Chub E.G., Pogorelov V.A. (Rostov-on-Don, Russia), **On some solution of the problem of optimal control of nonlinear stochastic systems based on the use of information criteria.**

Let the object be described by a nonlinear differential equation:

$$\dot{Y} = F_1(Y,t) + F_2(Y,t)V + U,$$

where Y - the function describing the dynamics of the object, F_1 , F_2 -known nonlinear functions that satisfy the Lipschitz condition for all Y, t, and differentiable N on a time interval (t_0, t), V - normalized white gaussian noise, U - sought for control [1,2].

It is required to determine the local optimal control on the current time interval of the object, minimizing the functional

$$J = -\int\limits_D \Phi_1[\rho]dY + \int\limits_{t_0}^{t}\int\limits_D \Phi_2[U]dYdt,$$

где D - the region of the state space in which optimal control is determined, $\rho(Y,t)$-probability density of the process Y, described in the general case by the Fokker-Planck-Kolmogorov equation (FPC)

$$\frac{\partial\rho}{\partial t} = -\frac{\partial[q(Y,\rho)]}{\partial Y} + \frac{1}{2}\frac{\partial^2}{\partial Y^2}[b(Y,t)\rho] - \frac{\partial[U\rho]}{\partial Y}$$

where $q(Y.t) = F_1(Y,t) + \frac{1}{2}F_2\frac{\partial F_2(Y,t)}{\partial Y}$, $b(Y,t) = F_2^2(Y,t)$.

As Φ_1 it is proposed to use the Shannon criterion as a quality, the function was chosen as the "energy" component U^2, that allowed to get control explicitly

$$U = \frac{1}{2}\frac{\partial\rho}{\partial Y}.$$

Assuming that the distribution density allows Gaussian approximation, the distribution parameters are determined from the system

$$\begin{cases} m'(t) = q(m(t)) \\ D'(t) = -2q'(m(t))D(t) + b(m(t)); \end{cases}$$

where $m(t)$- is the mathematical expectation, $D(t)$- dispersion of distribution.

An example is considertd telecommunication system equation $y' = \omega\sqrt{A^2 - y^2} + V + U$.The control that provides the maximum information on the state of the object at the current time, describes equation $U = \frac{1}{2}\frac{\partial\rho}{\partial Y}$, and the distribution parameters are determined from the system $\begin{cases} m'(t) = \omega\sqrt{A^2 - y^2} \\ D'(t) = \dfrac{2\omega m}{\sqrt{A^2 - y^2}}D(t) + 1 \end{cases}$, having an analytical solution. Thus, the procedure for solving a partial differential equation by the grid method is excluded.The presented control is easily implemented in modern computing devices.

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