SPEED CHECK OF ASYNCHRONOUS MACHINES BY CHANGING THE FREQUENCY

Karimov Nematulla Ubaydulla ugli
Fergana Polytechnic Institute, assistant
E-mail: nematullokarimov@gmail.com

ABSTRACT

Adjusting the speed of an asynchronous motor using a thyristor frequency converter. And with the help of Matlab simulnik, we will build its mathematical model and see its characteristics.

Keywords: Thyristor, frequency converter, asynchronous motor, speed adjustment, mathematical model.

Currently, the most characteristic features of the new generation of electric drives are the presence of a number of additional “intellectual” operating modes that significantly expand the functional capabilities of the drive. These include:

- self-testing, in which the electrical system itself checks the operability of all its elements, identifies, limits and diagnoses possible failures.

- automatic adjustment of the control system to the indicators of the high-current channel of the electrical system.

-high energy saving system;

- “self-holding” system at an unknown rotational speed, automatic restart system, etc.

In the automatic adjustment mode, the motor nominal voltage Unom, nominal stator current Inom, nominal frequency fnom, nominal slip Snom, nominal power coefficient cosphnom, active resistance of the stator circuit in the automatic operation system based on the information about the number of pole pairs initially entered from the electric drive control panel , determines the magnetizing inductance Lm, the active resistance of the rotor R and calculates all the parameters of the control system. Determination of the active resistance of the stator circuit is carried out in the "non-moving" vector mode, which corresponds to the formation of a constant equivalent voltage in the stator windings.

Operations are performed in the following sequence:

1) The constant voltage value corresponding to the rated current of the motor, the step-by-step assignment of the output voltage, and the current amplitude control mode is determined at each step;

2) Serial measurements of the stator current are carried out at the set value of the constant voltage;

3) The active resistance of the stator circuit is calculated according to the following expression:

Electric drive characteristics become very sensitive to orientation accuracy at low rotational speeds (i.e., where the rotational speed is nearly equal to the nominal slip). Therefore, the mathematical model of the asynchronous motor (AD), which forms the basis of the construction of the control system, should first of all be focused on the accuracy of calculations in the field of low frequencies. This makes it possible to significantly simplify the model without significant losses for the description of electrical behavior, therefore, the amount of calculation work is also reduced. Among the indicators of the AD switching scheme in the field of small frequencies, the following relationships are relevant.

$$\omega L_{\sigma s}, \omega L_{\sigma r} << R_s , R_{r,} \omega L_m$$

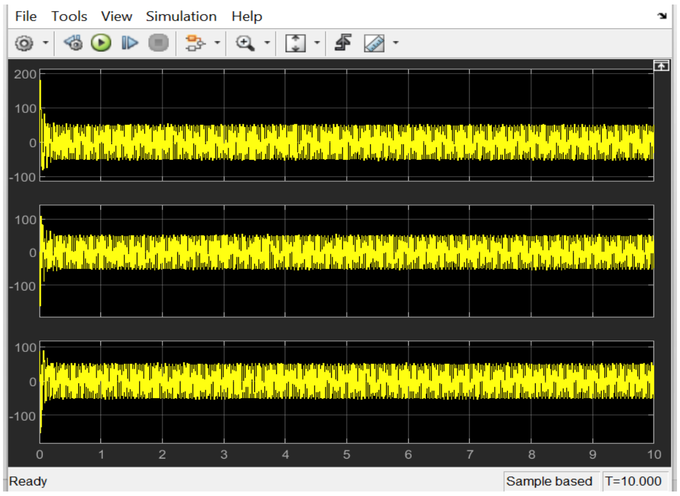
This allows not to take into account the leakage inductances of the stator and rotor, which are present in the traditional mathematical models of AD, in particular, to switch from the traditional T-shaped switching scheme of the motor-wire phase to a simplified T-shaped switching scheme. The use of a simplified model for calculating the variable values of electrical conductivity at medium and high rotational speeds leads to the occurrence of differences between the given and real values of the rotational speed. However, in the operating modes of the electric drive, this difference does not exceed 2...3% of the rotational speed value, which is completely acceptable for the considered group of drives.

The input and signal pre-processing unit includes an operation mode re-connector, an input signal filter, and an acceleration assigner. In the middle position of the mode re-connector, the output of the BVPO is fed from the analog input to the electrical driving speed command signal, in the upper position - from the output of the technological adjuster, in the lower position and in the case of - the digital assignment of speed comes. The technological adjuster is made in the form of a proportional-integral-differentiating link, it is additionally provided with limiting elements and a "non-sensitive zone".

The monitor calculates all the necessary variable values for the implementation of the electric drive control algorithm according to the following system of equations:

$$U_s = \frac{U_d}{U_d^{\delta}} U_s$$

Thyristor (from Greek: thyra - gate, input and resistor) is a semiconductor device based on silicon monocrystal that has the properties of an electric valve. A semiconductor element is made of a single crystal disk (plate) of silicon (with some boron, aluminum and phosphorus added). The principle of operation is based on the property of electron-hole transition (transition from electron p conductivity to hole r conductivity) of silicon single crystal. This property provides valved conductivity of the device. There are triode (trinistor; three external outputs — cathode, anode, control electrode) and diode (dynistor, no control electrode) types of thyristor. According to the function, it is divided into one-way and two-way conductive, high-frequency, pulsed, double-operation and special types. There are photoresistors, thyristors based on gallium arsenide.



REFERENCES:

1. Jaloliddinova Nozima Doniyorjon Qizi, Sultonov Ro‘Zmatjon Anvarjon O‘G‘Li Renewable sources of energy: advantages and disadvantages // Достижения науки и образования. 2019. №8-3 (49). URL: https://cyberleninka.ru/article/n/renewable-sources-of-energy-advantages-and-disadvantages (дата обращения: 01.12.2023).
2. Султонов Рузиматжон Анваржон Угли, Кодиров Хусанхон Мунавжархон Угли, Мирзалиев Бобурбек Бахтиёрович Выбор механических двигателей электрического тока, используемых в системе электропривода // Проблемы Науки. 2019. №11-2 (144). URL: https://cyberleninka.ru/article/n/vybor-mehanicheskih-dvigateley-elektricheskogo-toka-ispolzuemyh-v-sisteme-elektroprivoda (дата обращения: 01.12.2023).
3. Султанов Рузимаджон Анваржон Угли Рекомендации по выработке электроэнергии и компенсации потерянной энергии с помощью системы охлаждения электродвигателей // Вестник науки и образования. 2019. №19-3 (73). URL: https://cyberleninka.ru/article/n/rekomendatsii-po-vyrabotke-elektroenergii-i-kompensatsii-poteryannoy-energii-s-pomoschyu-sistemy-ohlazhdeniya-elektrodvigateley (дата обращения: 01.12.2023).

4. Usmonov Shukurillo Yulbarsovich, Sultunov Ruzimatjohn Anvarjohn O‘G‘Li, Kuchkarova Dilnoza Toptievna Research potential of energy saving pump unit and hydraulic network // Проблемы Науки. 2019. №12-1 (145). URL: https://cyberleninka.ru/article/n/research-potential-of-energy-saving-pump-unit-and-hydraulic-network (дата обращения: 01.12.2023).
5. Usmonov S. Y. Analysis of Working Modes of Well Pumping Equipment Eectr //Central Asian Journal of Theoretical and Applied Science. – 2022. – Т. 3. – №. 11. – С. 119-125.
6. Yulbarsovich U. S., Nurillaevich M. N. FREQUENCY CONTROL OF POWER EQUIPMENT DURING SECONDARY STEAM GENERATION IN THE PRODUCTION UNIT //PRINCIPAL ISSUES OF SCIENTIFIC RESEARCH AND MODERN EDUCATION. – 2022. – Т. 1. – №. 6.
7. Yulbarsovich U. S. et al. MEASUREMENT AND CONTROL OF THE LOAD OF ENERGY DEVICES //Galaxy International Interdisciplinary Research Journal. – 2023. – Т. 11. – №. 4. – С. 663-666.
8. Yu U. S., Sultonov R. A. NONLINEAR FEEDBACK CONTROL IN INTELLIGENT AC MOTOR CONTROL //Advancing in research, practice and education. – 2022. – Т. 9. – С. 188.
9. Усмонов Ш. Ю., Султонов Р. А. У., Кучкарова Д. Т. СИНТЕЗ АЛГОРИТМОВ ИНТЕЛЛЕКТУАЛЬНОЙ СИСТЕМЫ УПРАВЛЕНИЯ МНОГОСВЯЗНЫМИ ЭЛЕКТРОПРИВОДАМИ //Universum: технические науки. – 2022. – №. 1-3 (94). – С. 50-53.
10. Усмонов Ш. Ю., Кучкарова Д. Т., Султонов Р. А. Автоматические системы управления машин и агрегатов шелкомотания на основе энергосберегающего электропривода //Universum: технические науки. – 2021. – №. 12-6 (93). – С. 37-41.
11. Sultonov R. A., Shermatov B. A. IMPROVING PRODUCT QUALITY BY REDUCING THE ENERGY CONSUMPTION OF ELECTRIC DRIVES IN THE SILK INDUSTRY //Экономика и социум. – 2021. – №. 11-1 (90). – С. 538-544.
12. Mukaramovich A. N., Yulbarsovich U. S. CALCULATION OF THE SPEED CONTROL RANGE OF AN INTELLIGENT ASYNCHRONOUS ELECTRIC DRIVE DURING REWINDING RAW SILK //ЭЛЕКТРИКА. – 2011. – №. 4. – С. 26-28.
13. Арипов Н. М., Усмонов Ш. Ю. Разработка энергосберегающего частотно-регулируемого асинхронного электропривода с вентиляторной нагрузкой //Электрика. – 2011. – №. 4. – С. 26-28.