Comprehensive automation allows you to quickly manage and monitor the above systems in real time.

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DEVELOPMENT OF A ROBUST ASYNCHRONOUS ELECTRIC DRIVE CONTROL SYSTEM

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Improvement of technological processes and production, improving process equipment productivity and quality increased requirements for the quality of manufactured products have been determined. automated electric drives. This is particularly true for increase the accuracy of output coordinate regulation in steady state and transient modes.

Thus, the task of building systems is relevant today electric drives that provide the specified quality of regulation in the changing parameters of the object and the environment without serious complexity of design methods and resulting control algorithms.

A comparison of the most common synthesis methods of traditional and robust automatic control systems (ACS) made it possible to isolate, and later to use effectively, the method of polynomial equations (PE), which has recently gained popularity, and is distinguished by its simplicity, convenience, and wide capabilities [1,2,3].

Imagine the system of equations of an induction motor [4,5,6,7], provided that the rotor ($\Psi_{rx} = \Psi_r$, $\Psi_{ry} = 0$) is oriented along the flux linkage vector in the interval form:

1. equations of stator and rotor chains

$$u_{sx} = \tilde{R}_{se}\left(\tilde{T}_{se}s + 1\right) \cdot i_{sx} - \omega_{\psi_r} L_{se} i_{sy} - \frac{k_r \psi_r}{\tilde{T}_r},$$
$$u_{sy} = \tilde{R}_{se}\left(\tilde{T}_{se}s + 1\right) \cdot i_{sy} - \omega_{\psi_r} L_{se} i_{sx} + z_p \omega_1 k_r \psi_r\ ;$$

2. equations of the rotor chains

$$k_r \tilde{R}_r i_{sx} = \frac{\tilde{T}_r s + 1}{\tilde{T}_r} \cdot \psi_r\ ,$$
$$k_r \tilde{R}_r i_{sy} = \left(\omega_{\psi_r} - z_p \omega_1\right) \cdot \psi_r\ ;$$

3. equation of the electromagnetic moment of an asynchronous motor (AM)

$$m = \frac{3}{2} z_p k_r \left(\psi_r \cdot i_{sy}\right);$$

4. equations of mechanical motion of a two-mass system

$$\begin{gathered} m - m_{c1} - m_{12} - \beta_{c1}\omega_1 = \tilde{J}_1 \cdot s\omega_1 , \\ m_{12} - m_{c2} - \beta_{c2}\omega_2 = \tilde{J}_2 \cdot s\omega_2 , \\ sm_{12} = \tilde{C}_{12}(\omega_1 - \omega_2) . \end{gathered}$$

Where the parameters of $\tilde{R}_{se}, \tilde{T}_{se}, \tilde{R}_r, \tilde{T}_r, \tilde{J}_1, \tilde{J}_2$ change in a certain limited range and the limits of variation of these parameters are known.

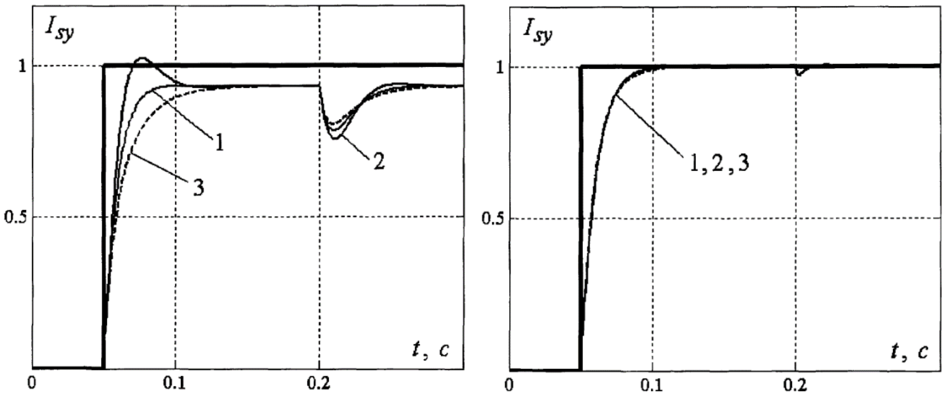
As a result of synthesis, obtain a current regulator and a filter of the digital ACS [8,9].

$$\begin{gathered} W_{pi}(s) = \frac{M^*(s)Q_K(s)}{sN^*P_K(s)} = \frac{R_{se}(T_{se}s + 1)[(T_D + T_i)s + 1]}{k_\Pi T_i T_D s^2}; \\ W_{\Phi i}(s) = \frac{L(s)}{M^*(s)} = \frac{(T_D s + 1)}{(T_D + T_i)s + 1} . \end{gathered}$$

regulator and filter of speed of ACS:

$$\begin{gathered} W_{p\omega}(s) = \frac{J_\Sigma}{1{,}5k_M} \cdot \frac{1 + T_\omega s(T_\text{Э} s + 1)\frac{1}{(T_D + 1)^2}}{T_\omega\left[1 - \frac{1}{(T_D + 1)^2}\right]} = \frac{J_\Sigma}{1{,}5k_M} \cdot \frac{(T_D^2 + T_\omega T_\text{Э})s^2 + (2T_D + T_\omega)s + 1}{2T_\omega T_D s(0.5T_D s + 1)} , \\ W_{\phi\omega}(s) = \frac{1}{1 + T_\omega s(T_\text{Э} s + 1)\frac{1}{(T_D + 1)^2}} = \frac{(T_D s + 1)^2}{(T_D^2 + T_\omega T_\text{Э})s^2 + (2T_D + T_\omega)s + 1} . \end{gathered}$$

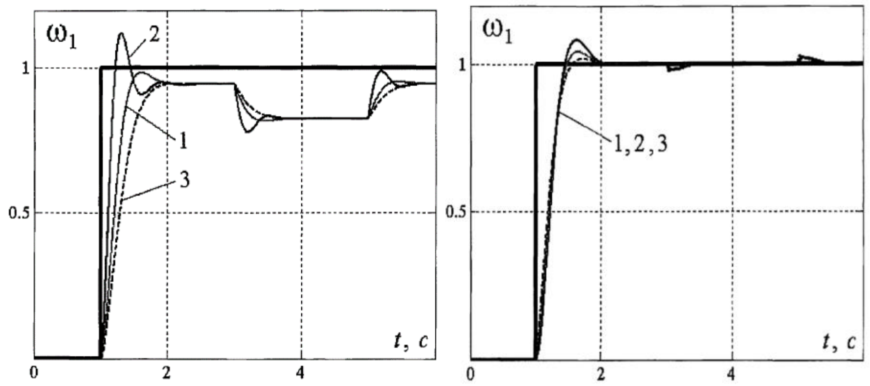
To confirm the results of the analysis of the studied ACS, computer modeling was performed in the MATLAB package [8,9,10].



a) b)

Figure 3.3 Processes in ACS of current with traditional (a) and robust (b) regulators: 1 - with estimated R_{se}; 2 - with a decrease in R_{se} by 1.5 times; 3 - with an increase in R_{se} by 1.5 times

The figures show that the robust current regulator effectively suppresses the effect of variation in the active resistance of the stator winding R_{se} on the quality of transients. In addition, the figures show that in a system with a robust current regulator, the static error in current really disappears and the development of an external disturbing effect ("drawdown" of the network voltage) in comparison with a traditional ACS is characterized by a significantly smaller dynamic error and a shorter transition time.



a) b)

Figure 3.9. The reaction of the speed control loop with traditional (a) and robust (b) controllers to step changes in the setting and perturbation effects when the engine moment of inertia varies J_Σ: 1 - at the calculated J_Σ; 2-when J_Σ decreases by 2 times; 3-when J_Σ increases by 2 times

The presented simulation results confirm the theoretical conclusions made earlier. Indeed, the use of a robust speed controller (3.66) actually minimizes the influence of variations in the moment of inertia J_Σ, elastic coupling and external viscous friction on the quality of transients; it improves the development of external perturbation ("load surge").

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