LONG-TIME SOLUTIONS OF DECOUPLED CONTINUOUS-TIME RANDOM WALKS WITH ASYMMETRIC HEAVY-TAILED JUMP LENGTH DISTRIBUTIONS

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Continuous-time random walks (CTRWs) form an important class of jump processes that are characterized by two random variables, namely, the waiting time between successive jumps and the jump magnitude of the walking particle. Since these variables are typical for variety of natural phenomena, CTRWs represent a powerful and flexible tool for studying stochastic systems. The reference walks are especially useful for modeling a wide range of natural phenomena that demonstrate anomalous average behavior. In particular, the CTRW approach is employed for describing anomalous diffusion characterized by the mean-square displacement that grows non-linearly with time [1].

One of the most important statistical characteristics of CTRWs is the limiting (in time) probability density of a properly scaled walker position. This quantity has recently been obtained for the CTRWs characterized by superheavy-tailed waiting time distributions (that have infinite moments of any fractional order) and jump length distributions with finite second moment [2] and symmetric heavy tails (whose first and/or second moments are infinite) [3]. In present work we concern ourselves with the limiting densities for the CTRWs described by superheavy-tailed waiting time distributions and *asymmetric* heavy-tailed jump length distributions. We show that these densities are either the one-sided exponential or one-sided/two-sided heavy-tailed densities. The main properties of the limiting probability densities are established and several representation forms for them are proposed. Also, we have performed numerical simulations of this type of random walks and have shown that the numerical resuls are in excellent agreement with our theoretical predictions.

1. R. Metzler, J. Klafter, *Phys. Rep.* **339**, 1 (2000).
2. S.I. Denisov, H. Kantz, *Phys. Rev. E* **83**, 041132 (2011).
3. S.I. Denisov, S.B. Yuste, Yu.S. Bystrik, H. Kantz, K. Lindenberg, *Phys. Rev. E* **84**, 061143 (2011).