



Statistical analysis for a distribution of a random walk on the plane

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A distribution that arises as a first-passage time distribution of a modified random walk on the half plane is considered. It is also a member of Kemp's family of convolutions of binomial and pseudo-binomial variables. Thus it has a simple probabilistic structure and computer generation of random samples from this distribution is straightforward. Some probabilistic properties, like log-concavity, unimodality, and reliability properties have been derived. The distribution can cater for under, equi and over dispersion in count data without requiring restriction in the support and computation of normalizing constant. It has a simple three-term recurrence formula for computing the probabilities which facilitates its applications. For equi-dispersion the distribution is non-Poisson. This provides an alternative to the popular Poisson model for empirical modelling of data exhibiting equi-dispersion. Test of hypothesis for equi-dispersion by the likelihood ratio test and simulation study of the power has been conducted. Parameter estimation by maximum likelihood, minimum Hellinger distance and a method based on the probability generating function has been considered. As an illustration of its application, a fit to a real data set is given.

Keywords: Under-, equi- and over-dispersion; Log-concavity, Unimodality and reliability properties; Parameter estimation; Goodness-of-fit.