Section "Labor Safety"

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SYNTHESIS OF IDENTIFICATION ALGORITHMS OF STATIC AND DYNAMIC CHARACTERISTICS OF AUTOMATIC CONTROL OBJECT

Local automatic control systems (SAC) are a basic element of current automatic control systems of technological processes (ACS TP). Control algorithms used to synthesize these systems should take into account specific features of both a control object and means of acquiring input information. In case of changing and dynamic characteristics of the control object, automatic control systems should adjust their parameters to achieve high-quality control over the process. Efficiency of automatic control of processes in mining production can be enhanced by developing and introducing searchless jam-resistant algorithms of adaptation based on forming specified characteristics of transient processes in closed loop ACS.

To solve this problem, characteristics of the control object should be previously identified [1-3]. The automatic control system under analysis includes a proportional and integral controller (PI-controller) and an object, its transfer function being approximated by the first order relaxation circuit with time delay. The static factor of transmission K_0 and the time constant of the control object T_0 are defined by available results of measuring parameters of the automatic control system during its normal operation.

The unknown parameters are evaluated from the following algebraic equations

$$\sum_{i=0}^{p} a_i\lambda_i - b\Delta - b_0\eta = 0, \quad \sum_{i=0}^{p} a_i\ \delta_i - b(N+1) - b_0\Delta = 0, \qquad (1)$$

$$\aleph_{ij} = \sum_{k=1}^{N+1} X_k^{(j)} X_k^{(i)}, \quad \delta_j = \sum_{k=1}^{N+1} X_k^{(j)},$$

$$\lambda_j = \sum_{k=1}^{N+1} X_k^{(j)} Y_k, \quad \Delta = \sum_{k=1}^{N+1} Y_k, \quad \eta = \sum_{k=1}^{N+1} Y_k^2.$$

where X is an output signal of the control object, Y is an output signal of the PI-controller, g is an impact value.

The given expressions indicate that factors a_i, b, b_0 are determined by means of the system parameters K_0, T_0, g

$$a_0 = \frac{1}{T_0}; \ b_0 = \frac{K_0}{T_0}; \ b = \frac{K_0 g}{T_0} \ . \tag{2}$$

Thus, identification reduces to finding parameters of equation (2) in which $Y(t)$ and $X^{(t)}(t)$ are measurable values.

After solving (1) and (2), we obtain the formulae for determining parameters of the control object

$$T_0 = a_0^{-1} = \frac{\lambda_0^2 - \aleph_{00}\eta}{\aleph_{10}\eta - \lambda_0\lambda_1} \ , \tag{3}$$

$$K_0 = T_0 b_0 = \frac{b_0}{a_0} = \frac{\aleph_{10}\lambda_0 - \aleph_{00}\lambda_1}{\aleph_{10}\eta - \lambda_0\lambda_1} \ . \tag{4}$$

The resulted expressions are used to synthesize algorithms of adaptive control over various mining objects, the static and dynamic characteristics of which vary widely. The industrial acceptance of the developed adaptive control algorithms reveals their potential to reduce dispersion of the controlled parameter by 15-20 % and duration of transient processes in closed loop automatic control systems by 20-30%.

References

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