

Utilizing jackknife and bootstrap to understand tensile stress to failure of an epoxy resin

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Abstract-

A study was conducted on the tensile stress of an epoxy resin (Resoltech® 1050/1056). This was done by gathering a sample of 39 tensile strength data under consistent levels of stress. The tensile stress resistance is often characterized using a three-parameter Weibull distribution and the reliability of this characterization, given by confidence intervals (CIs). This approach commonly utilizes data-resampling techniques to estimate the CI of its parameters. CIs are constructed from six existing point-estimation methods. Herein, the jackknife was carried out to calculate the CIs using 39 subsamples and bootstrap methods using 100 or 200 subsamples. To date, there have been no studies exploring the effectiveness of subsampling methods for constructing CIs related to tensile strength. In this study, jackknifed and bootstrapped samples are used to implement the percentile method and three variations of the bias correction methods. We then performed simulations to evaluate the reliability of these methods using a Weibull random number generator. Our results showed that while the bias-corrected approach generated the most stable CIs from replicate samples, its accuracy was contingent on the point-estimation method employed. We also found that the different methods for calculating CIs resulted in significantly varying widths of the CIs.

Index Terms- jackknife; bootstrap confidence intervals; three-parameter Weibull distribution; point-estimation methods

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