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A New Mathematical Logistic Model and Its Applications

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Abstract

We present a new 4-parameter logistic growth model where the rate of change of quantity function is directly proportional to its remaining quantity for growth by a time-dependent logistic function per quantity per unit time. The model can be used to determine the expected number of quantities at time t. Several real world applications are discussed to illustrate the usefulness of the new model including the earthquake occurrence events, the student population growth, and the software modeling. Examples are included to illustrate the goodness-of-fit of the proposed model and existing logistic growth models based on real data sets collected from software applications, earthquake events in the US, and a high school senior class. Three goodness-of-fit test criteria and a recent normalized criteria distance method are used to illustrate the model comparisons. The results show that the proposed model fit significantly better than other existing growth models.

Keywords: Logistic reliability growth, predictive-ratio risk, loglog distribution, normalized criteria distance.