EUROPEAN JOURNAL OF LIFE SAFETY AND STABILITY (EJLSS)
ISSN 2660-9630
www.ejlss.indexedresearch.org Volume 12, 2021 ||

Mathematical Analysis of Electric Power Replacement Schemes of Weaving Machines

Islom Khafizov
Candidate of Physical and Mathematical Sciences, Associate Professor, Bukhara Engineering-Technological Institute, Bukhara, Uzbekistan

Komil Gafforov
Assistant, independent researcher, Bukhara Engineering-Technological Institute, Bukhara, Uzbekistan

Bahodir Yormamatov
Master.Bukhara Engineering-Technological Institute, Bukhara, Uzbekistan

Abstract: At present, a lot of attention is paid to the processing of raw cotton and its delivery to consumers in the form of fabrics or ready-made clothes. Over the years, a series of modern and improved workbenches have been developed. This article aims to increase the energy efficiency of the Optimax-i-4-R loom by mathematically analyzing the replacement shops of asynchronous machines used in looms.

Keywords: *current, frequency, power, asynchronous motor*

Date of Submission: 07-11-2021 ***Date of Acceptance: 10-12-2021***

A formula that is simpler than formula (1.2) can be used to calculate the torque of an engine and then construct its mechanical characteristics. To do this, switch from the T-shaped switching circuit to the G-shaped switching circuit (Figure 1.1). Certain restrictions are allowed when switching to a G-shaped switching circuit with a magnetizing circuit at the input of the circuit. These limitations are mainly due to the fact that the magnetizing current I_m and the current coupling Ψ_m are not connected to the motor load, because the magnetizing circuit is directly connected to the supply voltage U_1.As a result, the voltage drop across the resistor $R_1 + j\bar{\omega}_0 x_{1\sigma}$of the magnetizing current is not taken into account. However, such a schematic representation makes it possible to obtain a simpler expression from the characteristic points of the mechanical characteristic to determine the moment and velocity.

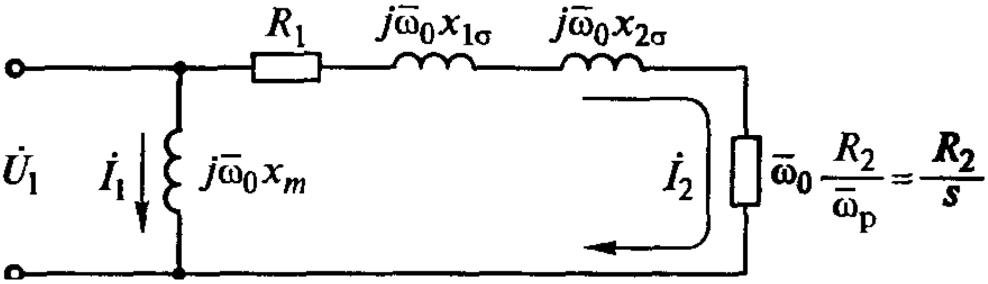

Figure 1.1. G-shaped switching circuit of an induction motor.

As can be seen from Figure 1.1, the rotor current is determined by the following expression:

$$I_2 = \frac{U_1}{\sqrt{\left(R_1 + R_2\bar{\omega}_0/\bar{\omega}_p\right)^2 + \bar{\omega}_0{}^2 x_k^2}}; \qquad (1.1)$$

where $x_k$is the inductance of the motor short-circuit resistance, $x_k = x_{1\sigma} + x_{2\sigma}$.

The electromagnetic power of a three-phase motor is defined by the expression $R_{em} = 3I_2^2\, R_2\bar{\omega}_0/\bar{\omega}_p$as the triple power dissipated in the resistor $R_2\bar{\omega}_0/\bar{\omega}_r$. Putting the value of the rotor current from formula (1.1), and taking into account the relationship between electromagnetic force and electromagnetic torque $M_d = R_{em}r_p/(\bar{\omega}_0\omega_{el.n})$, the expression for the electromagnetic moment is given by apparently:

$$M_d = 3\frac{r_p U_1^2}{\omega_{0el.n}} \frac{R_2}{\bar{\omega}_r\left[\left(R_1 + R_2\bar{\omega}_0/\bar{\omega}_p\right)^2 + \bar{\omega}_{0_0}^{\ 2} x_k^2\right]}. \qquad (1.2)$$

The value of the starting torque is determined as follows, taking into account that the frequency of the rotor EYUK in the stationary rotor is equal to the frequency of the voltage in the stator $\bar{\omega}_p$:

$$M_{ish.t} = 3\frac{r_p U_1^2}{\omega_{0el.n}} \frac{R_2}{\bar{\omega}_0\left[(R_1 + R_2)^2 + \bar{\omega}_{0_0}^{\ 2} x_k^2\right]}. \qquad (1.3)$$

The critical value of the relative frequency of the rotor EDP is found by searching for extremums:

$$\bar{\omega}_{r.kr} = \pm\frac{R_2\bar{\omega}_0}{\sqrt{R_1^2 + \bar{\omega}_0^2 x_k^2}}. \qquad (1.4)$$

It is possible to determine the value of the critical moment by pouring this value in the expression written for the moment:

$$M_{kr} = \frac{3}{2}\frac{r_p U_1^2}{\bar{\omega}_0\omega_{0el.n}} \frac{1}{R_1 \pm \sqrt{R_1^2 + \bar{\omega}_0^2 x_k^2}}, \qquad (1.5)$$

where “add” corresponds to engine mode and “deduction” corresponds to brake mode.

Although there are limitations to the simplification of the substitution scheme, formulas (1.2) ... (1.5) are widely used in practical calculations due to their convenience.

We can write the expression for the moment in a different way, in which the rotor slides instead of the EDP frequency. These quantities are related by the following expression:

$$s = \left(\omega_{0el} - r_p\omega\right)/\omega_{0el} = \omega_p/\omega_{0el} = \bar{\omega}_p/\bar{\omega}_0.$$

Therefore, instead of the multiplier$r_p/(\omega_{0el.n}\,\bar{\omega}_r)$ in formula (1.2) we should write:

$$r_p/(\omega_{0el.n}\,\bar{\omega}_r s) = 1(s\omega_0),$$

where $\omega_0 -$ is the synchronous speed of the motor at a given frequency $\omega_{0el}, \omega_0 = \omega_{0el}/r_p$ of the supply voltage.

$\bar{\omega}_0^2 x_k^2$can be expressed as follows:

$$\bar{\omega}_0^2 x_k^2 = \left(\frac{\omega_{0el}}{\omega_{0el.n}}\right)^2 \omega_{0el.n}^2 (L_{1\sigma} + L_{2\sigma})^2 = \omega_{0el}^2 (L_{1\sigma} + L_{2\sigma})^2.$$

Typically, the value $\omega_{0el}(L_{1\sigma}+L_{2\sigma})$ is denoted by x_k, which means the short-circuit inductive resistance calculated at the frequency at which the motor is running, not at the rated frequency. Then the expression for the electromagnetic moment can be written as follows:

$$M_d = \frac{3U_1^2 R_2}{s\omega_0[(R_1+R_2/s)^2+x_k^2]}. \qquad (1.6)$$

In this case, as analyzed in formula (1.2), the starting torque, critical slip s_{kr} and critical torque can be determined.

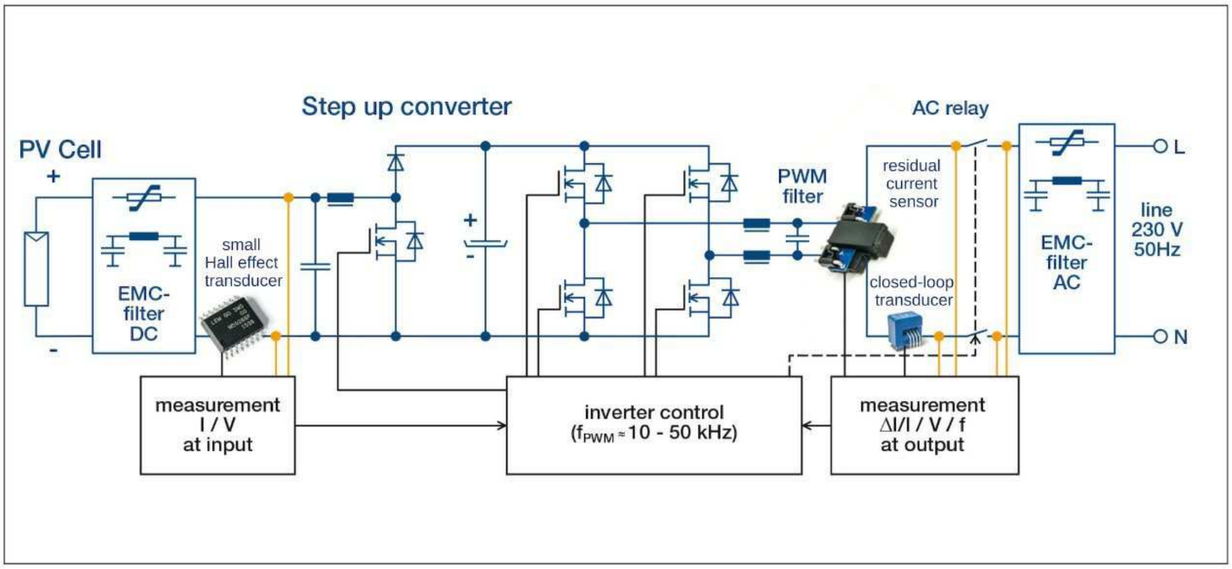

Figure 1.2. Frequency converter principle diagram.

When calculating the frequency-adjustable electric drive, it is necessary to recalculate the value of the inductive resistance applied to the catalogs, taking into account the frequency at which the motor is running, using the formula (1.6).

Sometimes the expression for an electromagnetic moment can be described in a different way by including the critical moment and the critical slip:

$$M_d = 2M_k\frac{1+s_k R_1/R_2}{\frac{s}{s_k}+\frac{s_k}{s}+2s_k\frac{R_1}{R_2}}.$$

This formula is called the Kloss formula.

References:

1. IslomKhafizov, Komil Gafforov,Muxammedov Sh., Jurakulov A Energy saving when using a variable frequency drive in pump installations, Journal of Critical Reviews, ISSN- 2394-5125 Vol 7, Issue 12, 2020, P.99-102, http://dx.doi.org/10.31838/jcr.07.12.16
2. Khafizov I.I., Komil Gafforov, Bakhodir Oblokulov, Aziz Azimov Elimination of energy losses in pumping installations by means variable frequency drive, International Engineering Journal For Research & Development, Vol.5, Issue 3, April 2020, E-ISSN NO:-2349-0721, Impact factor : 6.03.P.83-89, http://iejrd.com/index.php/%20/article/view/17/5
3. Khafizov I.I.,Khaitov B.B. The investigation of ions implantation processes into a single-crystal GaAs(001) in order to increase the efficiency of the solar cells, MODERN SCIENCE

International scientific journal №02, 2017, Founder and publisher: "Strategic Studies Institute" LLC., Moscow, 2017, P.43-46

4. Khafizov I.I., GafforovK.K. Application and prospects of variable frequency means in electric drives of pumping units, Международныйнаучно-практическийэлектронныйжурнал «МОЯПРОФЕССИОНАЛЬНАЯКАРЬЕРА» (ISSN 2658-7998, договорсElibrary №284-07/2019), 15.11.2020
5. Khafizov I.I., Xafizov X.I. Modeling the introduction of ions into single-crystal gaas (001) to create p-n junctions in order to increase the efficiency of solar cells, МОЛОДЕЖНЫЙИССЛЕДОВАТЕЛЬСКИЙПОТЕНЦИАЛ, Сборникстатей II Международногонаучно-исследовательскогоконкурса, состоявшегося 11 января 2021 г. вг. Петрозаводске, ст.105-111
6. Juraev M.Q, Muzaffarov F.F, RustamovS.Sh "Transparent Surface Lens Of Low-Temperature Solar Devices" The American Journal of Applied Sciences, 2 (10), 145-149. https://usajournalshub.com/index.php/tajas/article/view/1297
7. B.Shaymatov, D.A.Rakhmatov, A.F.Muxtorov, M.U.Rakhmatova "Probe of process of multiple - loop chains of parallel and consecutive joints". Rudenko International Conference on Methodological Problems in Reliability Study of Large Energy Systems, (RSES 2020). Scopus https://www.e3sconferences.org/articles/e3sconf/abs/2020/76/e3sconf_rses2020_01142/e3sconf_rses2020_01142.html
8. K.K.Gafforov, M.U.Rakhmatova, Sh.N.Sharipov "Three-phase corrective analysis of automatic control of pumping systems", Kazan 2020, Priority directions of innovative activity in the industry (international conference)
9. https://journals.researchparks.org/index.php/IJIE/article/view/1607
10. https://wos.academiascience.org/index.php/wos/article/view/52
11. https://reserchjet.academiascience.org/index.php/rjai/article/view/100
12. https://it.academiascience.org/index.php/it/article/view/49