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ANALYSIS OF THE CIRCUITS OF THE ELECTROMAGNETIC PRIMARY CURRENT AND VOLTAGE OF THE CONTROL AND CONTROL SYSTEMS

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ABSTRACT

Conversion circuits and designs of electromagnetic current and voltage converters of monitoring and control systems for quantities and parameters of power supply as new physical and technical effects are used, sets the task of their systematization and selection of parameters of their elements and design. The paper presents the materials for the study of circuits and the design of the transformation of the primary electromagnetic converter of electric current and voltage in power supply systems.

KEYWORDS: *Physical And Technical Effect, Control, Circuit, Control, Current, Voltage, Parameter, Power Supply, Converter, Magnetic Circuit.*

INTRODUCTION

The values and parameters in the designs of the primary electromagnetic current and voltage converter of electrical energy of power supply systems are distributed in the transformation space, which, depending on the purpose and purpose, have a complex geometric configuration. Given the distribution, heterogeneity, nonlinearity, etc. values, parameters, nature of the environment and space of transformation of electromagnetic converters of primary electric current and voltage of the power supply system, one can imagine that their study and calculation in full is a difficult task even with the widespread use of modern computing systems.

Designs of elements and conversion circuits of primary electromagnetic current and voltage converters, the number of which is continuously increasing as various physical and technical effects are used in them, the problem of their systematization and the choice of rational values and conversion parameters and a design that meets the requirements of modern control and management of quantities and parameters is determined power supply systems.

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In the presented graph model, the conversion areas of the primary electromagnetic current and voltage converter are the conversion factors for each phase output voltage $W_a(x,y,z,t); W_b(x,y,z,t)$ and $W_c(x,y,z,t)$ is determined based on the following analytical expressions:

$$\frac{F_{\mu 11}-F_{\mu 12}}{\Pi_{\mu 11}}+\frac{F_{\mu 11}-F_{\mu 12}}{\Pi 1_{\mu 11}}=K_{IF_A}\dot{I}_A$$

$$\frac{F_{\mu 12}-F_{\mu 11}}{\Pi_{\mu 11}}+\frac{F_{\mu 12}-F_{\mu 22}}{\Pi 1_{\mu 12}}=-K_{FU_a}\dot{U}_a$$

$$\frac{F_{\mu 21}-F_{\mu 11}}{\Pi 1_{\mu 11}}+\frac{F_{\mu 21}-F_{\mu 22}}{\Pi_{\mu 21}}=K_{IF_B}\dot{I}_B$$

$$\frac{F_{\mu 22}-F_{\mu 21}}{\Pi_{\mu 21}}+\frac{F_{\mu 22}-F_{\mu 32}}{\Pi 1_{\mu 22}}=-K_{FU_b}\dot{U}_b$$

$$\frac{F_{\mu 31}-F_{\mu 21}}{\Pi 1_{\mu 21}}+\frac{F_{\mu 31}-F_{\mu 32}}{\Pi_{\mu 31}}=K_{IF_C}\dot{I}_C$$

$$\frac{F_{\mu 32}-F_{\mu 31}}{\Pi_{\mu 31}}+\frac{F_{\mu 32}-F_{\mu 22}}{\Pi 1_{\mu 22}}=-K_{FU_c}\dot{U}_c$$

in the form of a system of equations

$$\left(\frac{1}{\Pi_{\mu 11}}+\frac{1}{\Pi 1_{\mu 11}}\right)F_{\mu 11}-\frac{1}{\Pi_{\mu 11}}F_{\mu 12}-\frac{1}{\Pi 1_{\mu 11}}F_{\mu 21}=K_{IF_A}\cdot\dot{I}_A$$

$$-\frac{1}{\Pi_{\mu 11}}F_{\mu 11}+\left(\frac{1}{\Pi_{\mu 11}}+\frac{1}{\Pi 1_{\mu 12}}\right)F_{\mu 12}-\frac{1}{\Pi 1_{\mu 12}}F_{\mu 22}=-K_{FU_a}\dot{U}_a$$

$$-\frac{1}{\Pi 1_{\mu 11}}F_{\mu 11}+\left(\frac{1}{\Pi 1_{\mu 11}}+\frac{1}{\Pi_{\mu 21}}\right)F_{\mu 21}-\frac{1}{\Pi_{\mu 21}}F_{\mu 22}=K_{IF_B}\cdot\dot{I}_B$$

$$-\frac{1}{\Pi_{\mu 21}}F_{\mu 21}+\left(\frac{1}{\Pi_{\mu 21}}+\frac{1}{\Pi 1_{\mu 22}}\right)F_{\mu 22}-\frac{1}{\Pi 1_{\mu 22}}F_{\mu 32}=-K_{FU_b}\dot{U}_b$$

$$-\frac{1}{\Pi 1_{\mu 21}}F_{\mu 21}+\left(\frac{1}{\Pi 1_{\mu 21}}+\frac{1}{\Pi_{\mu 31}}\right)F_{\mu 31}-\frac{1}{\Pi_{\mu 31}}F_{\mu 32}=K_{IF_C}\cdot\dot{I}_C$$

$$-\frac{1}{\Pi_{\mu 31}}F_{\mu 31}+\left(\frac{1}{\Pi_{\mu 31}}+\frac{1}{\Pi 1_{\mu 22}}\right)F_{\mu 32}-\frac{1}{\Pi_{\mu 22}}F_{\mu 22}=-K_{FU_c}\dot{U}_c$$

Where:

$$A_{11}=\frac{1}{П_{\mu 11}}+\frac{1}{П1_{\mu 11}};\ A_{12}=-\frac{1}{П_{\mu 11}};\ A_{13}=-\frac{1}{П1_{\mu 11}};\ A_{14}=A_{15}=A_{16}=0;$$

$$A_{21}=-\frac{1}{П_{\mu 11}};\ A_{22}=\frac{1}{П_{\mu 11}}+\frac{1}{П1_{\mu 12}};\ A_{23}=0;\ A_{24}=-\frac{1}{П1_{\mu 12}};\ A_{25}=A_{26}=0;$$

$$A_{31}=-\frac{1}{П1_{\mu 11}};\ A_{32}=0;\ A_{34}=-\frac{1}{П1_{\mu 21}};\ A_{35}=A_{36}=0;$$

$$A_{41}=A_{42}=0;\ A_{43}=-\frac{1}{П_{\mu 21}};\ A_{44}=\frac{1}{П_{\mu 21}}+\frac{1}{П1_{\mu 22}};\ A_{45}=0;\ A_{46}=-\frac{1}{П1_{\mu 22}};$$

$$A_{51}=A_{52}=0;\ A_{53}=-\frac{1}{П1_{\mu 21}};\ A_{54}=0;\ A_{55}=\frac{1}{П_{\mu 31}}+\frac{1}{П1_{\mu 21}};$$

$$A_{61}=A_{62}=A_{63}=0;\ A_{64}=-\frac{1}{П_{\mu 22}};\ A_{65}=-\frac{1}{П_{\mu 32}};\ A_{66}=\frac{1}{П_{\mu 32}}+\frac{1}{П1_{\mu 22}};$$

$$П_{\mu 11}\div П_{\mu 31}=П1_{\mu 11}\div П1_{\mu 33}=\frac{l_{\mu i}}{\mu_i S_i}$$

l_μ - path length$i$ – current sections of magnetic flux, $м$;

μ_i or μ_{0i} - magnetic permeability$i$ – current plots;

S - section plots$м^2$, i – current sections of the conversion circuit.

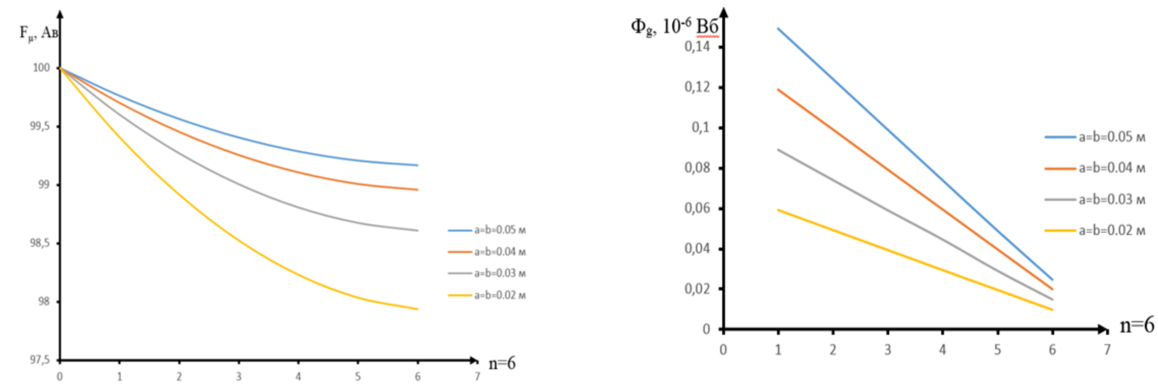
The limits are defined as follows:

$B_1=K_{IF_A}\cdot \dot{I}_A;\ B_2=-K_{FU_a}\cdot \dot{U}_a,\ \ B_3=K_{IF_B}\cdot \dot{I}_B;\ B_4=-K_{FU_b}\cdot \dot{U}_b;\ B_5=K_{IF_C}\cdot \dot{I}_C;$
$B_4=-K_{FU_c}\cdot \dot{U}_c.$

orinmatrixform

$$\begin{bmatrix} A_{11} & A_{12} & A_{13} & A_{14} & A_{15} & A_{16} \\ A_{21} & A_{22} & A_{23} & A_{24} & A_{25} & A_{26} \\ A_{31} & A_{32} & A_{33} & A_{34} & A_{35} & A_{36} \\ A_{41} & A_{42} & A_{43} & A_{44} & A_{45} & A_{46} \\ A_{51} & A_{52} & A_{53} & A_{54} & A_{55} & A_{56} \\ A_{61} & A_{62} & A_{63} & A_{64} & A_{65} & A_{66} \end{bmatrix}\begin{bmatrix} F_{\mu 11} \\ F_{\mu 12} \\ F_{\mu 21} \\ F_{\mu 22} \\ F_{\mu 31} \\ F_{\mu 32} \end{bmatrix}=\begin{bmatrix} B_1 \\ B_2 \\ B_3 \\ B_4 \\ B_5 \\ B_6 \end{bmatrix}.$$

Результаты исследования участков электромагнитного преобразования преобразователя первичного тока представлены на рис.2. а и б).



a)b)

Fig. 2. Results of the study of areas of magnetic transformation:

a – change in ppm on the number of subdivisions – n,

b – change in magnetic flux from the number of sections of the partition – n.

The graph model of the study of the magnitudes of the electromagnetic conversion of the primary current and voltage transducer for monitoring and controlling the values of the power supply system, makes it possible to analyze the rationality of the choice of both the geometric dimensions of the conversion sections (Figure 2, dimensions a = b = 0.01-0.04) and the quantity sections of division n - allowing to increase the accuracy of the calculation and study of the sections for converting the primary current of electrical energy of power supply systems, is distinguished by clarity and high formalization in the formation of dependencies, which represent the main characteristics in general form. The unified value of the output signal in the form of an electric voltage depends on the rationalized forms and parameters of the sections of the magnetic circuit (the air gap where the sensitive element is installed - a flat measuring winding), which ensure the perpendicularity and uniformity of the intersection of the area of the sensitive element by the magnetic flux created by the primary currents of the electric network of the power supply system.

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