ABSTRACT

In this thesis, a new stress-strength index (SSI) is proposed primarily as a measure of relative stresses/strengths of components with those of the average distribution.

In **Chapter 1**, the motivation for studying stress-strength reliability (SSR) is given with examples. Form of the newly proposed SSI for multi-component systems is given. A detailed literature review on inference on various measures of stress-strength reliability and a summary of results in the thesis is given.

In **Chapter 2**, the expression of SSI is derived when components have independent exponential distributions with unequal scales. The MLE, the UMVUE, Bayes, generalized Bayes and an analogue of the BSE estimators are derived and their risk performances are compared numerically. The asymptotic distribution of the MLE is obtained. Real data applications are given.

In **Chapter 3**, a parametric bootstrap (PB) confidence intervals are developed for SSIs considered in Chapter 2. Their coverage probabilities and average lengths are compared using simulations. 'R' packages are developed and implemented on real life data sets.

In **Chapter 4**, various parametric and nonparametric tests are considered for testing the homogeneity of SSIs introduced in Chapter 2. A detailed comparison of the size and power performance of these tests is carried out with the development of 'R' packages and real life applications. The robustness of these tests is also investigated.

In **Chapter 5**, the expression for the SSI is derived when components have independent exponential distributions with unequal scales but a common unknown location. Various estimators of SSI are derived and their risk performances are compared numerically. Applications of these methods are given to problems in duration analysis and tensile strengths.

In **Chapter 6**, PB confidence intervals are obtained for SSIs considered in Chapter 5. Coverage probabilities and average lengths of all proposed intervals are compared numerically. 'R' packages are developed and applied to real data sets.

In **Chapter 7**, a comprehensive performance analysis of test procedures for the homogeneity of SSIs is carried out. A software package is developed to implement tests on given data sets.

In **Chapter 8**, SSI is developed when component lives are exponentially distributed with unequal locations but a common hazard rate. Some estimators for SSI are developed and their performances are compared numerically through simulations.

In **Chapter 9**, some possible extensions of the work contained in the thesis to more complex systems are discussed.

Keywords: Asymptotic distribution, Bayes estimator, Confidence interval, Equivariant estimator, Generalized Bayes, Likelihood ratio test, Maximum likelihood estimator, Multivariate delta method, Parametric bootstrap, Confidence interval, Robustness, Stress-strength reliability, Uniformly minimum variance unbiased estimator.