

APPROXIMATION OF BURST DURATION'S PDFS OF BIRTH-DEATH PROCESSES

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Indicator of long-range memory is considered to be a power-law power spectral density in the low frequency domain [1]. However, many different stochastic processes may have this long-range memory property. In order to identify different stochastic processes and solve previously mentioned problem we are focusing on the analysis of the stochastic processes burst and inter-burst duration's probability density functions (PDF) which can be used to determine whether a particular complex process retains the characteristics of a long-range memory in cases of different inter-burst duration's threshold limits [2].

To generate time series we used the stochastic differential equation (SDE) asymptotically describing agent-based Kirman Birth-Death process. We performed the numerical calculation of burst and inter-burst duration's PDF's dependence on the threshold value of the process. It was shown that such PDFs generated by respective SDE in general case cannot be described by analytical approximation proposed for transformations of Bessel process. However, it was shown that analytical approximation derived in this work can be used to describe the bursts PDF of Bessel process and in specific cases could be used to approximate more complex processes than Bessel process such as agent-based Birth-Death process [3].

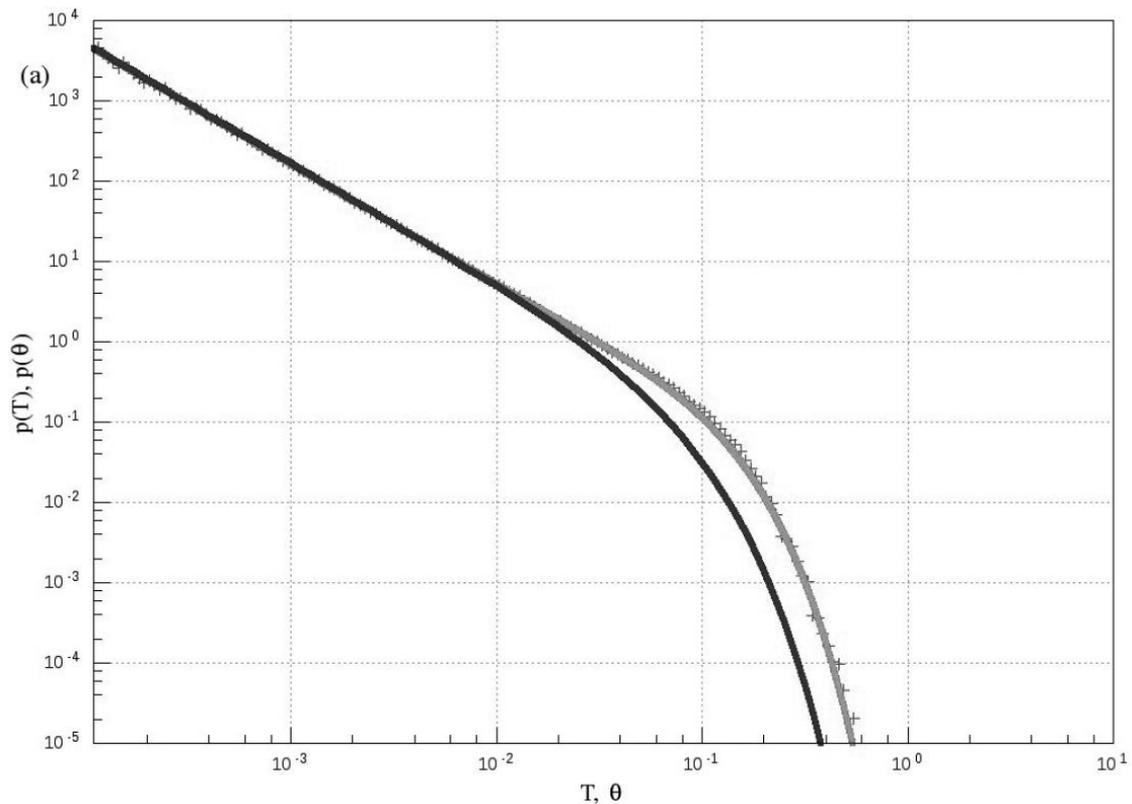


Fig. 1. Burst duration's PDFs: a) PDF calculated by solving SDE numerically (crosses), b) analytical PDF approximation [4] (black lines), c) Analytical PDF approximation in a newer work (gray lines) [3].

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[4] Kononovičius A., Gontis V. Approximation of the First Passage Time Distribution for the Birth-Death Processes, Journal of Statistical Mechanics 2019: 073402 (2019).