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Additive Weibull Model Using Warranty Claim and Finite Element Analysis Fatigue Analysis

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Abstract : This paper presents an additive reliability model using warranty data and Finite Element Analysis (FEA) data. Warranty data for any product gives insight to its underlying issues. This is often used by Reliability Engineers to build prediction model to forecast failure rate of parts. But there is one major limitation in using warranty data for prediction. Warranty periods constitute only a small fraction of total lifetime of a product, most of the time it covers only the infant mortality and useful life zone of a bathtub curve. Predicting with warranty data alone in these cases is not generally provide results with desired accuracy. Failure rate of a mechanical part is driven by random issues initially and wear-out or usage related issues at later stages of the lifetime. For better predictability of failure rate, one need to explore the failure rate behavior at wear out zone of a bathtub curve. Due to cost and time constraints, it is not always possible to test samples till failure, but FEA-Fatigue analysis can provide the failure rate behavior of a part much beyond warranty period in a quicker time and at lesser cost. In this work, the authors proposed an Additive Weibull Model, which make use of both warranty and FEA fatigue analysis data for predicting failure rates. It involves modeling of two data sets of a part, one with existing warranty claims and other with fatigue life data. Hazard rate base Weibull estimation has been used for the modeling the warranty data whereas S-N curved based Weibull parameter estimation is used for FEA data. Two separate Weibull models' parameters are estimated and combined to form the proposed Additive Weibull Model for prediction.

Keywords : bathtub curve, fatigue, FEA, reliability, warranty, Weibull
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