NEW ASYMPTOTIC SOLUTIONS OF THE UNBIASED CONTINUOUS-TIME RANDOM WALKS

Denisov S.I., *professor*; Bystrik Yu.S., *student*

Asymptotic solutions of the continuous-time random walks (CTRWs), i.e., properly scaled probability densities of the walker's position at long times, are important statistical characteristics of these walks. They have been found for the CTRWs characterized by different distributions of waiting times and jump magnitudes, including heavy-tailed distributions whose first and/or second moments are infinite. There also exists a class of *superheavy-tailed* distributions that do not have finite moments of an arbitrary (fractional) order. These distributions are useful for modeling, e.g., randomly interrupted processes [1,2] and superslow diffusion [3].

The asymptotic solutions for both biased and unbiased CTRWs described by the superheavy-tailed distribution of waiting times and the jump distribution with *finite* second moment have been recently derived in Ref. [4]. The aim of this talk is to present a new class of asymptotic solutions related to the unbiased CTRWs with superheavy-tailed distribution of waiting times and power-law distribution of jump magnitudes characterized by *infinite* second moment. Using the Montroll-Weiss equation in the Fourier-Laplace space and the Tauberian theorem for the Laplace transform, we show that the desired class consists of the symmetric functions which can be represented in the form

$$P_\alpha(x) = \frac{1}{\pi}\int_0^\infty dy\, \frac{\cos xy}{1+y^\alpha} \qquad (1)$$

($0 < \alpha \le 2$). We prove that these functions are positive and normalized, i.e., they are in fact probability densities, derive the asymptotic formulas at $x \to 0$ and $x \to \infty$, and numerically investigate the dependence of these functions on the variable x and parameter α.

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2. S.I. Denisov, H. Kantz, *Eur. Phys. J. B* (2011) [arXiv: 1101.2466].
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4. S.I. Denisov, H. Kantz, arXiv: 1102.2590.