minimum energy consumption in non-adjustable electric drives when the load is variable, as well as in controlled automated electric drives due to changes in the coordinates of the electric drive in accordance with the requirements of the technological process. The choice and implementation of one of the above ways to save energy depends on the specific conditions created by the technological mechanism, each of which has its own advantages and disadvantages. Given the energy crisis and rising energy prices, a way to save a significant portion of the energy required by improving power management is of particular importance. The most promising way is the fourth way, which will save 30-40% of energy by improving the automated control algorithm. Therefore, the main attention should be paid to the theoretical issues and computational methods of energy-saving automated electric drive due to the radical improvement of the control algorithm and the development of new automated electric drive systems that provide the least energy consumption due to the most convenient (optimal) control. It is known that the largest consumers of electricity in all countries are mainly AC electric drives, especially asynchronous motor drives, which convert almost half of the electricity produced worldwide into mechanical energy. Operation of the main part of these motors with low load or at values much smaller than the nominal leads to a significant reduction in the Efficiency and cosφ of the electric drive. This has a significant impact on the overuse of electricity and heat in the world. Therefore, the object of analysis is mainly an automated electric drive with an asynchronous motor. But it is also important to consider the optimal way to control DC electric drives.

We consider the analysis of the characteristics of an induction motor for a load characterized by a constant static moment $M_S = M_N = const$ at normal and optimal (energy-saving) currents, operating in frequency-adjustable electric drive systems. Based on the above method, the operating and tuning characteristics were calculated for a 4A series asynchronous motor with a power range of 0.6 -15 kW, operating on frequency-adjustable electric drives, and for k = 1

ISSN: 2249-7137 Vol. 11, Issue 10, October 2021 Impact Factor: SJIF 2021 = 7.492

harmonics. Given the almost uniformity of the results for different powers, below are the descriptions for a single brand of asynchronous motor (4A80B4Y3) built in relative units. The basic values are the rated currents of the stator and rotating, the magnetic current, slip, electromagnetic and total losses, the power factor and the efficiency, and the product of the coupling φ=1and m = 1.

In Figure 1, the frequency is nominal in a speed-adjustable electric drive system

The operating characteristics of the current function of an induction motor at

F = 1 are given. The stator current I_S is equal to the geometric sum of the magnetizing current I_0 and the applied current of the rotor φ; the applied current of the rotor is inversely proportional to the current and therefore decreases with increasing. Therefore, the connection of the I_S to the current has a nonlinear and curved appearance. Power dissipation: electromagnetic ΔP_{EM} and total $\sum \Delta P$; also, the power required by the network P_N will have a similar shape in the φ function. When the excitation power dissipation and the magnetic flux gain of the alternating power dissipation are equal, the power dissipation has an extreme value. It should be noted that the stator current does not change when the control frequency changes, while the extreme value of power dissipation changes relative to the value corresponding to the nominal frequency (shifted to the right or left when the frequency decreases or increases).

As the magnetic flux increases, the speed of the induction motor increases slightly, resulting in a decrease in slip s, while the useful power increases. Therefore, the minimum value of power required from the network is the smallest value of the magnetic flux relative to the minimum value of electromagnetic energy dissipation. Characteristics of electromagnetic indicators: Efficiency η power coefficient cos φ and their multiply η cos φ. Reach a maximum at a certain value of current. When the values of variable power dissipation and excitation power dissipation are equal, the efficiency reaches its maximum value. The power coefficient increases and reaches its maximum value at small values of current, and as the current increases, the active component of the stator current decreases and the magnetizing current increases significantly.

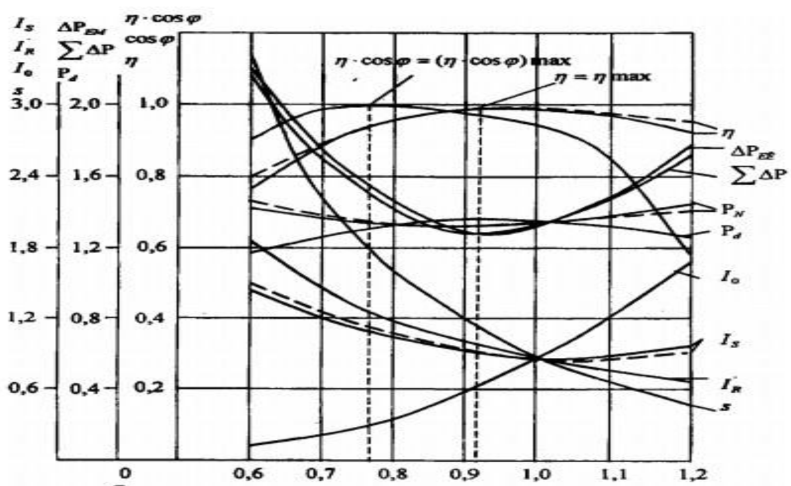

Figure 1. Characteristics of the magnetic flux of electrical and energy parameters of a 4A asynchronous motor in a frequency-adjustable electric drive with a frequency value of F = 1.

The typical curve of the load dependence of the induction motor efficiency is shown in the figure. Figure 2 shows that an overestimation of the installed power of the motor leads to a decrease in its efficiency, i.e. inefficient power consumption. The efficiency of a converter based on powerful semiconductor devices is much higher. Transformer losses are mainly determined by the voltage drop across the semiconductor device. We can assume that the average U = 2 V is U = 4.0 V for bridge circuits.

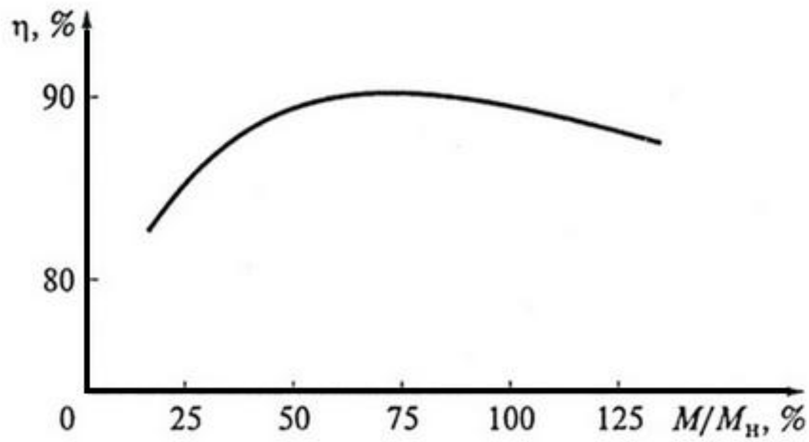

Figure 2. Dependence of asynchronous motor on efficiency load

REFERENCES

1. O.O. Hoshimov, A.T. Imomnazarov. Elektrmexanik tizimlarda energiya tejamkorligi. Darslik. -T .: «Fan vatexnologiya», 2015. -128 b.

2. Anuchin, A.S. Electric drive control systems / A.S. Anuchin. - Vologda: Infra-Engineering, 2015 .-- 373 p.

3. Denisov, V.A. AC drives with frequency control: Textbook / V.A. Denisov. - Art. Oskol: TNT, 2013 .-- 164 p.

4. Yani, A.V. Adjustable asynchronous electric drive: Textbook / A.V. Jani. - SPb .: Lan, 2016 .-- 464 p.

5. Austin Hughes, Electric Motors and Drives, Fundamentals, Types and Applications. Oxford, UK 2006