Karachanskaya E. V. (Khabarovsk, Russia) **Solution of the characteristic equation for one nonclassical diffusion model**

In the paper [1] the Langevin equation with orthogonal perturbations to the velocity of a Brownian particle was considered and the characteristic function for the process $\{\mathrm{v}(t), x(t)\}$:

$$d\mathrm{v}(t) = -a(t)\mathrm{v}(t)dt + \frac{b(t)}{|\mathrm{v}(t)|}\left[\mathrm{v}(t) \times d\mathrm{w}(t)\right], \quad dx(t) = \mathrm{v}(t)dt, \quad \mathrm{v}(t),\ x(t) \in R^3$$

is found, and under the assumption that $x(0)$ and $\mathrm{v}(0)$ are independent, solutions of the equation for the distribution density are studied, which, at constant values of the coefficients a and b, has the form:

$$\begin{array}{l} \dfrac{\partial^2 \rho(t, x/\mathrm{v}(0))}{\partial t^2} + a\dfrac{\partial \rho(t, x/\mathrm{v}(0))}{\partial t} = \\ = 3^{-1}|\mathrm{v}(0)|^2[1 - \exp\{-3at\}]\nabla_x^2 \rho(t, x/\mathrm{v}(0)) + \sum_{l=1}^{3}\sum_{j=1}^{3} \mathrm{v}_l(0)v_j(0)\frac{\partial^2 \rho(t,x/\mathrm{v}(0))}{\partial x_l \partial x_j} \end{array} \quad (1)$$

Suppose, that $\psi(t, \lambda) = M\left[\exp(\lambda, x(t))/V = \mathrm{v}(0)\right]$ is a characteristic function for (1).

Theorem. General solution $\psi(t)$ equations

$$\frac{\partial^2 \psi(t)}{\partial t^2} + a\frac{\partial \psi(t)}{\partial t} = -|\lambda|^2 \psi(t)\left[|V|^2(1 - e^{-3at})/3\right] - (\lambda, \mathrm{v}(0))^2\psi(t),$$

$$\psi(0) = M[\exp\{\mathrm{i}\,(\lambda, x(0))\}], \qquad \frac{\partial \Psi(t)}{\partial t}\Big|_{t=0} = \mathrm{i}(\lambda, \mathrm{v}(0))\psi(0), \quad \mathrm{i}^2 = -1,$$

under condition $|\lambda| \in \left[0, 2a\sqrt{3}/|V|\right]$ is

$$\psi(t) = C_1 F_\upsilon(t)\exp(-[1 + 3\upsilon]at/2) + C_2 F_{-\upsilon}(t)\exp(-[1 - 3\upsilon]at/2), \quad (2)$$

where C_1 и C_2 are solutions for equations

$$\left\{\begin{array}{l} C_1 F_\upsilon(0) + C_2 F_{-\upsilon}(0) \ = \mathrm{M}[\exp\{\mathrm{i}\,(\lambda, x(0))\}], \\ C_1 \frac{\partial e^{-\frac{[1-3\upsilon]at}{2}} F_\upsilon(t)}{\partial t}\Big|_{t=0} + C_2 \frac{\partial e^{-\frac{[3\upsilon+1]at}{2}} F_{-\upsilon}(t)}{\partial t}\Big|_{t=0} = -\mathrm{i}(\lambda, \mathrm{v}(0))\mathrm{M}[\exp\{\mathrm{i}\,(\lambda, x(0))\}] \end{array}\right., \quad (3)$$

and $\Psi_t = \mathrm{M}\left[\exp\{\mathrm{i}\,(\lambda, x(t))\}/\mathrm{v}(0); x(0)\right], \ \forall \ \mathrm{v}(0) \neq 0$ characteristic function for the process $x\,(t)$, $\lambda \in \mathbb{R}^3$, $F_{\pm\upsilon}(t) = \sum_{m=0}^{\infty} \frac{[p\cdot\eta(t)]^{2m}}{\Gamma(m\pm\upsilon+1)m!}$.

REFERENCES

1. *Dubko V.A.* Peculiarities of the dynamics of a Brownian particle with random disturbances orthogonal to its speed // Mathematical notes of NEFU, **25**:1 (2019), P.31-44.