Algorithm of control systems required accuracy providing under the undetermined external disturbances

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Abstract - **New control algorithm and algorithm for providing required quality are defined. It based on comparison the forecast system condition, allowance conditions value, dynamic system properties and undetermined external disturbances compensation.**

Keywords - **Control algorithm; disturbance compensation; decision making.**

I. Introduction And Problem Definition

One of the problems is to provide the dynamic objects a required accuracy under undetermined disturbances. The inverse dynamic model application allows providing disturbance effect compensation by the controller. Its parameters change depending on the dynamic system reaction on disturbances [1], [2]. Controller parameter determination is shown in [3]. Let's find the algorithm for controller parameter determination with quality function simplification.

II. Mathematical Model

The solution of the matrix equation

$$(sI + A)\,x = -KBx + EF \qquad (1)$$

for the dynamic object with n state variables x and control is

$$x = (sI + A + KB)^{aa}\ EF\Delta^{-1},$$
$$sx = s(sI + A + KB)^{aa}\ EF\Delta^{-1},$$

$$EF - KBx = \Delta F = (sI + A + KB)^{aa} \cdot (sI + A)EF\Delta^{-1}, \quad (2)$$

and in some cases

$$\Delta = K_0\Delta_0 = (1 + K_*)\Delta_0 . \qquad (3)$$

Coefficient K_0 alteration causes a proportional change of the value of the state variable x and of the total disturbance ΔF (2) [3], as well as the state variable *x* derivatives. Quality function [2],[3] can be simplified as $\psi(\tau) = \dot{x}_i(\tau)$.

II. Disturbance Compensation Algorithm

The value of external disturbance (2) is altered by the operator K_0. Control system structure (3) provides only value alteration of the dynamic system state variables x. Thus, disturbance action control algorithm by the operator K_0 can be implemented by the drift of quality functions from its permissible value. Then, for the control coefficients $K_*(t)$ (3) would have by the direct Lyapunov method

$$K_{*i}(t) \geq (\dot{x}_{if}(t) - \dot{x}_{it}(t)) / (\dot{x}_{it}(t) - \dot{x}_{il}(t)), K_{*i}(t) \geq 0,$$

where x_{if} is a forecast value of state variable $\dot{x}_i$.

The procedures (6) would be repeated every next step $t + \Delta t, k = 1, ..., n$ with $K_{*i}(t)$ value that had been determined on the previous k-1 step.

II. Simulation

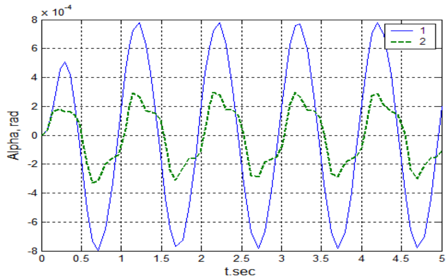

Fig.1.Simulation results

Control systems errors are shown on the Fig. 1 with $K_*(t) = 0$ (line 1) and with algorithm (line 2). affect without the dynamic system features infringement.

II. Conclusion

Algorithm of the undetermined external disturbances compensation is based on using the current and forecast values of system state variables. It does not require the disturbance determination.

II. References

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