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## To the Inverse Problem of Stochastic Differential Systems

Let us give the system of stochastic differential equations of Ito's type

$$\begin{cases} \dot{x} = f(x, y, t), \qquad x \in R^n, \\ \dot{y} = R(x, y, t) + D(x, y, t)U + \sigma(x, y, t)\dot{\xi}, \qquad y \in R^p, U \in R^r, \xi \in R^k. \end{cases} \tag{1}$$

It is required to determine the control $U$ and the diffusion matrix $\sigma$ so that the set

$$\Lambda(t) : \begin{cases} \lambda_1(x, t) = 0, \\ \lambda_2(x, y, t) = 0, \end{cases} \lambda_1 \in C^{22}_{xt}, \lambda_2 \in C^{121}_{xyt}, \lambda_1 \in R^{m_1}, \lambda_2 \in R^{m_2}, m_1 + m_2 = m \tag{2}$$

were an integral manifold of equations' system (1).

Here $\{\xi_1(t, \omega), \ldots, \ldots, \xi_k(t, \omega)\}$ is the system of independent Wiener processes.

The posed problem under $\sigma \equiv 0$ is adequately investigated in [1,2] and stochastic case of reconstruction's problem with initial stochastic differential Ito equation of second order $\ddot{x} = f(x, \dot{x}, t) + D(x, \dot{x}, t)u + \sigma(x, \dot{x}, t)\dot{\xi}$ and given set $\Lambda(t) : \lambda(x, \dot{x}, t) = 0, \ \lambda \in R^m$ is considered in [3].

Under proposition $f \in C^{121}_{xyt}$ it is proved the follow theorem by quasi-inversion method [2] with use the designations from [2,3] in combination with the Ito rule of stochastic differentiation of complicated function.

**Theorem 1.** *In order that the system of equations (1) has given integral manifold (2) it is necessary and sufficient that the set of controls $\{U\}$ and the set of coefficients' diffusion $\{\sigma\}$ have the form $\{U\} = \{U_1\} \bigcap \{U_2\}, \{\sigma\} = \{\sigma_1\} \bigcap \{\sigma_2\}$, where $U_1$, $U_2$, $\sigma_1$, $\sigma_2$ define in the form*

$$\begin{cases} U_1 = s_1[H_1 C_1] + (H_1)^+(A_1 - G_1), \\ U_2 = s_2[H_2 C_2] + (H_2)^+(A_2 - G_2), \end{cases} \qquad \begin{cases} \sigma_{1i} = s_3[H_3 C_1] + (H_3)^+ B_{1i}, \\ \sigma_{2i} = s_4[H_4 C_4] + (H_4)^+ B_{2i}, \end{cases}$$ *here*

$$G_1 = \frac{\partial^2 \lambda_1}{\partial t^2} + 2\frac{\partial^2 \lambda_1}{\partial t \partial x} + \frac{\partial^2 \lambda_1}{\partial x \partial x} f + f^T \frac{\partial^2 \lambda_1}{\partial x \partial x} f + \frac{\partial \lambda_1}{\partial x}\frac{\partial f}{\partial y} R + \frac{\partial \lambda_1}{\partial x} S_1, \quad S_1 = \frac{1}{2}\left[\frac{\partial^2 f}{\partial y \partial y} : \sigma\sigma^T\right],$$

$$G_2 = \frac{\partial \lambda_2}{\partial t} + \frac{\partial \lambda_2}{\partial x} f + \frac{\partial \lambda_2}{\partial y} R + S_2, \quad S_2 = \frac{1}{2}\left[\frac{\partial^2 \lambda_2}{\partial y \partial y} : \sigma\sigma^T\right], \ H_1 = \lambda_{1x} f_y D, \ H_2 = \lambda_{2y} D,$$

$H_3 = \lambda_{1x} f_y$, $H_4 = \lambda_{2y}$; $\sigma_{1i}$, $\sigma_{2i}$, $B_{1i}$, $B_{1i}$ *- i- columns of matrices* $\sigma_1$, $\sigma_2$, $B_1$, $B_2$.

### References

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