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STABILITY OF STOCHASTIC SELF-ADJUSTING DYNAMICAL SYSTEMS WITHOUT AFTEREFFECT AND WITH ETALON MODEL

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Self-adjusting systems are well known (see [1]). In these systems the parameters changing of the regulator arises from the information about parameters of external random disturbances, dynamical characteristics of the studied object or the stochastic dynamical system, and functioning, which is defined in the real time [2].

Let us suppose that the real object is described by the following linear stochastic differential equation of the n order with non-random initial conditions

$$\frac{d^n x(t,\omega)}{dt^n} + \sum_{i=1}^{n} [a_i + \Delta a_i + \delta a_i(t)] \frac{d^{n-i} x(t,\omega)}{dt^{n-i}} = \sum_{i=1}^{n} b_i \frac{d^{n-i} x(t,\omega)}{dt^{n-i}} \cdot \frac{dw_i(t,\omega)}{dt}, \tag{1}$$

$$x(t_0,\omega) = x_{00}; \frac{dx(t_0,\omega)}{dt} = x_{10}, ..., \frac{d^{n-1} x(t_0,\omega)}{dt^{n-1}} = x_{n-1,0}, \tag{2}$$

where $a_i, b_i \in R^n$, $i = \overline{1,n}$; $w_i(t,\omega) \in R^1$ are pairwise-independent Wiener random processes; $\frac{dw_i(t,\omega)}{dt}$ are white noises; $\Delta a_i \in R^1$ are unknown as now real numbers; $\delta a_i(t)$, $i = \overline{1,n}$ are produced by the self-adjusting contour. The etalon model is described by the following equation

$$\frac{d^n y(t,\omega)}{dt^n} + \sum_{i=1}^{n} a_i \frac{d^{n-i} y(t,\omega)}{dt^{n-i}} = \sum_{i=1}^{n} b_i \frac{d^{n-i} y(t,\omega)}{dt^{n-i}} \cdot \frac{dw_i(t,\omega)}{dt}, \tag{3}$$

$$y(t_0,\omega) = y_{00}; \frac{dy(t_0,\omega)}{dt} = y_{10}, ..., \frac{d^{n-1} y(t_0,\omega)}{dt^{n-1}} = y_{n-1,0}. \tag{4}$$

The basic result of this report is construction of the self-adjusting contour, i.e. obtaining of such algorithm of changing of $\delta a_i(t)$, where $\lim\limits_{t \to +\infty} E\left\{x^2(t,\omega) - y^2(t,\omega)\right\} = 0$. We suppose that the system (3), (4) is asymptotic stable in the mean square. The synthesis of the self-adjusting contour is realized with the help of the second Lyapunov's method. The exponential p-stability in the whole is investigated in the stochastic self-adjusting systems with etalon model.

REFERENCES

[1] B.N.Petrov, V.Yu.Rutkovskij, I.N.Krutova, S.D.Zemljakov. *Principles of constructing and projecting of self-adjusting control systems [on Russian].* Mashinostrojenije, Moscow, 1972.

[2] D.G.Korenevskij. *Stability of dynamical systems with random disturbances of parameters. Algebraic criterions [on Russian].* Naukova dumka, Kyiv, 1989.