A one-parameter distribution with two turning points and bathtub shaped failure rate function

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Abstract

The challenge of obtaining distributions that provide adequate fits to real life complex data sets across various fields of study has led to the continual development of lifetime distributions. In this study, a new lifetime distribution is introduced. The novel distribution has a density that is capable of exhibiting a unimodal shape or two turning points. It also possesses a bathtub shaped failure rate function. Statistical characteristics of the new distribution such as the moment and other related measures, moment generating function, stochastic ordering, mean absolute deviation, the entropy, mean residual life function and Bonferroni and Lorentz curves are discussed in detail. The maximum likelihood approach to estimating the parameter of the distribution is considerably expounded. A simulation study is performed to investigate the consistency property of the maximum likelihood estimator of the parameter. The potentiality of the distribution is demonstrated by comparing it fit to a data set with the fits of other notable lifetime distributions. The results obtained show that the new distribution gives the best fit among all the distributions being considered.

Keywords: Bathtub shape, goodness of fit test, maximum likelihood approach, mixture distribution, turning points.