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Title: *Step-Stress Models*

Abstract

Step-stress models form an essential part of accelerated life testing procedures. Under a step-stress model, the test units are exposed to stress levels that increase at intermediate time points of the experiment. Statistical inference is then developed for, e.g., the mean lifetime under each stress level, targeting to the extrapolation under normal operating conditions.

Step-stress models are usually considered under the cumulative exposure assumption and for continuous monitoring of the tested units lifetime. In this case, explicit expressions for maximum likelihood estimators of parameters and their conditional density functions, given their existence, are possible only for exponential lifetimes. A step-stress model is constructed that considers a general scale family of distributions, which allows for flexible modeling. It is based on a failure rate approach and leads to explicit expressions for parameters' maximum likelihood estimators and their conditional density functions, for underlying lifetime distributions out of this family. The approach is considered for Type-I and Type-II censored experiments. Furthermore, it is dealt with experiments for which a continuous monitoring of the tested items is infeasible and only their inspection at particular time points is possible. The available information is then the number of failures in specific time intervals (interval monitoring). The existing literature on step-stress models for interval monitored experiments is not as rich as for the continuous monitoring set-up. The model discussed above is extended for an interval monitoring scheme that allows for more intermediate inspection points than the stress level change points and the associated inference for Type-I censored data is developed. Results under interval censoring are illustrated and compared to those derived under the corresponding continuous monitoring set-up in terms of characteristic examples.