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A study of stress-strength reliability using a generalization of power transformed half-logistic distribution

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ABSTRACT

A new probability model obtained by generalizing the power transformed half logistic distribution is introduced by transforming the type II beta distribution. The basic properties of the distribution are studied and observed that the distribution can be used for modeling heavy tailed data. Further the expression for stress strength reliability of a single component system with strength following the proposed model and different cases for stress are obtained. Different methods of estimation of parameters – method of moments, quantile estimation, and maximum likelihood estimation are also explained. The usefulness of the model is also studied by applying it to a real-life data set.

1. Introduction

In the present world, the problem of increasing reliability of any system has become significant in many fields of industry, transport, communications technology, etc. There are appliances which survive due to their strength even if they receive a certain level of stress. But if a higher level of stress is applied than the strength then the appliances tend to break down. Suppose the random stress applied on a certain appliance be represented by Y and the random strength to sustain the stress be represented as X. Then the system fails if and only if at any time the applied stress is greater than its strength. Thus, a measure of reliability of a system is given by $R = Pr\{X > Y\}$.

The stress-strength reliability for several distributions like exponential, normal, gamma, Weibull, Burr, generalized exponential, generalized Weibull, generalized logistic have been developed in the statistical literature by many authors. The stress-strength reliability R, when X and Y are independent Weibull random variables and independent generalized exponential random variables were studied by Kundu and Gupta (2006, 2005). Raqab, Madi, and Kundu (2008) and Kundu and Raqab (2009) obtained R when X and Y are independent three parameter generalized exponential and three parameter Weibull random variables respectively. Kundu and Raqab (2013) also estimated the stress-strength reliability for three parameter generalized Rayleigh distribution. Surles and Padgett (1998, 2001) gave inference procedures for R when X and Y were

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