MODELING OF ASYNCHRONOUS MOTOR REACTIVE POWER CONSUMPTION ON THE BASIS OF CURRENT TRANSDUSERS

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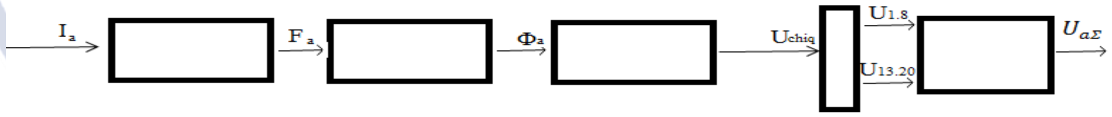
The study of the physical and technical effects that form the basis of the structure of the inverter is required in the modeling of the elements and interconnections of the controlled output voltage converters of symmetrical quantities of reactive power of an induction motor [68,74]. The process of converting the value of primary three-phase currents into voltages and the algorithm for constructing a model of the converter structure include the principles of signal conversion of different types of physical nature, the relationship between the sizes and parameters of the converter structure and elements takes This algorithm is suitable for the process of controlling and controlling the reactive power of an induction motor [1].

When modeling the physical and technical effects of three-phase current magnetization parameters of an induction motor, the parametric structure scheme, which takes into account the physical and technical effects (FTE) used in the structure of the converter, changes the electrical magnitude and parameters, their a graph model of the interconnected structure is developed [2].

The structure of the primary current converter of an induction motor and a model based on FTEs are shown in pic-1.



Pic-1. A generalized model of an asynchronous motor based on the physical and technical effects of asymmetrical magnitude of reactive power applied to a controlled output voltage converter.

Uout. - output voltage generator; $U_{1.8}$ – is the component of the controlled output voltage in one ring, $U_{13.20\ 8}$ – is the component of the controlled output voltage in the second loop, , $U_{a\Sigma}$ - is the component of the total controlled output voltage in the common measuring ring.

In the process of supplying of electricity to an asynchronous motor from the mains, taking into account various external and internal parameters, writed as a graph model of the change in the output voltage, controlled by symmetrical quantities of reactive power consumed [3].

$$U_{a\Sigma} = U_a = U_{1,8} = \left(4{,}44 \cdot f \cdot W_{c1} \cdot \frac{I_A}{R_\mu}\right) W_{11}$$

where: I_A – is the primary current of phase A of the mains consumed by the induction motor; f - current frequency; w_2, w_1 – number of stator windings and sensing element windings;

$P_\mu = R_\mu - \frac{\rho L}{F}$ - resistance of the signal change part (magnetic); ρ- is the specific resistance of the magnetic core material;

The asynchronous motor stator winding is calculated for phase A. The following is a summary parametric model of a single-element current converter with an output voltage controlled by symmetrical magnitudes of reactive power of an asynchronous motor (pic.2).

Pic-2. An asynchronous motor is a composite parametric model of a single-sensitive element converter of controlled voltage of symmetrical quantities of reactive power.

The following is a distributed parametric model of a two-element element converter sensitive to the output voltage controlled by symmetrical quantities of reactive power of an induction motor.

From this,

$$I_A = P_{EA} \cdot U_A = \frac{U_A}{R_A}$$

$$F_{\mu A} = K_{IF} \cdot I_A = K_{IF} \cdot P_{EA} \cdot U_A = K_{IF} \cdot \frac{1}{R_A} \cdot U_A$$

$$F_{\mu A} = P_{\mu A} \cdot F_{\mu A} = P_{\mu A} \cdot K_{IF} \cdot I_A = P_{\mu A} \cdot K_{IF} \cdot P_{EA} \cdot U_A$$

$$U_a = K_{FU} \cdot F_{\mu A} = K_{FU} \cdot P_{\mu A} \cdot K_{IF} \cdot P_{EA} \cdot U_A$$

$$U_a = 4{,}44 \cdot f \cdot W_c \cdot \frac{I_A \cdot W_{cE}}{R_{\mu A}}$$

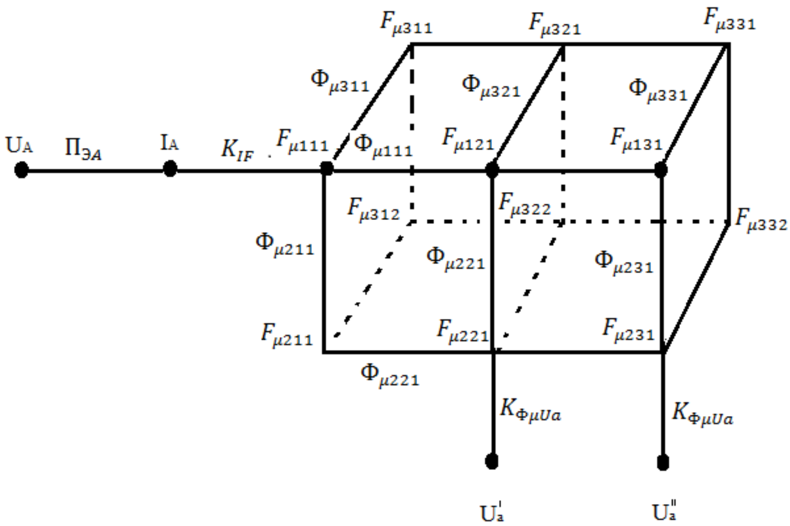
Three-phase stator currents in the stator core of an induction motor generate magneto-moving forces F_μ [5].

The controlled output voltage at the output of the two sensitive element converters is formulated as follows:

$$\frac{F_{\mu 111} - F_{\mu 121}}{R_{\mu 111}} + \frac{F_{\mu 111} - F_{\mu 211}}{R_{\mu 211}} + \frac{F_{\mu 111} - F_{\mu 311}}{R_{\mu 311}} = K_{IF} \cdot I_A$$

or

$$\left(\frac{1}{R_{\mu111}}+\frac{1}{R_{\mu211}}+\frac{1}{R_{\mu311}}\right)\cdot F_{\mu111}-\frac{1}{R_{\mu111}}F_{\mu121}-\frac{1}{R_{\mu211}}F_{\mu211}-\frac{1}{R_{\mu311}}F_{\mu311}= = K_{IF}\cdot I_A$$



Pic-3. The reactive power of an asynchronous motor is a distributed parametric model of a controlled output voltage of symmetrical quantities with two sensitive element converters.

The voltage across the first ring of the controlled output voltage, which is the symmetrical magnitude of the reactive power of an induction motor, that is, from a single sensing element, is expressed as follows.

$$U'_a = K_{F\mu UA}\cdot W'(I_A\ U'_a)\cdot K_{IF}\cdot I_A$$

On the same basis we find the controlled output voltage in the second loop.

$$U''_a = K_{F\mu UA}\cdot W''(I_A\ U''_a)\cdot K_{IF}\cdot I_A$$

The asynchronous motor reactive power symmetrical magnitudes of the controlled output voltage are expressed as a signal from two sensitive elements as follows [5].

$$U_a = U'_a + U''_a = K_{F\mu UA}(W'(I_A, U'_a) + W''(I_A\ U''_a))\ \cdot K_{IF}\cdot I_A$$

In the process of supplying electricity of asynchronous motor from the nets, taking into account various external and internal parameters, the symmetrical magnitudes of reactive power consumed are expressed for each phase current.

The magnetic processes in the stator windings of an induction motor can be clearly seen using a combined parametric model of currents consumed in all phases of e output voltage transducers, which controle the symmetrical magnitudes of reactive power of the asynchronous motor.

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